WOOD PLASTICS AND COMPOSITES GENERAL REQUIREMENTS

1. GENERAL

1.1 Summary

.1 This Section specifies wood, plastic and composites general requirements.

1.2 Submittals

.1 Provide submittals in accordance with Section 01300 and the following:

.1 Manufacturer's descriptive literature for materials.

.2 Provide shop drawings for wood, plastics and composite materials.

1.3 Quality Assurance

.1 Lumber by grade stamp of an agency certified by Canadian Lumber Standards Accreditation Board.

.2 Plywood and wood-based composite panels in accordance with CSA and ANSI standards.

2. PRODUCTS

2.1 Materials

.1 Do not use materials containing urea formaldehyde.

.2 Wood framing design is to be certified by the Professional of Record.

.3 Use pre-finished pressure-treated wood for exterior exposed wood.

2.2 Rough Carpentry

.1 Furring, blocking, rough bucks: SPF No. 2 grade or better.

2.3 Finish Carpentry

.1 Interior wood frames: to AWMAC custom grade, solid stock.

.2 Flush paneling: to AWMAC custom grade, hardwood veneer plywood.

3. EXECUTION

3.1 General

.1 Install in accordance with Manufacturer’s recommendations and as required by the Final Design.

.2 Architectural woodwork shall comply with Quality Standards of the Architectural Woodwork Manufacturers Association of Canada (AWMAC), except where specified otherwise.

END OF SECTION

WOOD TREATMENT

1. GENERAL

1.1 Summary

.1 This Section specifies the requirements for preservative treated and fire-retardant treated wood.

1.2 Standards

.1 Canadian Standards Association (CSA):

.1 CSA 080 - Series Wood Preservation.

.2 Canadian Wood Preservation Association.

1.3 Submittals

.1 Provide submittals in accordance with Section 01300 and the following:

.1 Manufacturer's descriptive literature for materials.

2. PRODUCTS

2.1 Materials

.1 Pressure treat wood in accordance with CSA 080

.2 Treat wood associated with windows, wood enclosed in masonry, roofing, concrete or other material not enclosed in heated space to CSA 080 using P5 Wolman chromated copper arsenate salt preservative to obtain minimum net retention of 40 kg/m^3 of wood.

.3 Following water-borne preservative treatment, dry material to maximum moisture content of 12 percent.

3. EXECUTION

3.1 General

.1 Install in accordance with Manufacturer’s recommendations and as required by the Final Design.

.2 Comply with American Wood Preservers Association.

.3 Remove with fine sandpaper chemical deposits on treated wood to receive applied finish.

.4 Treat cuts with hand-applied preservative.

END OF SECTION

ROUGH CARPENTRY

1. GENERAL

1.1 Summary

.1 This Section specifies the supply and installation of rough carpentry.

1.2 Standards

.1 All codes and standards to be latest edition unless noted otherwise.

.2 American Society for Testing and Materials (ASTM):

.1 ASTM A123/A123M - Zinc (Hop-Dip Galvanized) Coatings on Iron and Steel Products.

.2 ASTM A153/A153M - Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

.3 ASTM F1667 - Driven Fasteners: Nails, Spikes and Staples.

.3 American Wood Protection Association (AWPA):

.1 AWPA M2 - Inspection of Wood Products Treated with Preservatives.

.2 AWPA M4 - Care of Preservative-Treated Wood Products.

.4 Canadian Standards Association (CSA):

.1 CSA O80 - Wood Preservation.

.2 CSA O86 - Engineering Design in Wood (Working Stress Design).

.3 CSA O112 Series - CSA Standards for Wood Adhesives:

.1 CSA O112.10, Evaluation of Adhesives for Structural Wood Products (Limited Moisture Exposure).

.2 CSA O112.9, Evaluation of Adhesives for structural wood products (exterior exposure).

.4 CSA O121 - Douglas Fir Plywood.

