

FIBERGLASS REINFORCED PLASTIC (FRP) TROUGHS

PART 1 GENERAL

1.1. SUMMARY

- A. This Section includes fiberglass reinforced plastic (FRP) troughs for clarifier effluent, filter basins, U/V tanks, and other applications as shown on the Contract Drawings.

1.2. QUALITY ASSURANCE

- A. The material covered by these specifications shall be furnished by a reputable and qualified manufacturer of proven ability that is regularly engaged in the manufacture and installation of FRP products.
- B. Fabricator shall be experienced in successfully producing FRP products specified for this project, with sufficient production capacity to produce required units without causing delay in the work.
- C. Fabricator shall provide a list of five (5) installations of comparable size in operation for at least three (3) years.

1.3. SUBMITTALS

- A. The following shall be submitted in accordance with the General and Special Provisions.
 - i. Shop Drawings
 - a. Dimensions.
 - b. Job specific layout.
 - c. Sectional assembly.
 - d. Location and identification mark.
 - e. Weir locations and attachment
 - f. Scum Baffle locations and attachment.
 - g. Accessories, attachments, transition pieces.
 - h. Connection details.
 - ii. Manufacturer's catalog data showing:
 - a. Dimensions, spacing, and construction details
 - b. Materials of construction.
 - c. Description.
 - iii. Certificates
 - a. Submit Manufacturer's certification that all materials furnished are in compliance with the applicable requirements of this specification.
 - iv. Manufacturer's Instructions

- a Submit complete information and instructions relating to the storage, handling, installation, and inspection of all equipment related to this Section.

1.4. SHIPPING AND STORAGE INSTRUCTIONS

- A. All FRP components shall be shop fabricated and assembled into the largest practical size suitable for transporting.
- B. The parts and assemblies that are shipped unassembled shall be packaged and tagged in a manner that will protect the equipment from damage and facilitate the final assembly in the field.
- C. All FRP materials shall be stored before, during, and after shipment in a manner to prevent cracking, twisting, bending, breaking, chipping or damage of any kind to the materials.

PART 2 PRODUCTS

2.1. MANUFACTURERS

- A. The following manufacturer is named to establish a standard of quality necessary for the Project:

MFG Construction and Water Products Company, 55 Fourth Avenue, Union City, Pennsylvania 16438.

- B. Manufacturer and Supplier of troughs shall be NSF 61 Certified and listed on NSF website as a certified manufacturer.
 - i. When a project is NSF61 Certified all drawings and shipping documents shall be stamped with the NSF61 logo.
- C. Manufacturer and supplier to supply a performance bond
- D. Manufacturer of products shall be ISO 9001 certified
- E. All FRP products shall be manufactured entirely in the United States
- F. Supplier of FRP material shall be the manufacturer of the FRP material

2.2 DESIGN CRITERIA

- A. Gravity Load - Downward vertical loads shall include the weight of the trough and appurtenance attachments, such as weir plates, baffles and spreader bars, together with the weight of water to fill the trough. Any additional loads, such as piping, etc., shall also be considered.
- B. Buoyant Load - The buoyant load shall act vertically upward, its magnitude equal to the weight of displaced water (trough weight neglected). The line of action passes through the centroid of the submerged cross-sectional area.
- C. Lateral Load - Loads acting against the trough sidewalls; specifically those induced by differential water levels on either side of the trough walls. The maximum possible

differential, existing when the trough is empty and the tank is full, or, when the trough is full and when the tank is empty, shall be used when calculating deflection, fiber stress, etc.

- D. Thermal Stresses - The troughs shall be designed to accommodate temperature induced stresses resulting from differences in coefficients of thermal expansion (contraction) between the trough and tank/support materials over temperature range of -10°F to 100°F.
- E. Torsional Stability - The trough system shall be designed to resist torsional oscillations induced by the flow of water over trough edges. Any or all of the following trough stabilization techniques shall be considered.
 - 1. Trough-to-trough stabilization
 - 2. Torsional stiffness
 - 3. Support spacing and rigidity
- F. Thermal Expansion/Contraction - The troughs shall be designed to accommodate a thermally induced expansion (contraction) of 1/8" per 20 ft. length of trough over temperature range of -10°F to 100°F, without exceeding the deflection or strain limitations set forth in the preceding sections

2.3 MATERIALS

- A. The trough laminate shall meet the following minimum physical and mechanical requirements:

Table 1. Laminate Mechanical and Physical Properties

<u>Property</u>	<u>Test</u>	<u>Minimum Value</u>
Tensile Strength	ASTM D-638	18,500 psi
Flexural Strength	ASTM D-790	27,900 psi
Flexural Modulus	ASTM D-790	1,080,000 psi
Barcol Hardness	ASTM D-2853	40
Notched Izod	ASTM D-256	15.4 ft-lbs/in
Water Absorption	ASTM D-570	0.13%

