SECTION 06 10 00
ROUGH CARPENTRY

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: Rough carpentry for the following:

1. Wood grounds, nailers, and blocking.
2. Plywood backing panels.

B. Drawing and general provisions of Contract, including General and Supplementary Conditions and Division 1, apply to this Section.

1.02 DEFINITIONS

A. Rough carpentry includes carpentry work not specified as part of other Sections and which is generally not exposed, except as otherwise indicated.

1.03 SUBMITTALS

A. Shop Drawings: Submit in accordance with Section 01 33 00 Submittal Procedures covering the items included under Section. Shop Drawing submittals shall include:

1. Product Data: Manufacturer's specifications and installation instructions for materials listed below:
2. Wood Treatment Data: Chemical treatment manufacturer's instructions for handling, storing, installation, and finishing of treated material.
3. Preservative Treatment: For each type specified, include certification by treating plant stating type of preservative solution and pressure process used, net amount of preservative retained, and conformance with applicable standards.
4. For water-borne treatment, include statement that moisture content of treated materials was reduced to levels indicated prior to shipment to Site.
5. Fire-Retardant Treatment: Certification by treating plant that treated material complies with specified standard and other requirements.

1.04 PRODUCT HANDLING

A. Delivery and Storage: Keep materials under cover and dry. Protect against exposure to weather and contact with damp or wet surfaces. Stack lumber as well as plywood and other panels; provide for air circulation within and around stacks and under temporary coverings including polyethylene and similar materials.

1.05 PROJECT CONDITIONS

A. Coordination: Fit carpentry work to other work; scribe and cope as required for accurate fit. Correlate location of furring, nailers, blocking, grounds, and similar supports to allow attachment of other Work.

PART 2 - PRODUCTS

2.01 LUMBER

A. Lumber Standards: Manufacture lumber to comply with PS 20, American Softwood Lumber Standard, and with applicable grading rules of inspection agencies certified by American Lumber Standards Committee's (ALSC) Board of Review.

B. Inspection Agencies: Inspection agencies and the abbreviations used to reference with lumber grades and species include the following:

1. SPIB - Southern Pine Inspection Bureau.
2. WCLIB - West Coast Lumber Inspection Bureau.
3. WWPA - Western Wood Products Association.

C. Grade Stamps: Factory-mark each piece of lumber with grade stamp of inspection agency evidencing compliance with grading rule requirements and identifying grading agency, grade, species, moisture content at time of surfacing, and mill.

D. Nominal sizes are indicated, except as shown by detail dimensions. Provide actual sizes as required by PS 20 for moisture content specified for each use.

1. Provide dressed lumber, S4S, unless otherwise indicated.
2. Provide lumber with 15 percent maximum moisture content at time of dressing and shipment for Sizes 2 inches or less in nominal thickness, unless otherwise indicated.

2.02 BOARDS

A. Exposed Boards: Where boards will be exposed in the finished work, provide the following:

1. Moisture Content: 15 percent maximum, "MC-15."
2. Where transparent or natural finish or no finish is indicated, provide Redwood, Select Heart Grade (RIS).
3. Where painted finish is indicated, provide No. 1 Boards per SPIB rules, Select Merchantable Boards per WCLIB rules, or No. 2 Common Boards and Better per WWPA rules.

2.03 MISCELLANEOUS UNTREATED LUMBER

A. Provide wood for support or attachment of other Work including bucks, nailers, blocking, furring, grounds, stripping, cants, rooftop equipment bases and support curbs, and similar members. Provide lumber of sizes indicated, worked into shapes shown, and as follows:

1. Moisture content: 15 percent maximum.
2. Grade: Standard grade, light framing size lumber of any species or board size lumber as required. No. 2 Common or Standard grade boards per WCLIB or WWPA rules or No. 2 boards per SPIB rules.

2.04 TREATED LUMBER

A. Rooftop Equipment Curbs, cant strips, support bases, and wood which will come in contact with water or concrete shall be No. 2, Grade dense or better, Southern Yellow Pine or Douglas Fir, moisture content of 15 percent maximum. All of the above shall be treated as specified under wood treatment for termite and decay protection.

2.05 CONSTRUCTION PANELS

A. Standards: Comply with PS 1 U.S. Product Standard for Construction and Industrial Plywood for plywood panels and, for products not manufactured under PS 1 provisions, with APA Performance Standard and Policies for Structural-Use Panels, Form No. E445.