.5 CSA O122 - Structural Glued-Laminated Timber.

.6 CSA O141 - Softwood Lumber.

.7 CSA O151 - Canadian Softwood Plywood.

.8 CSA O153 - Poplar Plywood.

.9 CSA O325 - Construction Sheathing.

.10 CSA-O437 - Standards on OSB and Waferboard.

.5 Canadian Wood Preservation Association.

.6 Canadian General Standards Board (CGSB):

.1 CAN/CGSB-71.26 - Adhesive for field-gluing plywood to lumber framing and floor systems.

.7 National Lumber Grades Authority (NLGA):

.1 Special products standard for finger-joined structural lumber SPS.

.2 Standard grading rules for Canadian Lumber.

1.3 Submittals

.1 Provide submittals in accordance with Section 01300 and the following:

.1 Manufacturer's descriptive literature for materials.

.2 Provide Shop Drawings of miscellaneous metal fittings and components in accordance with Section 05500.

1.4 Quality Assurance

.1 Identify lumber by official grade mark continuing symbol of grading agency, mill number or name, grade of lumber, species or species grouping or combination designation, rules under which grade and conditions of seasoning at time of manufacture.

.2 Plywood, particleboard, oriented strand board (OSB), and wood based composite panels to CSA and ANSI standards.

.3 For products treated with preservative by pressure impregnation, submit following information:

.1 Information listed in AWPA M2 and revisions specified in CSA 080 Series, Supplementary Requirement to AWPA M2 applicable to specified treatment.

.2 Moisture content after drying following treatment with water-borne preservative.

.3 Acceptable types of paint, stain, and clear finishes that may be used over treated materials to be finished after treatment.

2. PRODUCTS

2.1 Materials

.1 Framing and Structural Members:

.1 Lumber: unless specified otherwise, softwood, S4S, moisture content 19 percent (S-dry) or less to following standards:

.1 CSA O141.

.2 NLGA Standard Grading Rules for Canadian Lumber.

.2 Glued end-jointed (finger-jointed) lumber is not acceptable.

.3 Framing and board lumber: in accordance with NBCC, except as follows:

.1 Framing and board lumber: spruce-pine-fir (S-P-F) species, NLGA No.2 grade or better.

.4 Furring, blocking, nailing strips, grounds, rough bucks, curbs, fascia backing, and sleepers:

.1 Board sizes: S-P-F species, Standard or better grade.

.2 Dimension sizes: S-P-F species, Standard light framing or better grade.

.2 Panel Materials:

.1 Douglas fir plywood (DFP): conform to CSA O121, standard construction.

.2 Canadian softwood plywood (CSP): conform to CSA O151, standard construction.

.3 Poplar plywood (PP): conform to CSA O153, standard construction.

.4 Mat-formed structural panel boards (OSB wafer): conform to CAN/CSA-O437.

.3 Accessories:

.1 Sealants: as specified in Section 07900.

.2 General purpose adhesive: conform to CSA O112 Series.

.3 Nails, spikes, and staples: conform to ASTM F1667 and NBCC requirements.

.4 Bolts: 12 mm diameter unless indicated otherwise, complete with nuts and washers. Hot dipped galvanized.

.5 Proprietary fasteners: toggle bolts, expansion shields and lag bolts, screws and lead plugs, recommended for purpose by Manufacturer.

.6 Explosive actuated fastening devices: as recommended for purpose by Manufacturer.

.4 Fastener Finishes:

.1 Galvanizing: conform to ASTM A153/A153M, use galvanized finished fasteners for exterior work and pressure-preservative treated lumber.

.5 Pressure Preservative Treated Wood:

.1 Do not use preservative treated lumber or plywood for:

.1 Roof curbs, nailers, and sleepers on roof deck and parapets or for other wood in direct contract with roofing membranes, primers, or adhesives.

.2 Sustainable requirements: only wood materials located outside of the building air barrier assembly may be pressure preservative treated.

