SECTION 06500
FIBREGLASS REINFORCED PLASTIC PRODUCTS AND FABRICATIONS

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. American Society for Testing and Materials (ASTM):
   a. C177, Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded Hot-Plate Apparatus.
   b. D570, Standard Test Method for Water Absorption of Plastics.
   c. D635, Standard Test Method for Rate of Burning and/or Extent and Time of Burning Plastics in a Horizontal Position.
   d. D638, Standard Test Method for Tensile Properties of Plastics.
   e. D695, Standard Test Method for Compressive Properties of Rigid Plastics.
   f. D696, Standard Test Method for Coefficient of Linear Thermal Expansion of Plastics Between -30 Degrees C and 30 Degrees C.
   g. D790, Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.
   h. D792, Standard Test Methods for Density and Specific Gravity (Relative Density) by Plastics Displacement.
   i. D2344, Standard Test Method for Apparent Interlaminar Shear Strength of Parallel Fiber Composites by Short-Beam Method.
   j. D2583, Standard Test Method for Indentation Hardness of Rigid Plastics by Means of a Barcol Impressor.
   k. E84, Standard Test Method for Surface Burning Characteristics of Building Materials.
2. Building Officials and Code Administrators International (BOCA): National Building Code (NBC).
3. Canadian General Standards Board (CGSB): 41-GP-22 Process Equipment, Reinforced Polyester, Chemical Resistant, Custom-Contact Molded.
4. Canadian Standard Association (CSA): S806 Design and Construction of Building Components with Fibre-Reinforced Polymers.
5. National Building Code of Canada (NBC).
6. Underwriters' Laboratories, Inc. (UL): 94, UL Standard for Safety Test for Flammability of Plastic Materials for Parts in Devices and Appliances.

1.02 DESIGN REQUIREMENTS

A. This section contains components and connectors that require Contractor design.

B. Design handrails (guards) and ladder to meet NBC

1.03 SUBMITTALS

A. Shop Drawings:

1. Product Data: Catalog information and catalog cuts showing materials, shapes, weights, design tasks, and showing load, span, and deflection; include manufacturer's specifications.
2. Handrails, Ladders, and Support Structures:
   a. Show dimensions, weight, size, and location of connections to adjacent supports and other Work.
   b. Structural calculations for ladders and handrails, and other fabrications shown, including design loads and other structural parameters considered

B. Samples: Each type of handrail, and handrail connection showing material composition, colour and texture of finish.

C. Information Submittals:

1. Handling and storage requirements.
2. Manufacturer's installation instructions.
3. Factory test reports for physical properties of product.
   a. Test data for handrails and supports may supplement load calculations providing data covers the complete system, including anchorage.
   b. Include test data for the following:
      1) Railing and post connections.
      2) Railing wall connections.
      3) Post and base connections.
      4) Railing expansion joint connections.
4. Manufacturer's Certification of Compliance for specified products.
5. Fabricator's qualification experience.
6. Manufacturer's qualification experience.
7. Independent laboratory test report, dated within 2 years of submittal date, of fire retardant testing conducted on exact type of grating proposed (not a resin test report).

1.04 QUALIFICATIONS

A. Designer: Calculations required for Contractor design shall be stamped by a registered engineer, licensed in Manitoba.

B. Manufacturer:

1. Minimum of 5 years' experience in manufacturing of products meeting these specifications.
2. Membership in good standing of the Society of the Plastics Industry of Canada.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Preparation for Shipment:

1. Insofar as is practical, factory assemble items provided hereunder.
2. Ladders shall be shipped fully shop-fabricated and assembled.
3. Package and clearly tag parts and assemblies that are of necessity shipped unassembled in a manner that will protect materials from damage, and facilitate identification and final assembly in field.

B. Storage and Handling: In accordance with manufacturer's recommendations and in such a manner as to prevent damage of any kind, including overexposure to sunlight.

1.06 WARRANTY

A. Submit a two year warranty for work of this Section against defects in materials and workmanship including, but not limited to:

1. Performance failure of units.
2. Fading, discolouration or evidence of other defects of exterior surface.

PART 2 PRODUCTS

2.01 GENERAL

A. Like Items of Materials: Where possible, provide end products of one manufacturer in order to achieve standardization for appearance, maintenance, and replacement.

B. Unless otherwise specified, all products shall be manufactured by a pultruded process using vinyl ester resin.

C. Products shall be manufactured with ultra-violet (UV) inhibitor additives.

D. Exterior surfaces shall have a synthetic surface veil covering.

E. Furnish molded products as an option where permitted by specifications.

F. Fire Retardance:

1. Flame spread shall be less than 25 as measured by ASTM E84.
2. Include combinations of aluminum trihydrate, halogen, and antimony trioxide, where required to meet fire retardance, in the resin system.
3. Meet self-extinguishing requirements of ASTM D635.

G. Colour pigment shall be dispersed in resin system.

H. Fabricate FRP products exposed to outdoor conditions with an additional 0.025 mm thick UV coating to shield product from UV light.