B. Trademark: Factory-mark each construction panel with APA trademark evidencing compliance with grade requirements.

C. Plywood Backing Panels: For mounting electrical or telephone equipment, provide fire retardant treated-plywood panels with grade designation, APA C-D PLUGGED INT, with exterior glue, in thickness indicated or, if not otherwise indicated, not less than 15/32 inch.

2.06 MISCELLANEOUS MATERIALS

A. Fasteners and Anchorages: Provide size, type, material and finish as indicated and as recommended by applicable standards, complying with applicable Federal Specifications for nails, staples, screws, bolts, nuts, washers, and anchoring devices. Provide metal hangers and framing anchors of the size and type recommended by the manufacturer for each use including recommended nails.

2.07 WOOD TREATMENT BY PRESSURE PROCESS

A. Preservative Treatment: Where lumber or plywood is indicated as "Trt-Wd" or "Treated," or is specified herein to be treated, comply with applicable requirements of AWPA Standards C2 (Lumber) and C9 (Plywood) and of AWPB Standards listed below. Mark each treated item with the AWPB Quality Mark requirements.

1. Pressure-treat aboveground items with water-borne preservatives to comply with AWPB LP-2. After treatment, kiln-dry lumber and plywood to a maximum moisture content of 15 percent. Treat indicated items and the following:

B. Fire-RetardantTreatment: Where fire-retardant-treated wood ("FRTW") is indicated, pressure impregnate lumber with fire-retardant chemicals to comply with AWPA C20 for treatment type indicated below; identify "FRTW" lumber with appropriate classification marking of Underwriters Laboratories, Inc., U.S. Testing, Timber Products Inspection, or other testing and inspecting agency acceptable to authorities having jurisdiction.

1. Interior Type A: Use where "FRTW" wood is indicated for interior applications.
2. Exterior Type: Use where "FRTW" wood is indicated for exterior, exposed applications.
3. Inspect each piece of treated lumber or plywood after drying and discard damaged or defective pieces.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Discard units of material with defects which might impair quality of work, and units which are too small to use in fabricating work with minimum joints or optimum joint arrangement.

B. Set carpentry work to required levels and lines, with members plumb and true to line and cut and fitted.

C. Securely attach carpentry work to substrate by anchoring and fastening as indicated, complying with the following:

1. CABO NER-272 for power driven fasteners.
2. Published requirements of metal framing anchor manufacturer.
3. Table 2304.9.1, "Fastening Schedule," in the Michigan Building Code.

D. Countersink nail heads on exposed carpentry work and fill holes.

E. Use common wire nails except as otherwise indicated. Use finishing nails for finish work. Select fasteners of size that will not penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting of wood; pre-drill as required.

F. Install fire-retardant treated plywood backing panels with classification marking of testing agency exposed to view.

3.02 WOOD GROUNDS, NAILERS, BLOCKING, AND SLEEPERS

A. Provide wherever shown and where required for screening or attachment of other work. Form to shapes as shown and cut as required for true line and level of work to be attached. Coordinate location with other work involved.

B. Attach to substrates as required to support applied loading. Countersink bolts and nuts flush with surfaces, unless otherwise indicated. Build into masonry during installation of masonry work. Where possible, anchor to formwork before concrete placement.

3.03 INSTALLATION OF CONSTRUCTION PANELS

A. Comply with applicable recommendations contained in Form No. E 30K, APA Design/Construction Guide - Residential and Commercial, for types of plywood products and applications indicated.

1. Comply with "Code Plus" provisions in above-referenced guide.

3.04 PROTECTION

A. Protect wood that has been treated with inorganic boron (SBX) from weather. If, despite protection, inorganic boron-treated wood becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

B. Protect rough carpentry from weather. If, despite protection, rough carpentry becomes sufficiently wet that moisture content exceeds that specified, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION

SECTION 06 40 20
INTERIOR ARCHITECTURAL WOODWORK

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Laminate clad cabinets (plastic-covered casework).

B. Related Documents: Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to Work of this Section.

1.02 SUBMITTALS

A. Shop Drawings: Submit in accordance with Section 01 33 00, Submittal Procedures covering the items included under this Section. Shop Drawing submittals shall include:

1. Shop Drawings showing location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.
2. Samples for initial selection purposes of the following in form of manufacturer's color charts consisting of actual units or sections of units showing full range of colors, textures, and patterns available for each type of material indicated.
   a. Plastic laminate.