.3 Provide lumber and plywood materials pressure preservative treated for the following:

.1 Furring, blocking on exterior of building.

.2 Rough bucks at all exterior openings.

.3 Furring, blocking, and plywood sheathing at grade beams.

.4 Wood and plywood below grade or in contact with ground.

.5 Other materials indicated on Drawings.

.4 Preservative: to CSA O80 Series, water-borne, alkaline copper quaternary (ACQ).

.5 Treat material to CSA O80 Series using ACQ preservative to obtain minimum net retention for exposures as follows:

.1 UC3.2, material above grade.

.2 UC4.1, material below grade or in contact with ground.

.6 Each piece of treated material shall be identified with a tag or ink mark bearing the Canadian Wood Preservation Association quality mark.

.7 Following water-borne preservative treatment, dry material to maximum moisture content of 19 percent (S-dry) percent or less.

.8 Field treatment: comply with AWPA M4 and revisions specified in CSA O80 Series, Supplementary Requirements to AWPA M2. Apply surface applied wood preservative to heartwood exposed from trimming, cutting, or boring.

.9 Remove chemical deposits on treated wood to receive applied finish.

.6 Pressure Preservative Treated Wood for Landscape Work:

.1 Pressure treated Timbers, dimensional lumber, posts, and poles: to CSA O80, non-incised, ACQ-C treatment. Cedar tone brown in colour. Minimum moisture content at treatment to CSA O80. Minimum retention for above ground use 4.0 kg/m^3 and for ground contact 6.4 kg/m^3. All lumber to be free of defects, warping, or checking.

.2 Fence members: construction grade S4S mill run, square edge, pressure treated sawn timbers. Cedar tone brown in colour.

.3 Nails and spikes: to CSA O86 and ASTM F1667, galvanized for exterior works and for treated lumber. Use spiral thread nails except where noted elsewhere.

.4 Hardware: bolts, nuts, washers, lag screws, to be hot dipped galvanized or stainless steel where noted, sizes to suit application.

.5 End cut preservative: clear type to CSA O80, copper naphthenate or 5 percent pentachlorophenol solution.

.6 Stain: exterior solid water-based stain for wood (including pressure-treated). Colour to follow City Standards, be confirmed with Professional of Record and sample provided for approval. Apply per Manufacturer's instructions.

3. EXECUTION

3.1 General

.1 Install in accordance with Manufacturer's recommendations and as required by the Final Design.

.2 Comply with requirements of NBCC, Part 9 supplemented by following paragraphs.

.3 Install members true to line, levels, and elevations. Space uniformly.

.4 Construct continuous members from pieces of longest practical length.

.5 Install spanning members with "crown-edge" up.

3.2 Erection

.1 Frame, anchor, fasten, tie, and brace members to provide necessary strength and rigidity.

.2 Countersink bolts where necessary to provide clearance for other work.

.3 Use nailing disks for soft sheathing as recommended by sheathing Manufacturer.

.4 Use fastenings of following types, except where specific type is indicated or specified:

.1 To plaster and panel surfaces use toggle bolt.

.2 To concrete use expansion shield with lag screw, lead plug with wood screw.

.3 To structural steel use bolts through drilled holes, welded stud-bolts, power driven self-drilling- screws, welded stud-bolts, or explosive actuated stud-bolts.

.5 Furring and blocking:

.1 Install furring and blocking as required to space-out and support casework, cabinets, surface applied fixtures and equipment, and other work as indicated in the Final Design

.2 Install furring to support items applied vertically where there is no blocking and where sheathing is not suitable for direct nailing.

.3 Align and plumb faces of furring and blocking to tolerance of 1:600.

.6 Nailing strips, grounds, and rough bucks:

.1 Install rough bucks, nailers, and linings to rough openings as required to provide backing for frames and other work.

.2 Except where indicated otherwise, use material at least 38 mm thick.