- B. Resin - The resin shall be a commercial grade isophthalic polyester thermosetting resin, which has either been evaluated in a laminate, or which has been determined to be acceptable for use in a waste treatment plant environment.
- C. Fillers: The resin shall contain no fillers. Thixotropic agents for viscosity control are acceptable. Colorants which have been determined by at least five years previous service to be acceptable for the service condition are acceptable. The standard color for the trough shall be aqua. Ultraviolet stabilizers are required in all trough laminates. Catalysts, accelerators and/or promoters shall be added to provide

complete cure of the laminate and must meet the physical properties as indicated in Section 2.3 Table 1.

- D. Ultraviolet Resistance - Ultraviolet resistance is required in all laminates exposed to ultraviolet light, whether it be in the form of pigmentation or ultraviolet absorbers or a surface veil.
- E. Metal Reinforcement - When metal reinforcements are used, they shall be free of rust, oil and any foreign matter. They shall be completely encapsulated with a minimum of 1/8" thick laminate.
- F. Reinforcement - E glass with silane finish.
- G. The content of the finished laminate shall be adequate to produce mechanical and physical properties conforming to Section 2.3, Table 1.
- H. Other Reinforcement – Additional reinforcement in the form of foam, balsa sheet or other reinforcement for high stress areas at the sides and bottom of the trough shall be completely encapsulated within the laminate. Care shall be taken to insure that these areas of the trough laminate are not designated as attachment points or drilled for any purpose.
- I. Laminate Construction –
 - 1. Inner trough surface shall be a resin rich layer. A gelcoat interior surface shall be provided.
 - 2. Structural layers shall consist of plies of chopped strand mat with a maximum of 2 ounces per square foot. Adequate contact molding pressure ensures complete resin wet-out of glass fibers.
 - 3. Outer trough surface shall consist of a resin rich layer not less than 0.020 inches thick. The outer layer resin shall be applied after cure of the structural layer and suitably embed all reinforcing fibers.
 - 4. Finished trough shall be a minimum of 25% fiber reinforced with a minimum thickness of not less than 1/4".
- J. Materials used in the manufacture of the FRP troughs shall be new stock of the best quality and shall be free from all defects and imperfections that might affect the performance of the finished product.
- K. Color: Aqua
- L. Meet or exceed requirements of ANSI/AWWA F101 and ANSI/NSF 61
 - a. Supply NSF labeled products and proof of certification

2.4 DESIGN AND MANUFACTURE

- A. The inner surface of the trough shall be smooth and resin rich. The outer surface shall be reasonably smooth, resin rich, and no glass fibers shall be exposed.
- B. The top edges of the trough shall be level and parallel with a tolerance of plus or minus 1/8" (measured when the trough is not loaded).
- E. The length of a trough section shall have a tolerance of $\pm 1/8$ " per 10 ft. length.
- F. Horizontal stiffening flanges shall be integrally molded along the top edge of each trough side. These flanges shall be 1" to 3" wide, depending upon the trough configuration and shall face outward.
- G. An integrally molded water stop shall be provided on the trough whenever the trough is grouted into and/or passes through a wall.
- H. Horizontal stiffeners shall be provided across the width of the trough to increase the structural rigidity of the trough system. The stiffeners shall be fastened through the trough walls on 2-foot centers, or as recommended by the manufacturer.
- I. After fabrication, all cut edges, holes and abrasions shall be sanded smooth and sealed with a compatible resin.

2.5 TROUGH SUPPORTS AND HARDWARE

- A. Manufacturer shall be responsible for the design and fabrication of supports suitable for installation of the troughs specified herein. In circular tanks, typical trough support spacing should be 6'-0" on center.
- B. Trough supports may be hot dip galvanized steel, type 304 or 316 stainless steel, or contact molded FRP. Supports fabricated from pultruded stock are not acceptable.
- C. All trough mounting hardware shall be Type 304 or 316 stainless steel and shall be supplied by the trough manufacturer.

EXECUTION

3.1 STORAGE

- A. Should it be necessary to store product prior to installation, precautions should be taken to prevent cracking, twisting, warping, distortion, bending, breaking, chipping or damage of any kind to the materials.

3.2 INSTALLATION

- A. Install troughs and supports in accordance with manufacturer's instructions and approved shop drawings.
- B. Field cutting of troughs is allowed if necessary. All field cut edges and field drilled holes shall be sealed per the manufacturer's instructions.
- B. Ensure that troughs and supports are installed plumb and true, free of warp or twist, within the tolerances specified by the manufacturer and as shown on the drawings.

END OF SECTION