B. Quality Control Submittals: Qualification data for firms and persons specified in "Quality Assurance" Paragraph to demonstrate their capabilities and experience. Include list of completed projects with project names, addresses, names of Engineers and Owners, and other information specified.

1.03 QUALITY ASSURANCE

A. Manufacturer Qualifications: Firms regularly engaged in manufacture of equipment, of types and sizes required, and whose products have been in satisfactory use in similar projects for not less than 5 years.

B. Codes and Standards:

1. Applicable requirements of Architectural Woodwork Quality Standards published by the Architectural Woodwork Institute (AWI), except as otherwise indicated.

a. Casework.
b. Plastic laminate countertops.
c. Laboratory countertops.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Protect woodwork during transit, delivery, storage, and handling to prevent damage, soilage, and deterioration.

B. Do not deliver woodwork until painting, wet work, grinding, and similar operations that could damage, soil, or deteriorate woodwork have been completed in installation areas. If woodwork must be stored in other than installation areas, store only in areas whose environmental conditions meet requirements specified in "Project Conditions."

1.05 PROJECT CONDITIONS

A. Environmental Conditions: Obtain and comply with woodwork manufacturer's and installer's coordinated advice for optimum temperature and humidity conditions for woodwork during its storage and installation. Do not install woodwork until these conditions have been attained and stabilized so that woodwork is within plus or minus 1.0 percent of optimum moisture content from date of installation through remainder of construction period.

B. Field Measurements: Where woodwork is indicated to be fitted to other construction, check actual dimensions of other construction by accurate field measurements before manufacturing woodwork; show recorded measurements on final Shop Drawings. Coordinate manufacturing schedule with construction progress to avoid delay of Work.

PART 2 - PRODUCTS

A. Subject to compliance with specified requirements, manufacturers offering products which may be incorporated in Work include:

1. High-Pressure Decorative Laminates:
   a. Formica Corp.
   b. Laminart.
   c. Micarta Division, Westinghouse Electric Corp.
   d. Nevamar Corp.
   e. Ralph Wilson Plastics Co.

2.02 MATERIALS

A. Provide materials that comply with requirements of the WIC woodworking standard for each type of woodwork and WIC quality grade indicated unless otherwise indicated.

B. Provide materials that comply with requirements of the AWI woodworking standard for each type of woodwork and quality grade indicated and, where the following products are part of woodwork, with requirements of the referenced product standards that apply to product characteristics indicated:

1. Hardboard: ANSI/AHA A135.4.
2. High-Pressure Laminate: NEMA LD 3.
3. Medium Density Fiberboard: ANSI A 208.2.
4. Particleboard: ANSI A 208.1.
5. Softwood Plywood: PS 1.
6. Formaldehyde Emission Levels: Comply with formaldehyde emission requirements of each voluntary standard referenced below:
   a. Particleboard: NPA 8.
   b. Medium Density Fiberboard: NPA 9.
   c. Hardwood Plywood: HPMA FE.

2.03 FABRICATION

A. Wood Moisture Content: Comply with requirements of referenced quality standard for moisture content of lumber in relation to relative humidity conditions existing during time of fabrication and in installation areas.

B. Fabricate woodwork to dimensions, profiles, and details indicated. Ease edges to radius indicated for the following:

1. Corners of c`abinets and edges of solid wood (lumber) members less than 1 inch in nominal thickness: 1/16 inch.
2. Edges of rails and similar members more than 1 inch in nominal thickness: 1/8 inch.

C. Complete fabrication, including assembly, finishing, and hardware application, before shipment to Site to maximum extent possible. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.

D. Factory-cut openings, to maximum extent possible, to receive hardware, appliances, plumbing fixtures, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized

and shaped openings. Smooth edges of cutouts and, where located in countertops and similar exposures, seal edges of cutouts with a water-resistant coating.

2.04 LAMINATE CLAD CABINETS (PLASTIC-COVERED CASEWORK)

A. Quality Standard: Comply with AWI Section 400 and its Division 400B "Laminate Clad Cabinets."

1. Grade: Premium.

B. AWI Type of Cabinet Construction:

1. Flush overlay.

C. Laminate Cladding: High-pressure decorative laminate complying with the following requirements:

1. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:
   a. Provide selections made by ENGINEER from laminate manufacturer's full range of standard colors and finishes in the following categories:
      i. Solid colors.