.3 For concrete block or cast-in-place concrete backing secure lumber with 10 mm diameter galvanized bolts located within 300 mm from ends of members and uniformly spaced at maximum 1200 mm on centre in between. Countersink bolts where necessary to provide clearance for other work.

.7 Fascia Backing, Curbs, and Nailers:

.1 Install fascia backing, nailers, curbs, and other wood supports as required and secure using galvanized fasteners.

.2 Secure roof curbs and nailers with 10 mm diameter galvanized bolts where indicated, galvanized nails elsewhere. Space bolts within 300 mm from ends of members and uniformly spaced at maximum 1200 mm on center in between. Countersink bolts where necessary to provide clearance for other work.

.3 On roof deck provide strips of roofing vapour barrier sheet under curbs, nailers and sleepers installed directly onto roof deck. Extend vapour barrier sheet minimum 300 mm onto roof deck both sides of curbs or sleeper to allow for overlap and sealing to roofing vapour barrier. Apply as continuous strips, with 200 mm overlap at joints, and seal joints with mastic. Use same material used for roofing vapour barrier. Coordinate with roofing subcontractor.

.8 Electrical equipment backboards: install plywood backboards on 38 by 38 mm wood strapping installed vertically along edge and at 600 mm on center for large boards. Treat electrical equipment backboards with fire retardant paint.

3.3 Handling and Use of Treated Timber

.1 Handle and use treated material in a manner that will avoid damage or cause alteration in original treatment.

.2 Treat in-field, cuts and damages to surface of treated material with an appropriate, clear preservative as described in CSA O80. Thoroughly saturate damaged areas such as abrasions and nail and spike holes with field treatment solutions as per CSA O80.

3.4 Schedules

.1 Exterior sheathing: plywood, DFP or CSP sheathing grade or PP standard sheathing grade - square edges, thickness indicated.

.2 Protection board at foundation walls and grade beams: plywood, DFP or CSP sheathing grade or PP standard sheathing grade - square edges, thickness indicated, and pressure preservative treated.

.3 Electrical equipment backboards: plywood, CSP or DFP, veneer core, G1S grade - square edges, 19 mm thick.

.4 Supply and install blocking surface mounted.

END OF SECTION

GLUED LAMINATED CONSTRUCTION

1. GENERAL

1.1 Summary

.1 This Section specifies glued laminated construction general requirements.

1.2 Standards

.1 All codes and standards to be latest edition unless noted otherwise.

.2 Canadian Standards Association (CSA):

.1 CAN/CSA O80 - Series 15, Wood Preservation.

.2 CSA O112 - Standards for Wood Adhesives.

.3 CSA-O86 - Engineering Design in Wood.

.4 CAN/CSA O122 - Structural Glued-Laminated Timber.

.5 CAN/CSA-O177 - Qualification Code for Manufacturers of Structural Glued Laminated Timber.

.6 CSA G164 - Hot Dip Galvanizing of Irregularly Shaped Articles.

.3 Canadian Institute of Steel Construction/ Canadian Paint Manufacturers Association (CISC/CPMA) Standard 2-75 Quick-drying Primer for Use on Structural Steel.

1.3 Submittal

.1 Provide submittals in accordance with Section 01300 and the following:

.1 Manufacturer's descriptive literature for materials.

.2 Submit Shop Drawings for all glue-laminated structural units.

.3 Indicate stress grade, service grade, appearance grade, shop applied finishes, shop and erection details, including cuts, holes, fastenings, connection hardware and camber.

.4 Include description of miscellaneous metal connections.

.5 Provide all quality assurance and control documentation.

1.4 Quality Assurance

.1 Manufacture structural glued-laminated members in plant certified by CSA as meeting requirements of CAN/CSA O177 to manufacture Class I interior and Class X exterior members.

.2 Submit certificate in accordance with CAN/CSA O177, Appendix B.

.3 Maintain protection of glued-laminated members until deck over and roofing are installed.