I. All cut ends, holes, and abrasions of FRP shapes shall be sealed with resin to prevent intrusion of moisture.

J. Comply with CGSB 4-GP-22. Do not regard shape of FRP units indicated as exact or complete.

K. Design units to applicable parameters established by the CSA S806 including snow loads and wind loads for return period of 1 in 30.

L. Design for erection loads, effect of creep and other causes of dimensional change.

M. Design for strength and integrity at service conditions in accordance with engineering practices prevalent in the field of fibreglass reinforced plastics.

N. Provide products free of defects such as voids, porosity, cracks, pits, scratches, dry spots, and any other irregularity.

2.02 HANDRAIL

A. Structural Criteria:

1. Design handrail system in accordance with the requirements of CSA S806, including top rails, posts, mid-rails, brackets, connections, mounts, bases, and anchors.

B. Thermal Movement:

1. Allow for maximum range of ambient temperature change (difference between high or low and installation temperature).

2. Base design on actual surface temperatures of materials due to both solar heat gain and night time sky heat loss.
3. Temperature Change Range: 50 degrees C, ambient; 65 degrees C, material surfaces.

C. Rails and Posts:

1. 43 mm nominal square or round tubing posts.
2. 43 mm nominal round or square rails.
3. Maximum Post Spacing: 1.5 m.
4. Clearance Between Rails: 290 mm.

D. Kickplates: Corrugated, 125 mm by 12 mm by 3 mm thick or 125 mm by 14 mm thick at all handrail locations.

E. Kickplate Connectors and Splices: Continuous with provision for expansion and contraction without distortion or buckling.

F. Connections, Mounts, Bases: Fibreglass or Type 316 stainless steel.

G. Pultruded Parts:

Minimum Mechanical Properties	**Test Method**	**Values**
Tensile Stress	ASTM D638	207 MPa
Tensile Modulus	ASTM D638	17.2×10^3 MPa
Compressive Stress	ASTM D695	207 MPa
Compressive Modulus	ASTM D695	17.2×10^3 MPa
Flexural Stress	ASTM D790	207 MPa
Flexural Modulus	ASTM D790	11.0×10^3 MPa
Shear Stress	ASTM D2344	31.0 MPa
Density	ASTM D792	$1.72\text{-}1.94 \times 10^{-3}$ g/mm^3
24-Hour Water Absorption	ASTM D570	0.6% max.
Coefficient of Thermal Expansion	ASTM D696	8×10^{-6} mm/mm/degree C
Flexural Stress	Full Section	248 MPa
Flexural Modulus	Full Section	25.5×10^3 MPa

H. Manufacturers:

1. Strongwell Corp..
2. Fibergrate Composite Structures, Inc.

2.03 LADDERS AND CAGES

A. Ladder Criteria:

1. Design in accordance with the requirements of OSHA and CSA S806 in addition to the requirements listed below.
2. Side Rails: 45 mm square tubes, 6 mm thick.
3. Rungs: Minimum 25 mm-diameter thermal cure rod with pigmented epoxy, nonskid grit surface, or 32 mm minimum diameter pultruded, fluted, nonslip surface of vinyl ester resin.

B. Cage Criteria:

1. Design in accordance with the requirements of OSHA in addition to the requirements listed below.
2. Top and Bottom Hoops: 75 mm minimum width by 6 mm minimum thickness.
3. Intermediate Hoops: 50 mm minimum width by 6 mm minimum thickness.
4. Hoops manufactured by open-mold hand layup process.
5. Vertical Connecting Straps to Hoops:
   a. 50 mm wide by 5 mm thick or 50 mm wide by 14 mm pultruded channels.
   b. Maximum Spacing: 225 mm.
6. Maximum Vertical Distance Between Hoops: 1 m.

C. Manufacturers:

1. Strongwell Corp.
2. Fibergrate Composite Structures, Inc.

PART 3 EXECUTION

3.01 GENERAL

A. Examination:

1. Examine surfaces to which work is to be anchored, and job conditions.
2. Report surfaces and conditions which would adversely affect installation.
3. Do not commence installation until unsatisfactory surfaces and conditions are corrected.

B. Install in accordance with manufacturer's written instructions.

C. Install plumb or level, rigid and neat, as applicable.

D. Furnish fasteners and anchorages for complete installation.

E. Seal field cut holes, edges, and abrasions with catalyzed resin compatible with original resin.

3.02 HANDRAIL

A. Provide and install expansion and contraction connections as shown on approved Shop Drawings.

3.03 STRUCTURAL SHAPES

A. Connect parts with approved connectors meeting manufacturer's design requirements and with corrosion resistance equal to structural shapes.

B. Provide supports and bracings required to comply with applicable codes and design requirements.

3.04 LADDERS AND CAGES

A. Epoxy and rivet joints and rungs.

B. Attach hoops to maintain full width clearance between rails, full height of ladder.

END OF SECTION