D. Laminate Grade for Exposed Surfaces: Provide laminate cladding complying with the following requirements for type of surface and grade.

1. Horizontal Surfaces other than Tops: HGS (Type 107), 0.048 inch nominal thickness.
2. Post-formed Surfaces: HGP (Type 350), 0.039 inch nominal thickness.
3. Vertical Surfaces: HGS (Type 107), 0.048 inch nominal thickness.
4. Edges:
   a. HGS (Type 107), 0.048 inch nominal thickness.

2.05 CABINET HARDWARE AND ACCESSORY MATERIALS

A. Provide cabinet hardware and accessory materials associated with architectural cabinets, except for items specified in Section 08 7100.

B. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with ANSI/ BHMA A 156.18 for BHMA code number indicated.
1. Satin Stainless Steel, Stainless Steel Base: BHMA 630.

C. For concealed hardware provide manufacturer's standard finish that complies with product class requirements of ANSI/BHMA A156.9.

2.06 ARCHITECTURAL CABINET TOPS (COUNTERTOPS)

A. Quality Standard: Comply with AWI Section 400 and its Division 400C.

2.07 EPOXY RESIN LABORATORY COUNERTOPS AND SPLASHES

A. Epoxy Resin Quality Standard:

1. Typical work surface: Nominal 1 inch flat. Finished tops to be supplied in maximum practical length up to 96 inches finished.
2. Surface finish to be smooth, non-glare matte finish with clean exposed edges in uniform plane, free of defects.
3. Loose Curbs and splashes: 1 inch or to match thickness of countertops. Typical height 4 inches.
4. Color: Black
5. Drip Grooves: Provide under all work surfaces exposed edges, unless noted otherwise. Drip grooves shall be ½ inch set back from the front edge where the top overhangs 1 inch and ¼ inch from the edge where the edge overhangs ½ inch. The drip groove is to be 1/8 inch depth and 1/8 inch wide.
6. Edge profile: All exposed upper edges and corners shall have 1/8 inch bevel or radius as required.
7. Sink Mounting: Drop-in sink cutout- cutouts shall be profiled to provide support for the sink, and to ensure that the rim of the installed sink is 1/8 inch below the surrounding work surface level or bottom of drain grooves, if present. The top edge of the cutout shall have 1/8 inch bevel. Fill any overcut wqith 2 part epoxy adhesive to ensure there will be no gaps between the installed sink rim and work surface.
8. Curbs and splashes: 4 inch height, unless noted otherwise, same material as countertops and bonded or field applied to the surface of the the top to form a square 90 degree joint.
9. Provide all faucet and utility holes and cutouts as required for built in equipment and mechanical and electrical service fixtures. Verify size and location of opening with actual size of equipment to be used prior to making openings. Form inside corners to a radius of not less than 1/8 inch. After drilling, rout and file cutouts to ensure smooth, crack free edges.
10. Install epoxy resin countertops with supplier's recommended silicone or Epoxy resin adhesive to the casework. All square butt joints, splashes and sealing around sinks to be manufacturer's recommended compatible and chemical resistant epoxy adhesive.

2.08 FASTENERS AND ANCHORS

B. Screws: Select material, type, size, and finish required for each use. Comply with FS FF-S-111 for applicable requirements.

C. Nails: Select material, type, size, and finish required for each use. Comply with FS FF-N-105 for applicable requirements.

D. Anchors: Select material, type, size, and finish required by each substrate for secure anchorage. Provide nonferrous metal or hot-dip galvanized anchors and inserts on inside face of exterior walls and elsewhere as required for corrosion resistance. Provide toothed steel or lead expansion bolt devices for drilled-in-place anchors. Furnish inserts and anchors, as required, to be set into concrete or masonry work for subsequent woodwork anchorage.

PART 3 - EXECUTION

3.01 PREPARATION

A. Condition woodwork to average prevailing humidity conditions in installation areas before installing.

B. Deliver concrete inserts and similar anchoring devices to be built into substrates well in advance of time substrates are to be built.

C. Before installing architectural woodwork, examine shop-fabricated Work for completion, and complete Work as required, including back-priming and removal of packing.

3.02 INSTALLATION

A. Quality Standard: Install woodwork to comply with AWI Section 1700 for same grade specified in Part 2 of this Section for type of woodwork involved.

