

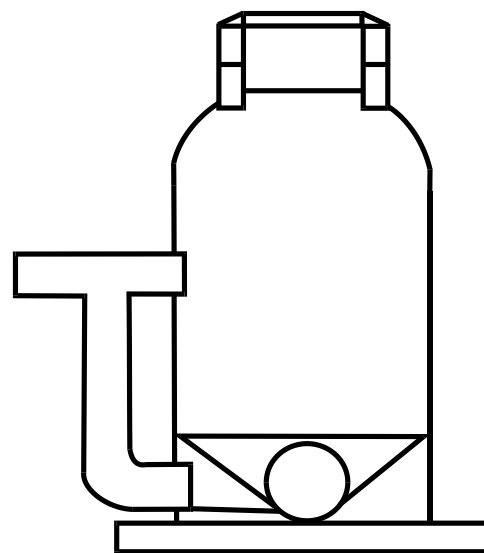


**CONTAINMENT**  
SOLUTIONS®

# **SPECIFICATIONS**

## **GLASS-FIBER REINFORCED POLYESTER (FRP) MANHOLES**

### **Standard Wall Manholes**



# SPECIFICATIONS

## GLASS-FIBER REINFORCED POLYESTER (FRP) MANHOLES

### 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 manholes. Glass-Fiber Reinforced Polyester Manholes shall be a **one-piece monolithic designed unit constructed of glass-fiber reinforced, supplier certified, unsaturated commercial grade polyester resin**. FRP manholes shall be manufactured in strict accordance with *ASTM D-3753 "Standard Specification for Glass-Fiber Reinforced Polyester Manholes"*, as manufactured by **Containment Solutions, Inc., Conroe, Texas, Fiberglass manholes**.

### II. GOVERNING STANDARDS

Manholes shall conform to the following design criteria:

- A. ASTM D-3753: Standard Specification for Glass-Fiber Reinforced Polyester Manholes.
- 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.
- H. AASHTO H-20: Axle Loading.

### III. GENERAL DESCRIPTION

- A. **Dimensions:** The manhole shall be a circular cylinder, reduced at the top to a circular manway not smaller than 22 1/2" inside diameter. Manholes shall be produced in half-foot increments in length +/- 2". Nominal inside diameters shall be 42", 48", 54", 60", 66", and 72". Tolerance on the inside diameter shall be +/- 1%. Other diameters as agreed upon between purchaser and the manufacturer are covered by this specification.

- B. **Configuration:**
  - 1). Cone Sections:

The Manway reducer must provide a bearing surface on which a standard ring and cover may be supported and adjusted to grade. The reducer shall be concentric and shall be joined to the barrel section at the factory with resin and glass fiber reinforcement, thus providing required monolithic design to prevent infiltration and/or exfiltration through the manhole.

**Manway reducer cone section shall be self-centering to permit vertical height adjustment (raising or lowering) of manhole by contractor utilizing manufacturer provided materials and detailed written instructions.**

- C. **Class:** The manhole shall be manufactured in one class of load rating. This class shall be H-20 wheel load (minimum 16,000 pounds dynamic wheel load).
- D. **Stubouts and Connections:**
- 1). Inserta-Tee: Joints for sewer pipe line and drop connections sizes 4" - 12" 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. Use of equipment which does not meet this requirement is expressly prohibited.
  - 2). Pipe Stubouts:
    - a. Install PVC sewer plain end pipe stubouts to manhole with resin and glass-fiber reinforced lay-up. Belled fittings (if required) shall meet the same performance requirements of the sewer pipe to be installed unless otherwise directed by the Engineer. Resin and fiberglass shall be of the same type and grade as used in the fabrication of the fiberglass manhole.
    - b. Install pipe-to-manhole connectors (boots) which conform to the performance requirements of ASTM C-923.
- E. **Manhole Bottom:** Resin and glass fiber reinforced manhole bottoms may be provided, upon engineer's request. Upon that request, manholes 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 will not be permitted. Bottom sections shall be furnished with an integral 3" wide anchoring flange. Invert and bench may be field installed utilizing concrete meeting applicable codes and standards. Invert and bench may be factory installed utilizing non-corrosive materials encapsulated in fiberglass minimum 1/4" thick.
- F. **Marking and Identification:** All manholes shall be marked with the following information:
- 1) Manufacturers Identification
  - 2) Manhole Length
  - 3) ASTM Designation
  - 4) Installation assist marks (vertical lines 90° apart at base of manhole).

#### 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 manhole surface 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 manhole 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. Manhole cylinders, manway reducers, and connectors shall be produced from glass fiber-reinforced polyester resin. Manhole 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. **Interior Access:** All manholes shall be designed so that a ladder or step system can be supported by the installed manhole. Manway openings to accommodate 24" or 32" standard ring and cover.
- C. **Manway Reducer:** Manway reducers shall be concentric with respect to the larger portion of the manhole diameters through 72".
- D. **Cover Ring and Support:** The manhole shall provide an area from which a typical ring and cover plate can be supported without damage to the manhole.
- E. **Assembly Joints:** Product components, i.e., cylinders, reducers, bottoms, and connectors, may be joined together to form a complete manhole.

