

# FIBERGLASS REINFORCED PLASTIC (FRP) TROUGHES

Revised 11/2008

## PART 1 GENERAL

### 1.1. SUMMARY

- A. This Section includes fiberglass reinforced plastic (FRP) Launderers for Clarifier Effluent 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:

NEFCO Inc., 4362 Northlake Boulevard, Palm Beach Gardens, FL 33410

### 2.2. GENERAL

- A. The troughs shall be constructed of fiberglass reinforced isophthalic polyester resin. They shall be constructed by a contact molding process which includes a combination of hand lay-up and spray-up manufacturing process. The troughs shall be constructed to the size and dimensions shown on the drawing.
- B. Materials used in the manufacture of the FRP trough system 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.
- C. After fabrication, all cut ends, holes and abrasions of FRP troughs shall be sealed with a compatible resin coating to prevent intrusion of moisture.
- D. FRP troughs shall contain an ultraviolet inhibitor and shall also receive a surfacing veil to shield from ultra-violet light.
- E. All exposed surfaces shall be smooth and true to form.
- F. Trough manufacturer shall be responsible for structural design of troughs and shall provide stiffeners and reinforcing as necessary.

## 2.3. PERFORMANCE REQUIREMENTS

A. All laminates shall meet the following minimum physical requirements:

<u>Property</u>	<u>Test</u>	<u>Minimum Value</u>
Tensile Strength	ASTM D-638	12,000 psi
Flexural Strength	ASTM D-790	19,000 psi
Flexural Modulus	ASTM D-790	$9 \times 10^5$ psi
Barcol Hardness	ASTM D-2853	35
Notched Izod	ASTM D-256	12 ft-lbs/in
Water Absorption	ASTM D-570	0.2%

B. The manufacturer shall be responsible for the structural design of the trough. Structural design shall meet the following criteria:

- i. Maximum vertical deflection under full buoyant or gravity load shall be equal to or less than  $L/1000$ , where L is defined as the unsupported fabrication length of the trough in inches. Maximum vertical deflection measured at mid-point between supports shall not exceed 3/16 inches (4.7 mm).
- ii. Maximum trough side wall horizontal deflection under full lateral load shall be equal to or less than  $D/100$ , where D is defined as the trough depth in inches. The maximum sidewall deflection shall not exceed 3/16 inches (4.7 mm).
- iii. Trough bottom deflection (oilcanning) under full buoyant or gravity load shall be equal to or less than  $W/100$  where W is the width of the trough in inches. Maximum bottom deflection shall not exceed 3/16 inches (4.7 mm).
- iv. Troughs shall be designed for empty (water up to weirs on outer walls) differential (varying water levels on outside and inside of troughs) and submerged conditions.

## 2.4. MATERIALS AND CONSTRUCTION

A. Troughs

- i. All cut edges shall be sanded smooth and sealed with resin to prevent water from penetrating into the laminate.
- ii. Horizontal stiffeners shall be provided across the width of the trough placed as shown on the drawings. The stiffeners shall be 1" PVC pipe with an internal 1/2" stainless steel rod threaded on both ends and fastened through the trough wall approximately 2'-0" on center.
- iii. End flanges where required to bolt trough sections together shall be a minimum of 1.5 times the nominal thickness of the fabrication, and shall be bolted together with stainless bolts.
- iv. Blind end for securing to wall shall be fabricated during the manufacturing process and built up to a minimum thickness of 1.5 times the nominal thickness. Holes will be

provided for bolting to wall and leveling with stainless steel anchor bolts and FRP washers.

- v. An integrally molded water stop shall be provided on either end of the trough that penetrates a supporting wall structure. Effluent troughs shall be provided with adjustable weir plates that are completely independent of any trough stiffening members.

#### B. Resin

- i. The resin shall be a commercial grade isophthalic polyester thermosetting resin, Corezyn COR75-AQ-010 or equivalent, which has either been evaluated in a laminate, or which has been determined to be acceptable for use in a waste treatment plant environment.
- ii. The resin shall contain no fillers. Thixotropic agents for viscosity control are acceptable. Colorants which have been determined by a least five years previous service to be acceptable for the service condition are acceptable. The typical color for the trough shall be green. 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 this Section,

#### C. Reinforcing Materials

- i. Fibrous Glass - The reinforcing materials used shall be Type E glass with chrome or silane finish and a binder compatible with the resin. The interior surface shall contain C Type veil with a binder compatible with the lay-up resin.
- ii. Metals - Longitudinal steel metal angles may be provided on each side of the trough to assure rigidity. The metal angles shall be completely encapsulated with a minimum of 1/8" thick laminate to ensure against pinhole bleeding.

#### D. Stiffening Flanges

- i. Additional support to the troughs may be provided by integrally molded stiffening flanges along one or both sides of each trough. These flanges shall be provided at the top of the trough wall, facing outward, and shall be between 1" and 3" wide, depending upon the trough configuration.

#### E. Laminate Construction

- i. Inner trough surface shall be a resin rich layer 0.020 inches thick reinforced with a 10-20 mil 'C' veil surfacing mat. This resin rich layer shall contain less than 20% by weight of the reinforcement veil. A gelcoat interior surface may be provided.
- ii. Structural layer shall consist of plies of chopped strand mat with a maximum of 2 ounces per square foot per spray-up pass. Other structural reinforcement materials such as cloth, woven roving, or unidirectional roving may be used provided each layer is inter-layered with chopped strand mat. Each successive pass of reinforcement shall be thoroughly wetted with resin and shall be well rolled to exclude all air pockets and bubbles prior to the application of additional reinforcement.

- iii. 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.
  - iv. Finished trough shall be a minimum of 30% fiber reinforced with a minimum thickness of not less than ¼". The interior surface shall be smooth and free of voids or surface cracks. The exterior surface will be free of protruding fibers. There shall be no areas of the laminate that are excessively resin rich or poorly wetted out. The laminate shall be dense, without dry spots.
- F. Trough Weir Plates
- i. Provide effluent weir plates as indicated in the Contract Drawings. Support weirs from the effluent trough wall. Mounting shall be adjustable for leveling to required elevations.
  - ii. The weir plates shall be straight edge type and be as indicated in the Contract Drawings and shall use splice plates at the joints for rigidity.
  - iii. All mounting hardware shall be of Type 304 stainless steel.

## **PART 3 EXECUTION**

### **3.1. INSTALLATION**

- A. Install FRP trough system in accordance with the configuration shown on the Contract Drawings.
- B. Install FRP trough system in accordance with the manufacturer's instructions and recommendations.

END OF SECTION