B. Install woodwork plumb, level, true, and straight with no distortions. Shim as required with concealed shims. Install to a tolerance of 1/8-inch in 8'-0" for plumb and level (including tops) and with no variations in flushness of adjoining surfaces.

C. Scribe and cut woodwork to fit adjoining Work and refinish cut surfaces or repair damaged finish at cuts.

D. Cabinets: Install without distortion so that doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in

openings and to provide unencumbered operation. Complete the installation of hardware and accessory items as indicated. Maintain veneer sequence matching (if any) of cabinets with transparent finish.

3.03 ADJUSTMENT AND CLEANING

A. Repair damaged and defective woodwork where possible to eliminate defects functionally and visually. Where not possible to repair, replace woodwork. Adjust joinery for uniform appearance.

B. Clean, lubricate, and adjust hardware.

C. Clean woodwork on exposed and semi-exposed surfaces. Touch-up factory-applied finishes to restore damaged or soiled areas.

3.04 PROTECTION

A. Provide final protection and maintain conditions in a manner acceptable to manufacturer and Installer that ensures that woodwork is being without damage or deterioration at time of Substantial Completion.

END OF SECTION

SECTION 06 61 00
FRP FABRICATIONS

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes the following:

1. FRP structural shapes.
2. FRP gratings, decking, and frames.

B. Related Documents: Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1, apply to Work of this Section.

1.02 DEFINITIONS

A. Definitions in ASTM E 985 for railing related terms apply to this Section.

B. Pultrusion: Process of pulling fiberglass rovings (strands), mats, and other forms of reinforcements such as woven fiberglass through baths of thermosetting liquid resin, and then through a heated forming die (made of steel) to form a completed composite fiberglass structural shape.

1.03 SYSTEM PERFORMANCE REQUIREMENTS

Structural Performance: Design, engineer, fabricate, and install the following FRP fabrications to withstand the following structural loads without exceeding the allowable design working stress of the materials involved, including anchors and connections. Apply each load to produce the maximum stress in each respective component of each FRP fabrication.

A. Design Criteria:

1. All FRP connections shall be 316 Stainless Steel
2. All primary and secondary supports shall be stainless steel, designed and furnished by the FRP manufacturer.
3. All perimeter edge support angles shall be FRP.

B. Structural Performance: Gratings shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated.

1. Elevated Platforms: Uniform load of 100 lb/sq. ft. or concentrated load of 300 lb, or as on plans.

1.04 SUBMITTALS

A. Shop Drawings: Submit in accordance with Section 013300, Submittal Procedures, Working Drawings, and Samples covering the items included under this Section. Shop Drawing submittals shall include:

1. Shop Drawings detailing fabrication and erection of each FRP fabrication indicated. Include plans, elevations, sections, and details of FRP fabrications and their connections. Show anchorage and accessory items. Provide templates for anchors and bolts specified for installation under other Sections.
2. Product Data for products used in miscellaneous FRP fabrications including paint products and grout.
3. Where installed FRP fabrications are indicated to comply with certain design loadings, include structural computations, material properties, and other information needed for structural analysis that has been signed and sealed by the qualified Professional Engineer, licensed in the state of Alabama, responsible for their preparation.
4. Samples representative of materials and finished products as may be requested by ENGINEER.

B. Quality Control Submittals: Qualification data for firms and persons specified in "Quality Assurance" Paragraph to demonstrate their capabilities and experience. Include list of completed projects with project name, addresses, names of Architects, Engineers and Owners, and other information specified.

1.05 QUALITY ASSURANCE:

A. Fabricator Qualifications: Firm experienced in successfully producing FRP fabrications similar to that indicated for this Project, with sufficient production capacity to produce required units without causing delay in Work.

1. Arrange for installation of FRP fabrications specified in this Section by same firm that fabricated them.

B. Engineer Qualifications: Professional Engineer licensed to practice in jurisdiction where Project is located and experienced in providing engineering services of the kind indicated that have resulted in the successful installation of metal fabrications similar in material, design, and extent to that indicated for this Project shall sign and seal the shop drawings.

1.06 PROJECT CONDITIONS

A. Field Measurements: Check actual locations of walls and other construction to which FRP fabrications must fit, by accurate field measurements before fabrication; show recorded measurements on final Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delay of Work.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Subject to compliance with specified requirements, manufacturers offering products which may be incorporated in Work include:

1. FRP Grating, and Frame Materials:
   a. Fibergrate Composite Structures: Safe-T-Span Pultruded Industrial Series Grating T5020 Series
   b. Or alternative manufacturer approved by architect, design engineer, and owner.