2. PRODUCTS

2.1 Materials

.1 Laminating stock: as specified or shown in the Final Design.

.2 Pressure-treated wood shall be in accordance with CSA O80 series.

.3 Sealer for glued-laminated members: two (2) coats of penetrating type, clear, nonyellowing liquid which protects wood against moisture entry during shipping and erection compatible with finish specified in Section 09910.

.4 Steel for connections: conform to CSA-G40.21 Grade, bolts to ASTM A307.

.5 Shop coat primer for steel connections: for finish painted steel primer is to be compatible with the finish paint system (minimum performance to CISC/CPMA standard); and for non-exposed steel conform to CISC/CPMA 1-73a.

.6 Galvanizing: conform to CSA G164 hot dipped, minimum zinc coating of 600 g/m^2.

2.2 Performance Criteria

.1 Glued-laminated structural units to meet the requirements of CAN/CSA-0122 and CAN/CSA-0177. All timber connector hardware exposed to the exterior to be hot dipped galvanized. All other nuts, washers and bolts to be galvanized.

.2 Adhesive: conform to CSA O112 Series, to grade of service required in accordance with CAN/CSA O122.

.3 Provide durable sealed finish to expose natural wood.

.4 Cross laminated timber panels are to meet the requirements of ANSI/APA PRG 320.

.5 Glue-laminated timber Manufacturer are to be certified by CSA Administrative Board, Structural Glue-laminated Timber Division.

2.3 Fabrication

.1 Mark laminated members for identification during erection. Marks must be concealed in final assembly or removed after erection. Clearly mark top surfaces of straight beams.

.2 Apply sealer to all sides and ends of members immediately after cutting unless they are to receive a stained finish or preservative treatment.

.3 Galvanize all connections.

.4 Prepare steel surfaces for priming where applicable. Clean and prepare surfaces of steel to suit the finish paint system, with minimum preparation to CISC/CPMA 2-75.

.5 Prime paint connections after fabrication with one (1) coat of primer, except items to be embedded in concrete.

3. EXECUTION

3.1 General

.1 Install in accordance with Manufacturer's recommendations and as required by the Final Design.

END OF SECTION

ARCHITECTURAL MILLWORK

1. GENERAL

1.1 Summary

.1 This Section specifies the design and construction general requirements for finished carpentry, millwork and architectural millwork.

1.2 Standards

.1 American National Standards Institute (ANSI):

.1 ANSI/NEMA LD3 - High-Pressure Decorative Laminates.

.2 ANSI/BHMA A156.9 - Cabinet Hardware.

.2 Canadian Standards Association (CSA):

.1 CSA/CAN3 A172 - High Pressure, Paper Base, Decorative Laminates.

.2 CSA O121 - Douglas Fir Plywood.

.3 CSA O151 - Canadian Softwood Plywood.

.3 Architectural Woodwork Manufacturers Association of Canada (AWMAC) Quality Standards Manual.

.4 Door and Hardware Institute (DHI).

1.3 Submittals

.1 Provide submittals in accordance with Section 01300 and the following:

.1 Manufacturer's descriptive literature for materials.

.2 Shop Drawings:

.1 Shop Drawings shall show construction details of all architectural woodwork and general arrangements; typical and special installation conditions; materials being supplied and all connections, attachments, anchorage and location of exposed fastenings, as applicable.

.2 Shop Drawings shall include plans, elevations, sections, and details for all architectural woodwork. The details shall show and specify all thicknesses, types and finishes, and all cabinet hardware.

.3 Shop Drawings shall show materials and finishes used for architectural woodwork and whether shop finished, or site finished and by whom. Include type and source of all cabinet hardware and any specialty items used under architectural woodwork.

.3 Samples:

.1 Submit finished samples 600 by 600 mm in duplicate of each finish to be applied at the factory prior to fabrication. Sample shall be given to the architectural woodwork Manufacturer to match prior to submitting his own match.

