

**ENGINEERING SPECIFICATION**

**PULTRUDED DYNAROUND™ ROUND PROFILE  
FIBERGLASS GUARDRAIL AND HANDRAIL**

SECTION 06 81 13

FIBERGLASS REINFORCED PLASTICS (FRP) FABRICATIONS

PULTRUDED ROUND PROFILE GUARDRAIL AND HANDRAIL

PART 1 - GENERAL

1.1 SCOPE OF WORK

- A. This specification is for a pultruded round fiberglass railing system in compliance with 2015 IBC and OSHA 1910.29 Fall Protection and Falling Object Protection.

1.2 REFERENCES

- A. 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

INTERNATIONAL CODE COUNCIL, INC.  
The International Building Code, 2015

THE OCCUPATIONAL HEALTH AND SAFETY ADMINISTRATION  
Code of Federal Regulations (CFR), Title 29, Section 1910.29

1.3 CONTRACTOR SUBMITTALS

- A. The CONTRACTOR shall furnish shop drawings of all fabricated railings 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' 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.
- C. Manufacturer shall be certified to the ISO 9001-2008 standard.
- D. Manufacturer shall provide proof of certification from at least two other quality assurance programs for its facilities or products (DNV, ABS, USCG, AARR).

#### 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, other deformations, and other types of damage. Adhesives, resins and their catalysts are to be stored in dry indoor storage facilities between 70 and 85 degrees Fahrenheit (21 to 29 degrees Celsius) until they are required.

### PART 2 - PRODUCTS

#### 2.1 MATERIALS

- A. Guardrail and/or Handrail system to be DynaRound™ as manufactured by

**Fibergrate Composite Structures Inc.**

5151 Belt Line Road, Suite 1212  
Dallas, Texas 75254-7028 USA  
(800) 527-4043 Phone (972) 250-1530 Fax

Website: [www.fibergrate.com](http://www.fibergrate.com)

E-mail: [info@fibergrate.com](mailto:info@fibergrate.com)

## 2.2 GENERAL

- A. All posts and rails are to be DYNAFORM® FRP structural shapes manufactured by the pultrusion process. 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 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. Resin shall be DYNAFORM® VEFR, fire retardant vinyl ester 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, 2) a synthetic surfacing veil to help produce a resin rich surface, and 3) an appropriate UV resistant coating for outdoor exposures.
- F. All FRP products shall have a tested flame spread rating of 25 or less per ASTM E-84 Tunnel Test.
- G. Horizontal rails and vertical posts for guardrails are to be 1.9" OD x 0.2" wall (48.3 mm x 5.1 mm) round tube and the kick plate is to be ½" deep x 4" wide x 0.125" thick (12.7 mm x 101.6 mm x 3.2 mm) with two reinforcing corrugations. Offset rail used as handrail is to be 1.5" OD x 0.25" wall (38.1 mm x 6.4 mm) round tube.
- H. The completed guardrail installation shall meet the following load requirements with a minimum factor of safety of 2.0:
  - Concentrated Load: 200 lb (891 N) applied in any direction at any point on the top rail.
  - Uniform Load: 50 lb/lf (730.5 N/m) applied in any direction on the top rail.
  - Loads are assumed not to act concurrently.
- I. All rails, posts, and kick plates are to be integrally pigmented yellow.

- J. The pultruded 1.9" OD x 0.2" wall (48.3 mm x 5.1 mm) round tube is to have the minimum longitudinal mechanical properties listed below:

Property	ASTM Method	Value	Units
Flexural Strength (Full Section)	---	70,000 (482)	psi (MPa)
Flexural Modulus (Full Section)	---	$5.0 \times 10^6$ (34.4)	psi (GPa)
Short Beam Shear (Transverse)	D-2344	4,500 (31)	psi (MPa)
Shear Modulus (Transverse)	N/A	$4.5 \times 10^5$ (3.1)	psi (GPa)
Density	D792	0.062 – 0.070 (1.71 – 1.93)	lb/in <sup>3</sup> (g/cc)
Coefficient of Thermal Expansion	D-696	$8.0 \times 10^{-6}$ ( $1.4 \times 10^{-6}$ )	in/in/°F (cm/cm/°C)
Flame Spread	E-84	25 or less	N/A

- K. All fasteners used in the railing system are to be AISI 316 stainless steel. Rivets and rivet nuts are to be AISI 304 stainless steel.

## PART 3 - EXECUTION

### 3.0 FABRICATION

- A. The post/rail connections for the 1.9" OD x 0.2" wall guardrail system are to be fabricated using molded, glass reinforced saddle connectors. The saddle connectors are to be attached to the tubes via bonding and riveting. The saddle connectors are to be connected to the adjoining tubes or connectors with 316SS 1/4" diameter bolts and/or 304SS rivet nuts as required. No sharp, protruding edges are to remain after assembly of the railing system. No PVC or CPVC connectors are to be used as a load carrying component of the railing system. Spacing of the posts for horizontal runs is not to exceed 4'-0" (1.22 m). Spacing of posts for inclined runs and offset handrail supports shall not exceed 3'-6" (1.07 m).
- B. The bases of guardrail posts are to be secured according to the contract drawings. The bases of the posts are to be internally reinforced to a height of 8.5" (216 mm). Posts are to be detailed with drain features that prevent the accumulation of water inside of the posts.
- C. The 1.5" OD x 0.25" wall round tube offset handrail is to be installed at a height of 34 inches above the walking surface and/or stair nosings and extend beyond the upper and lower treads as required to comply with governing building codes. The ends of the offset handrail are to terminate via a smooth, molded transition into the guardrail or wall. The offset handrails are to be attached to guards or walls with brackets fabricated from 316 stainless steel and/or FRP components. The configuration of the offset handrail brackets is to meet all IBC 2015 graspability requirements.
- D. For inline splices, the 1.9" OD x 0.2" wall horizontal rails are to be spliced using a 10" (152.4 mm) length of 1.5" OD x 1/4" (38.1 mm x 6.4 mm) FRP round tube bonded and riveted into place using epoxy adhesive. Inline splices for offset handrail to be a 5" (127 mm) length of 1" diameter (25.4 mm) FRP solid round rod.

- E. For 90 degree splices, both the 1.9" OD x 0.2" wall horizontal rails and the 1.5" OD x 0.25" wall round tube offset handrail are to be spliced using a specially molded component which smoothly transitions between the spliced tubes with a constant radius. The spliced tubes are to be bonded and riveted to this molded 90-degree splice.
- F. For non-90 degree splices, both the 1.9" OD x 0.2" wall horizontal rails and the 1.5" OD x 0.25" wall round tube offset handrail are to be connected using a molded adjustable splice which can be adjusted to an included angle of 180 to 39 degrees. The ends of the spliced tube are to be mitered to achieve a minimum-gap butt joint. The spliced tubes are to be bonded and riveted to the molded splice.
- G. All shop fabricated cuts are to be sealed to provide maximum corrosion resistance. Field cuts are to be similarly coated by the contractor in accordance with the manufacturer's instructions.