2.02 FRP SURFACES

A. For FRP fabrications exposed to view upon completion of Work, provide materials selected for their surface flatness, smoothness, and freedom from surface blemishes. Do not use materials whose exposed surfaces exhibit pitting, seam marks, roller marks, rolled trade names, roughness, and, for FRP sheet, variations in flatness exceeding those permitted by reference standards for stretcher-leveled sheet.

B. FRP resin shall be a corrosion resistant, fire resistant, pultruded-type premium grade isophthalic polyester.

2.03 MATERIALS

A. FRP structural shapes shall be manufactured using a pultruded process utilizing either flame-retardant isophthalic polyester containing an ultraviolet (UV) inhibitor. A synthetic surface veil shall be the outermost layer of reinforcement covering the entire exterior surface. The FRP shapes shall achieve a flame spread of 25 or less in accordance with ASTM test method E 84. The exterior of the pultruded shapes shall have a 1 mil (0.025 mm) minimum polyurethane protective coating for added UV protection. Dimensional tolerances shall be in accordance with ASTM specification D 3917. FRP shapes shall comply with the following material properties:

Table 1 - Fiberglass Pultruded Material Properties

Material Properties	**ASTM Test Method**	**Psi (MPa)**
Pultruded Fiberglass Structural Shapes		
Ultimate tensile strength in longitudinal direction	D 638	30,000 (207), minimum
Ultimate compressive strength in longitudinal direction	D 695	30,000 (207), minimum
Ultimate felexural strength in longitudinal direction	D 790	30,000 (207), minimum
Ultimate shear strength in longitudinal direction	D 3846	5,500 (38), minimum
Ultimate tensile strength in transverse direction	D 638	7,000 (48), minimum
Ultimate compressive strength in transverse direction	D 695	15,000 (103), minimum
Ultimate flexural strength in transverse direction	D 790	10,000 (69), minimum
Ultimate shear strengthen transverse direction	D 3846	5,500 (38), minimum
Density (lb/in.^{3} (kg/mm^3))	D 792	0.065 (0.00180), minimum
Water absorption (24-h immersion)	D 570	0.60 max, percent by weight
Pultruded Fiberglass Sheet		
Ultimate tensile strength in longitudinal direction	D 638	20,000 (138), minimum
Ultimate compressive strength in longitudinal direction	D 638	20,000 (138), minimum
Ultimate flexural strength in longitudinal direction	D 790	30,000 (207), minimum
Ultimate shear strength in longitudinal direction	D 3846	5,500 (38), minimum
Ultimate tensile strength in transverse direction	D 638	10,000 (69), minimum
Ultimate compressive strength in transverse direction	D 695	15,000 (103), minimum
Ultimate flexural strengthen transverse direction	D 790	13,000 (90), minimum
Ultimate shear strength in transverse direction	D 3846	5,500 (38), minimum
Density (lb./in.^{3}(kg/mm^3))	D 792	0.064 (0.00177), minimum
Water absorption (24-h) immersion)	D 570	0.50 max, percent by weight
Thermal		
Thermal Coefficient of Expansion	D 696	5 x 10^{-6} (inches with degree F)***
Thermal Conductivity		4 Btu per sq. ft./hour/ degree F/in.
Specific Heat		0.028 Btu/lb. degree F

Material Properties	**ASTM Test Method**	**Psi (MPa)**
Electrical		
Electric strength, short term in oil, 1/8 inch	D 149	200 vpm*
Electric strength, short term, in oil		35 kV per inch**
Dielectric constant, 60 Hertz	D 150	5.6
Dissipation factor, 60 Hertz	D 150*	0.03
Arc resistance	D 495	120 seconds***
Flame Retardant Properties		
Flame resistance	FTMS 402-2023	75/75 Ign. burn seconds
Intermittent flame test	HLT-15	100 rating
Flammability test	D 635	****
Surface burning characteristics	E 84	25 maximum
Flammability class	UL 94	V-0
Temperature index	UL 94	130

Notes to Table 1:

* Specimen tested perpendicular to laminate face.