.4 Brochures:

.1 Submit Manufacturer's descriptive literature of specialty items not manufactured by the architectural woodwork Manufacturer.

1.4 Quality Assurance

.1 Conform to AWMAC quality standards manual for minimum “Custom Grade”, and Door and Hardware Institute (DHI) standards for the design, fabrication, materials, installation, and workmanship of finish carpentry and architectural woodwork.

.2 Provide AWMAC review reports for finished carpentry, millwork and architectural millwork.

2. PRODUCTS

2.1 Performance Criteria

.1 Millwork shall be functional, robust, aesthetically attractive and easily maintained.

.2 Casework shall support functionality and operation of the Facility.

.3 Reception millwork shall provide full reception and accessible public interface.

.4 Adhesives shall be non-toxic, non-solvent glue to comply with AWMAC Quality Standards Manual, Canadian ‘Eco-Logo’ program and Canada Green Building Council.

.5 Panel materials shall meet requirements for moisture content and grades in accordance with AWMAC quality standards manual.

.6 Softwood plywood shall meet CSA O121 or CSA O151, cross-banded, sanded G2S.

.7 Use marine-grade plywood substrate for countertops. Do not use fibreboard or particleboard.

.8 All bottoms of sink cabinet boxes and areas that may come into contact with water shall have a marine-grade plywood substrate. Do not use fibreboard or particleboard.

.9 High-pressure decorative laminate shall conform to ANSI/NEMA LD3 or CSA/CAN3 A172; Grades and application shall comply with AWMAC quality standards manual.

.10 Low-pressure decorative laminate shall conform to ANSI/NEMA LD3, in accordance with AWMAC quality standards manual.

.11 For millwork and cabinets, seal all wood surfaces and edges. All door, drawer and other exposed millwork edges shall have an appropriately sized PVC edge strip, heat applied. There shall be no P-Lam to P-Lam edges.

.12 Solid polymer fabricated surfacing for all reception desks and other areas as required to create surfaces that provide antiseptic or clean characteristics and resistance to caustic action of chemicals or agents.

.13 Chemical resistant laminate for laboratory counters.

.14 Stainless steel for maintenance workshop counters.

.15 Provide architectural millwork including all counters, cabinet units, shelving, hardware, finishing and installing as follows:

.1 All cabinets shall be flush overlay construction.

.2 Design millwork with no exposed sharp edges.

.3 Provide minimum 25 mm radiused corner to countertops.

.4 All cabinets shall be provided with locks.

.5 Incorporate all required mechanical, electrical and communication services into the millwork so that wires and pipes are hidden from view, provide access panels to all services to allow for future adjustment.

.6 Provide built-in valance lighting underneath all upper cupboards for task-oriented and staff areas.

.7 All architectural woodwork hardware shall be stainless steel of durable quality to meet ANSI/BHMA A156.9.

2.2 Laboratory Casework and Countertops

.1 Provide chemical-resistant plastic laminate, NEMA LD-3, with backing sheet over 45-pound density medium density fiberboard (MDF) or particleboard core.

.2 Core shall have no added urea formaldehyde.

.3 Provide with 3 mm PVC edge band at countertops and casework edges; color to match plastic laminate.

.4 Minimum thickness at countertops: 25 mm.

.5 Minimum core thickness at typical casework: 19 mm except provide 6 mm thick hardboard at fully concealed unit backs.

.6 Core at toe space shall be marine grade plywood.

.7 Countertop brackets: Where no base cabinet is required by the Final Design, provide countertop brackets spaced at maximum 1200 mm.

.1 Acceptable Products:

.1 Rakks EH-1818 or EH-1824 by Rangine.

.2 Or approved equivalent.

.8 Provide millwork locks to secure all cabinets.

.9 Incorporate communications outlets and cabling within integral chases in the casework.

2.3 Stainless Steel Casework, Countertops and Shelves

.1 Provide stainless steel bench and counter tops in the laboratory and where staining or similar procedures are performed.