## 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/ft<sup>2</sup> 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/ft<sup>2</sup> 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 manhole repair is required to meet all requirements of this specification.
- D. **Manhole Lengths:** Manhole lengths shall be in whole or 1/2-foot increments +/- 2".
- E. **Load Rating:** The complete manhole shall have a minimum dynamic load rating of 16,000 lbs. when tested in accordance with ASTM 3753, 8.4 (note 1). To establish this rating the complete manhole shall not leak, crack, or suffer other damage when load tested to 40,000 lbs. and shall not deflect vertically downward more than 0.25" at the point of load application when loaded to 24,000 lb.

- F. **Stiffness:** The cylindrical portion of the manhole is to be tested in accordance with ASTM Method D 2412. The manhole 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).

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

- G. **Soundness:** In order to determine soundness, an air or water test is to be applied to the manhole test sample. While holding the pressure between 3-5 psi, the entire manhole must be inspected for leaks. Any leakage through the laminate is cause for failure of the test. Refer to ASTM 3753, Sec. 8.6.

- H. **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 manhole or samples manufactured in a manner consistent in every way with the manhole component construction.

- I. **Physical Properties:**

Flexural Strength (cone):	Hoop: 15.4 x 10 <sup>3</sup> psi
	Axial: 17.2 x 10 <sup>3</sup> psi
Flexural Strength (pipe)	Hoop: 22.5 x 10 <sup>3</sup> psi
	Axial: 14.3 x 10 <sup>3</sup> psi
Compressive Strength:	8.9 x 10 <sup>3</sup> 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 manhole 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 manhole fabrication. Records shall be maintained for these control checks. Proper glass content may be shown by glass usage checks or glass and resin application rate checks, in accordance with the material composition test in ASTM 8.8.1.
- C. All required ASTM 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 manhole 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

- A. Do not drop or impact the fiberglass manhole. Lift manhole with two slings on spreader bar in horizontal position or an appropriately sized timber or steel beam, 8" longer than the cone top opening, inserted crosswise inside the manhole to the underside of the collar with a rope or chain attached to backhoe or other lifting device. Manhole may be rolled, however, insure that ground is smooth and free of rocks, debris, etc. Use of chains or cables in contact with manhole surface is prohibited.

## XI. INSTALLATION METHODS

- A. General: The manhole installation should strictly follow the manufacturers recommended installation procedures.
  - 1. **To Install the Fiberglass Manhole:** Fiberglass manholes must be installed according to the latest edition of Containment Solution's Fiberglass Manhole Installation Instructions".  
In addition to these instructions, local codes may apply and should be consulted as applicable in manhole installation. Correct manhole installation requires proper concrete foundation, good backfill and proper handling to prevent manhole damage and insure long-term corrosion resistant service.
- B. General Installation Outline: Containment Solution's complete Manhole installation instructions must be consulted before actual installation is performed.
  - 1. **Prepare Excavation/Make Manhole Pipe Cut-Outs for stubout connections:** Prepare excavation in a normal manner. Excavation at manhole location should be at least wide enough to accommodate the slab specified and to provide working room around manhole. Insure the depth of manhole is sufficient to allow at least one course of brick or one concrete ring for adjustment of ring and cover at top of final grade. Pipe cut-outs at the flowline are made in manhole prior to setting manhole in place over pipe in trench. Quarter marks have been provided on barrel to facilitate alignment of cut-outs.
  - 2. **Pour Concrete Base:** Concrete slab base should be a minimum of 6" thick for up to 48" diameter manholes (8" for larger diameter manholes). Concrete slab should extend a minimum of 12" beyond manhole outside wall for manholes up to 20' in depth (24" up to 35' in depth).
  - 3. **Set Manhole:** To lift manhole, insert an appropriately sized timber or steel beam, 8" longer than the cone top opening, crosswise inside the manhole to the underside of the collar with a rope or chain attached to backhoe or other lifting device. Lower manhole into wet concrete base to a minimum depth of 4". Minimum 2" thick concrete bearing surface beneath bottom edge of the manhole is required. Plumb manhole using standard bubble level and by moving manhole with hands. Work concrete around manhole base and 6-inch minimum over incoming lines. Inverts and laterals are made following standard procedures.

4. **Backfill:** Backfilling is done just as soon as the concrete base has hardened enough to provide sufficient support for manhole and fill. Native soil (or sand, in unstable areas), free of large stones, debris, or concrete chunks may be used for backfill. Backfill should be placed evenly around manhole in 12" maximum lifts and should be thoroughly tamped to 90% standard proctor density before the next layer is installed. Backfill material shall be subject to approval by the engineer.
5. **Bring to Grade:** Construct chimney on flat shoulder of manhole using precast concrete rings.

## **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. 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 and fittings, manhole rings 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.