Fiberglass Fabricators, Incorporated

Standard Specification for Fiberglass Reinforced Plastic - Flat Profile - Tank Covers

1 Scope

1.1 This specification shall govern all work necessary to furnish a flat fiberglass cover, including all anchorage hardware required for proper installation of the tank cover.

2 General

2.1 The covers shall be self-supporting. The configuration shall be either of two designs:

a. If clearance below the cover is not a concern, separate panels and beams shall be used in conjunction with stainless steel supports, if needed.

b. If clearance below cover is a concern, structural members shall rest on the tank wall. Plank span (beam spacing) will be determined from calculations based on site conditions and specified loading. Access hatches and accessories provided as needed shall be of similar fiberglass material.

2.1.1 The covers shall be “Composi Cover™” as manufactured by Fiberglass Fabricators, Inc.

2.2 Governing Criteria

2.2.1 Applicable sections of the following standards shall apply to the fiberglass covers as indicated in this specification:

a. ANSI/ASCE 7-10 "Minimum Design Loads for Buildings and Other Structures"
b. ANSI/AWWA-F102-91 Section 5 "Standard Recommended Practice for Classifying Visual Defects in Glass Reinforced Laminates"

2.3 Design Criteria

2.3.1 Cover shall be designed in accordance with ANSI/ASCE 7-10 for the designated area:

a. Environmental load: 30 psf minimum (or designated area data per ANSI/ASCE 7-10) with an L/360
b. Personnel load: 250 lbs. in 12" square with an L/240.

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c. Wind load: 90 mph minimum (or designated area data per ANSI/ASCE 7-10)
d. Snow load: The value of the snow load shall be as calculated in accordance with ANSI/ASCE 7-10 for the designated area.
e. Seismic zone requirements per ANSI/ASCE 7-10 for the designated area.
f. Design safety factor of 4:1 for allowable stresses shall be met for all load combinations.

2.3.2 Horizontal loads shall be contained by both support structures and panel sections.

2.3.3 The design and installation shall incorporate provisions for thermal expansion and contraction over an ambient air temperature range of -30 to 120^0F.

3 Materials

3.1 All materials shall be new and shall be specially designed or selected for the function and service specified. No material may be used in the project that has not been approved by the engineer. Approval for incorporation into the project will be made only after the review of shop drawings and specifications.

3.2 Resin Requirements

3.2.1 The resin shall be corrosion-resistant general purpose polyester, which has been determined to be acceptable for the service conditions. Ultraviolet-light inhibitors shall be added to the laminate.

3.3 General Requirements

a. With the exception of beam clips, all structural components shall be FRP pultruded material.
b. Standard color shall be gray.
c. Cut edges or drilled holes shall be deburred and sealed with paraffinated resin solution.
d. A non-skid surface shall be supplied that is comprised of aliphatic acrylic polyurethane non-skid coating with UV protection.

3.4 Gasketing for panel joints shall be EPDM sponge.

3.5 Access hatches and accessories shall be provided on cover segments if required on the contract drawings.

3.6 Physical Properties (minimum):

Table 1. Laminate Minimum Physical Properties – Pultruded FRP

Property @ 70^{0}F	**Value**	**Test Method**
Tensile Strength - plank 3" thk.	31,100 psi	ASTM D 638
Tensile Strength - plank 2" thk.	30,000 psi	ASTM D 638
Tensile Strength - structurals	30,000 psi	ASTM D 638
Tensile Modulus - plank 3" thk.	2,486,000 psi	ASTM D 638
Tensile Modulus - plank 2" thk.	3,000,000 psi	ASTM D 638
Tensile Modulus - structurals	2,500,000 psi	ASTM D 638
Compressive Strength - structurals	30,000 psi	ASTM D 695
Compressive Modulus - structurals	2,500,000 psi	ASTM D 695
Flexural Strength - plank 3" thk.	24,500 psi	ASTM D 790
Flexural Strength - structurals	30,000 psi	ASTM D 790
Flexural Modulus - plank 3" thk.	885,000 psi	ASTM D 790
Flexural Modulus - structurals	1,600,000 psi	ASTM D 790
Modulus Elasticity - structurals	2,500,000 psi	Full Section
Shear Strength - plank 3" thk.	3190 psi	ASTM D 2344
Shear Strength - plank 2" thk.	4,500 psi	ASTM D 2344
Shear Strength - structurals	4,500 psi	ASTM D 2344
Shear Modulus - structurals	425,000 psi	-
Barcol Hardness	45	ASTM D 2583
Glass Content	45%	ASTM D 2584
Water Absorption	.6% Max	ASTM D 570
Coefficient of Linear Thermal Expansion (in/in/°F)	4.4×10^{-6}	ASTM D 696