.2 Fabricate from Type 316, No. 4 finish stainless steel.

.3 Corners shall be welded, ground, polished and crevice-free. Joints and welds shall be polished to a uniform No. 4 satin finish.

.4 Fillers or solders is not permitted.

.5 Straight lengths to be one-piece with all seams, including field joints, welded.

.6 Sound-deaden tops and reinforce with waterproof plywood core, bonded to tops with waterproof contact cement. Seal underside of top (plywood core) with a waterproof finish.

.7 The front edges of the tops shall be marine edge.

.8 Form backsplashes as an integral part of the tops, radiused where vertical and horizontal surfaces meet. Bond all backsplashes to plywood core, bonded the same as specified for the tops.

.9 Fabricate countertops, backsplashes, and front aprons out of one piece of stainless steel.

.10 Drill backsplashes tops and sinks to accommodate plumbing and electrical fittings.

.11 Form integral sinks with all-welded rounded corners, seamless construction with all traces of welding removed.

.12 Weld stainless steel sinks integrally into tops without seams or joints.

.13 Slope tops for sinks and adjacent drain boards to sinks.

.14 Provide sinks with drain outlets with removable stainless steel strainer.

.15 Provide casework locks to secure cabinets and drawers.

3. EXECUTION

3.1 General

.1 Install in accordance with Manufacturer's recommendations and as required by the Final Design.

.2 Undertake commissioning phases as specified in the Schedule 18 Technical Requirements.

END OF SECTION

FIBREGLASS REINFORCED PLASTIC STRUCTURAL PRODUCTS AND FABRICATIONS

1. GENERAL

1.1 Summary

.1 This Section specifies fibreglass reinforced plastic (FRP) platforms, stairs stringers, railings, gates and ladders.

1.2 Standards

.1 All codes and standards to be latest edition unless noted otherwise.

.2 American Society for Testing and Materials (ASTM):

.1 ASTM D570 - Water Absorption of Plastics.

.2 ASTM D635 - Rate of Burning and/or Extent and Time of Burning Plastics in a Horizontal Position.

.3 ASTM D638 - Tensile Properties of Plastics.

.4 ASTM D695 - Compressive Properties of Rigid Plastics.

.5 ASTM D696 - Coefficient of Linear Thermal Expansion of Plastics Between -30°C and 30°C.

.6 ASTM D790 - Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.

.7 ASTM D792 - Density and Specific Gravity (Relative Density) by Plastics Displacement.

.8 ASTM D2344/S2344M - Short-Beam Strength of Polymer Matrix Composite Materials and Their Laminates.

.9 ASTM D258 - Indentation Hardness of Rigid Plastics by Means of a Barcol Impressor.

.10 ASTM E84 - Surface Burning Characteristics of Building Materials.

.11 ASTM E662 - Specific Optical Density of Smoke Generated by Solid Materials.

.3 International Code Council (ICC).

1.3 Submittals

.1 Provide submittals in accordance with Section 01300 and the following:

.1 Manufacturer's descriptive literature for materials.

.2 Shop Drawings: stairs, platforms, stringers, guardrails, handrails, ladders, and support Structures:

.1 Show dimensions, weight, size, and location of connections to adjacent supports and other work.

.2 Provide structural calculations for platforms, support structures, embedments, ladders and cages, handrails, guards, and other fabrications sealed by a Professional Engineer registered in the Province of Manitoba.

.3 Samples: each type of product to be submitted. Submit samples of each type of railing and railing connection, 300 mm minimum length of railing assembly.

.4 Provide handling and storage requirements.

.5 Provide colour options for review by the designer and the City.

.6 Provide factory test reports to document the physical properties of product:

.1 Test data to supplement load calculations providing data covers the complete system, including anchorage.

.2 Test data for all components showing load and deflection due to load, to demonstrate railing satisfies national, provincial, and local standards, regulations, code requirements, using design loads specified.

