ENGINEERING SPECIFICATION

PULTRUDED PROForms® FIBERGLASS STRUCTURAL SHAPES
SECTION 06610
FIBERGLASS REINFORCED PLASTICS (FRP) FABRICATIONS
PULTRUDED FIBERGLASS STRUCTURAL SHAPES

PART 1 - GENERAL

1.1 SCOPE OF WORK
   A. The CONTRACTOR shall furnish, fabricate (where necessary), and install all fiberglass
      reinforced plastic (FRP) items, with all appurtenances, accessories and incidentals necessary
      to produce a complete, operable and serviceable installation as shown on the Contract
      Drawings and as specified herein, and in accordance with the requirements of the Contract
      Documents.

1.2 REFERENCES
   The publications listed below (latest revision applicable) form a part of this specification to the extent
   referenced herein. The publications are referred to within the text by the designation only.

   AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM) Test
   Methods:
   - ASTM D-638-Tensile Properties of Plastics
   - ASTM D-790-Flexural Properties of Unreinforced and Reinforced Plastics
   - ASTM D-2344-Apparent Interlaminar Shear Strength of Parallel Fiber Composites by
     Short Beam Method
   - ASTM D-696-Coefficient of Linear Thermal Expansion for Plastics
   - ASTM E-84-Surface Burning Characteristics of Building Materials

   NSF/ANSI STANDARD 61

1.3 CONTRACTOR SUBMITTALS
   A. The CONTRACTOR shall furnish shop drawings of all fabricated structural systems and
      accessories in accordance with the provisions of this Section.
   B. The CONTRACTOR shall furnish manufacturer's shop drawings clearly showing material
      sizes, types, styles, part or catalog numbers, complete details for the fabrication of and
      erection of components including, but not limited to, location, lengths, type and sizes of
      fasteners, clip angles, member sizes, and connection details.
   C. The CONTRACTOR shall submit the manufacturer's published literature including structural
      design data, structural properties data, corrosion resistance tables, certificates of
      compliance, test reports as applicable, and design calculations for systems not sized or
      designed in the contract documents, sealed by a Professional Engineer.
D. The CONTRACTOR may be requested to submit sample pieces of each item specified herein for acceptance by the ENGINEER as to quality and color. Sample pieces shall be manufactured by the method to be used in the WORK.

1.4 QUALITY ASSURANCE

A. All items to be provided under this Section shall be furnished only by manufacturers having a minimum of ten (10) years of experience in the design and manufacture of similar products and systems. Additionally, if requested, a record of at least five (5) previous, separate, similar successful installations in the last five (5) years shall be provided.

B. Manufacturer shall offer a 3 year limited warranty on all FRP products against defects in materials and workmanship.

1.5 PRODUCT DELIVERY AND STORAGE

A. Delivery of Materials: Manufactured materials shall be delivered in original, unbroken pallets, packages, containers, or bundles bearing the label of the manufacturer. Adhesives, resins and their catalysts and hardeners shall be crated or boxed separately and noted as such to facilitate their movement to a dry indoor storage facility.

B. Storage of Products: All materials shall be carefully handled to prevent them from abrasion, cracking, chipping, twisting, and other types of damage. Store adhesives, resins and their catalysts and hardeners in dry indoor storage facilities between 70 and 85 degrees Fahrenheit (21 to 29 degrees Celsius) until they are required.

PART 2 - MATERIALS

2.1 MANUFACTURER

A. Structural shapes shall be PROForms® as manufactured by

Bedford Reinforced Plastics, Inc.
One Corporate Drive, Suite 106
Bedford, PA 15522, USA
(814) 623-8125 Phone
(814) 623-6032 Fax
Website: https://bedfordreinforced.com

2.2 GENERAL

A. All structural shapes are to be manufactured by the pultrusion process with a glass content minimum of 45%, maximum of 55% by weight. The structural shapes shall be composed of fiberglass reinforcement and resin in qualities, quantities, properties, arrangements and dimensions as necessary to meet the design requirements and dimensions as specified in the Contract Documents.