** 1-inch long specimen tested parallel to laminate face using 2-inch diameter electrodes.

*** Indicates reported value measured in longitudinal direction.

**** Average time of burning = 0.5 second, average extent of burning = 15 minutes.

B. Fiberglass sheet or solid fiberglass bar shall be used to fabricate the internal connectors for the square tube. The internal connectors will be 1-1/2 by 1-1/2 inches (38.1 by 38.1 mm) with length and angularity variable to meet the requirements of each connection. Angular connections shall be fabricated from fiberglass sheet bonded together using a bisphenol A/epichlorohydrin epoxy resin with an amine-curing agent to give a minimum thickness of 1-1/2 inches. The angular connections will be fabricated to the proper dimension from the fiberglass sheets that have been bonded together.

Fiberglass sheet used for angular connections shall meet the properties specified in Table 1. Fiberglass solid bar, 1-1/2 by 1-1/2-inch, shall be used for the straight connections, and shall meet the properties specified in Table 1.

C. Rivets shall be nickel copper or nonmetallic.

D. Bolts shall be a minimum 3/8 inch (9.5 mm) diameter, 316 stainless steel. FRP bolts or fasteners are not permitted.

E. Adhesive used to bond internal connectors to fiberglass pultruded square tube shall be a bisphenol A/epichlorohydrin epoxy resin with an amine-curing agent.

2.04 FABRICATION

A. FRP Stairs and Treads: All stair components, stringers, frames, supports, and hangers, shall be of standard FRP structural shapes where specified.

1. The treads for the open riser type FRP stairs and landings shall be safety type similar to floor gratings with non-slip nosings.
2. See Standard Details on Drawings for construction details.

2.05 FRP GRATINGS, DECKING, AND FRAMES

A. Glass-fiber grating frames shall be fabricated from pultruded structural angles. No metallic fasteners shall be used.

B. Glass fiber decking shall consist of a solid flat plate bonded to square mesh type or pultruded type grating manufactured of continuous glass fibers completely wetted with polyester resin.

C. Glass fiber gratings shall be standard square mesh type or pultruded bar type manufactured of continuous glass fibers completely wetted with polyester resin.

PART 3 - EXECUTION

3.01 PREPARATION

A. Coordinate and provide anchorages, setting Drawings, diagrams, templates, instructions, and directions for installation of anchorages, including concrete inserts, sleeves, anchor bolts, and miscellaneous items having integral anchors that are to be embedded in concrete or masonry construction. Coordinate delivery of such items to Site.

B. Set sleeves in concrete with tops flush with finish surface elevations; protect sleeves from water and concrete entry.

3.02 INSTALLATION

A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing miscellaneous FRP fabrications to in-place construction. Include threaded fasteners for concrete and masonry inserts, toggle bolts, through-bolts, lag bolts, and other connectors as required.

B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installation of miscellaneous FRP fabrications. Set FRP fabrication accurately in

location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

C. Provide temporary bracing or anchors in formwork for items that are to be built into concrete masonry or similar construction.

D. All cut edges and holes shall be sealed with a compatible resin system containing an UV inhibitor.

E. All connections shall be made using a one-piece solid internal connector bonded to the interior of the square tube using an epoxy adhesive and riveted. The following types of connections are defined:

1. All bolted connections shall have a one-piece solid internal connector bonded to the interior of the square tube through which connector holes will be drilled. A minimum 1 inch (26 mm) length of the solid internal connector will be on each side of the drilled hole.

F. Additional solid internal connector pieces can be bonded with epoxy adhesive to the interior of the square tube as desired.

3.03 INSTALLATION OF FRP BAR GRATINGS AND DECKING

A. Install gratings and decking to comply with recommendations of NAAMM grating standard referenced under Part 2 that apply to grating types and/or bar sizes indicated, including installation clearances and standard anchoring details.

B. Secure removable units to supporting members with type and size of clips and fasteners indicated or, if not indicated, as recommended by grating manufacturer for type of installation conditions shown.

C. Attach toe plates to gratings by bolting, at locations indicated.

D. Install removable railing sections where indicated in slip-fit sockets secured with expansion anchors into concrete. Accurately locate sockets to match post spacing.

E. Expansion Joints: Provide expansion joints at locations indicated or, if not indicated, at intervals not to exceed 40 feet. Provide slip joint with internal sleeve extending 2 inches beyond joint on either side; fasten internal sleeve securely to one side; locate joint within 6 inches of posts.

END OF SECTION