Table 2. Laminate Minimum Physical Properties – HLU FRP

Property @ 70 deg.F	Value	Test Method
Tensile Strength	26,500 psi	ASTM D 638
Compressive Strength	30,000 psi	ASTM D 695
Compressive Modulus	2,500,000 psi	ASTM D 695
Flexural Strength	39,400 psi	ASTM D 790
Flexural Modulus	1,550,000 psi	ASTM D 790
Glass Content	45.6 %	ASTM D2584
Barcol Hardness	50	ASTM D 2583
Izod Impact Strength	29.1 ft-lb/in	ASTM D256
Water Absorption	.09% Max	ASTM D 570
Coefficient of Linear Thermal Expansion (in/in/°F)	3.6×10^{-6}	ASTM D 696

4 Submittals

4.1 Final approval for incorporation into the project will be made only after the review of shop drawings, specifications, and data as follows:

a. Shop drawings shall be complete with all dimensions, anchor locations, details of connecting piping and the size and locations of any required openings.
b. Specifications for all components shall be provided.
c. Details of the major fabricated components showing the arrangement of components and labeled with component sizes and materials of construction shall be submitted.
d. Structural design calculations for all components shall be submitted.
e. Manufacturer's recommended procedures for job site storage of equipment, handling, and erection shall be submitted.

4.2 Design Calculations

4.2.1 As part of the shop drawings for the cover components, the fabricator shall supply any and all analyses pertinent to the composite design. The calculations shall include standard strength of materials approaches and computerized finite element analyses of sections where conventional methods do not apply. Furthermore, for the calculated loads, a complete laminate analysis shall be submitted identifying the various factors of safety for the proposed laminate schedule. Factors of safety shall be evaluated using criteria such as Tsai-Hill or equivalent theories.

4.2.2 The evaluation of deflection and stresses on panel sections under uniform loading shall incorporate numerical analysis calculations.

4.2.3 The calculations shall fully consider the access hatches.

4.2.4 A written narrative that clearly states all of the basic design assumptions and parameters shall accompany the computerized calculations.

4.2.5 Approval by the engineer shall not relieve the manufacturer of responsibility for providing materials and design conforming to the intent of these specifications.

4.2.6 Complete structural design calculations and drawings shall be submitted as required herein. Design calculations and drawings must be approved and stamped by a registered Professional Engineer in the state of manufacture.

5 Quality Assurance

5.1 Qualifications

5.1.1 Flat cover manufacturer must have a minimum of five (5) years history of successful installations of similar size. Past job list with customer contact information will be required. Subject to compliance with requirements, manufacturers offering products which may be incorporated are limited to: Fiberglass Fabricators Inc. of Smithfield, RI.

5.2 Manufacturer's Quality Control

5.2.1 All fabrication shall be carefully inspected at the site of fabrication by factory inspectors who shall use whatever means necessary to assure the proper fit of all field connections and compliance with all material and fabrication requirements of the specifications.

5.3 Warranty

5.3.1 A general warranty of the fabricated Flat Cover for materials and workmanship shall be for a minimum of one (1) year after installation with a maximum of eighteen (18) months from date of shipment.

5.4 The contractor shall be responsible for verifying all field dimensions to develop and approve shop drawings.

6 Manufacture

6.1 Fabrication

6.1.1 If required, provisions shall be made to provide adequate drainage of water from cover.

6.1.2 The installation contractor shall confirm all field measurements with the approved flat cover fabrication drawing before fabrication is initiated.

6.2 Shop Assembly

6.2.1 The manufacturer shall pre-assemble a minimum of three (3) equal cover segments to a full scale layout to insure proper fit and assembly. If cover consists of less than (3) equal segments, the manufacturer shall pre-assemble the cover in its entirety.

6.2.2 Fiberglass cutouts from cover segments shall be identified and shipped with cover. Cutouts will be used by the engineer to determine proper thickness, glass content and laminate sequence. (Hand lay-up only)

6.2.3 Assembly of panel segments will be such as to allow all bolting to be performed from the exterior of cover.

6.2.4 Anchor bolts, assembly hardware, rail nut plates, hinges and lock sets shall be type 316 stainless steel.

6.3 Materials, equipment, and components in this section shall be the products of:

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7 Installation, Storage, Handling, and Maintenance

7.1 The manufacturer shall provide detailed written instructions for the installation, long term storage, handling, and maintenance for the products provided.