B. Fiberglass reinforcement shall be a combination of continuous roving, continuous strand mat, and surfacing veil in sufficient quantities as needed by the application and/or physical properties required.
C. Resins shall be ISO, non-fire retardant isophthalic polyester used to produce NSF Standard 61 certified shapes; ISOFR, fire retardant isophthalic polyester; VE, non-fire retardant vinyl ester used to produce NSF Standard 61 certified shapes or VEFR, fire retardant vinyl ester, (choose one) with chemical formulation necessary to provide the corrosion resistance, strength and other physical properties as required.

D. All finished surfaces of FRP items and fabrications shall be smooth, resin-rich, free of voids and without dry spots, cracks, crazes or unreinforced areas. All glass fibers shall be well covered with resin to protect against their exposure due to wear or weathering.

E. All pultruded structural shapes shall be further protected from ultraviolet (UV) attack with 1) integral UV inhibitors in the resin and 2) a synthetic surfacing veil to produce a resin rich surface.

F. All fire retardant FRP products shall have a tested flame spread rating of 25 or less per ASTM E-84 Tunnel Test.

G. Pultruded structural shapes are to have the minimum longitudinal mechanical properties listed below:

<table>
<thead>
<tr>
<th>Property</th>
<th>ASTM Method</th>
<th>Value</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tensile Strength</td>
<td>D-638</td>
<td>30,000 (206)</td>
<td>psi (MPa)</td>
</tr>
<tr>
<td>Tensile Modulus</td>
<td>D-638</td>
<td>$2.5 \times 10^6$ (17.2)</td>
<td>psi (GPa)</td>
</tr>
<tr>
<td>Flexural Strength</td>
<td>D-790</td>
<td>30,000 (206)</td>
<td>psi (MPa)</td>
</tr>
<tr>
<td>Flexural Modulus</td>
<td>D-790</td>
<td>$1.8 \times 10^6$ (12.4)</td>
<td>psi (GPa)</td>
</tr>
<tr>
<td>Flexural Modulus (Full Section)</td>
<td>N/A</td>
<td>$2.8 \times 10^6$ (19.3)</td>
<td>psi (GPa)</td>
</tr>
<tr>
<td>Short Beam Shear (Transverse)</td>
<td>D-2344</td>
<td>4,500 (31)</td>
<td>psi (MPa)</td>
</tr>
<tr>
<td>Shear Modulus (Transverse)</td>
<td>N/A</td>
<td>$4.5 \times 10^5$ (3.1)</td>
<td>psi (GPa)</td>
</tr>
<tr>
<td>Coefficient of Thermal Expansion</td>
<td>D-696</td>
<td>$7.0 \times 10^{-6}$ (12.6 x $10^{-6}$)</td>
<td>in/in°F (cm/cm°C)</td>
</tr>
<tr>
<td>Flame Spread</td>
<td>E-84</td>
<td>25 or less</td>
<td>N/A</td>
</tr>
</tbody>
</table>

PART 3 - EXECUTION

3.1 FABRICATION

A. Measurements: Structural Shapes supplied shall meet the minimum dimensional requirements as shown or specified. The Contractor shall provide and/or verify measurements in field for work fabricated to fit field conditions as required by manufacturer to complete the work. Determine correct size and locations of required holes or coping from field dimensions before structural shape fabrication.

B. Hardware: Type 316 stainless steel bolts shall be provided.
3.2 INSPECTION

A. Shop inspection is authorized as required by the Owner and shall be at Owner's expense. The fabricator shall give ample notice to Contractor prior to the beginning of any fabrication work so that inspection may be provided. The structural shapes shall be as free, as commercially possible, from visual defects such as foreign inclusions, delamination, blisters, resin burns, air bubbles and pits.

3.3 INSTALLATION

A. Contractor shall be required to install structural shapes in strict accordance with manufacturer's instructions.

B. Follow manufacturer's instructions when cutting or drilling fiberglass products. Provide adequate ventilation.

END OF SECTION