.3 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.

.7 Provide a statement certified by a Professional Engineer registered in the Province of Manitoba that the design meets the requirements of the governing codes and standards.

.8 Provide fabricator’s qualification experience.

.9 Provide Manufacturer’s qualification experience.

.10 Product data: catalog information and catalog cuts showing materials, design tasks, and showing load, span, and deflection. Include Manufacturer’s specifications.

1.4 Quality Assurance

.1 Design calculations are to be sealed and signed by a Professional Engineer registered in the Province of Manitoba and submitted with Shop Drawings.

.2 Fabricator: minimum of five (5) years experience.

.3 Manufacturer: minimum of five (5) years experience in manufacturing of products meeting these Specifications.

2. PRODUCTS

2.1 Performance Criteria

.1 General:

Minimum Ultimate Coupon Properties (UN)			
	Material Properties	Test Method	Units
	Pultruded Fibreglass Structural Shapes		
(1)	Ultimate tensile stress in longitudinal direction, MPa (psi)	ASTM D638	207 (30,000)
(2)	Ultimate compressive stress in longitudinal direction, MPa (psi)	ASTM D695	207 (30,000)
(3)	Ultimate flexural stress in longitudinal direction, MPa (psi)	ASTM D790	207 (30,000)
(4)	Ultimate short beam shear in longitudinal direction, MPa (psi)	ASTM D2344	31 (4,500)
(5)	Ultimate tensile stress in transverse direction, MPa (psi)	ASTM D638	48 (7,000)
(6)	Ultimate compressive stress in transverse direction, MPa (psi)	ASTM D695	103 (15,000)
(7)	Ultimate flexural stress in transverse direction, MPa (psi)	ASTM D790	69 (10,000)
(8)	Modulus of elasticity, full section, MPa (psi)	N/A	19,305 (2,800,000)
(9)	Density kN/m^3 ($lb/in.^3$)	ASTM D792	16.29-19.01 (0.060-0.070)
(10)	Water absorption (25-hr immersion)	ASTM D570	0.60 max, percent by weight
(11)	Barcol hardness	ASTM D2583	45
(12)	Coefficient of thermal expansion, 10^{-6} in./in./º C	ASTM D696	8.0
	Flame-Retardant Properties		
(13)	Flammability test	ASTM D635	Self-extinguishing
(14)	Surface burning characteristics	ASTM E84	25 maximum
(15)	Flammability class	UL 94	VO
(16)	Temperature index	UL 94	130ºC

.1 Like items of materials: provide end products of one (1) manufacturer in order to achieve standardization for appearance, maintenance, and replacement.

.2 All products to be manufactured by a pultruded process using vinyl ester resin.

.3 Products to be manufactured with UV inhibitor additives. An industrial grade polyurethane UV resistant coating is to be factory applied to all FRP structural products and fabrications.

.4 All pultruded shapes are to have a synthetic surface veil for added corrosion resistance.

.5 Vinyl ester resin matrix, approximately 50 percent resin-to-glass ratio.

.6 Continuous glass strand rovings are to be used internally for longitudinal strength.

.7 Continuous strand glass mats are to be used internally for transverse strength.

.8 All exposed surfaces are to be smooth and true to form.

.9 Minimum material properties:

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

.2 Verify field dimensions after construction of facilities and include in Shop Drawing submittal. Field verification of dimensions is a prerequisite for fabrication of railing.

.2 Grating and stair treads: in accordance with Section 06630.

.3 Structural platforms and stair stringers:

.1 Deflection and safety factors:

.1 Live load deflection criteria: maximum L/360.

.2 Live load plus dead load deflection criteria: maximum L/240.

.3 Safety factors: minimum ratios of ultimate stress to allowable static service stress:

.1 Flexural members: 2.5.

.2 Compression members: 3.0.

.3 Shear: 3.0.

.4 Connections: 3.0.

.5 Modulus of elasticity: 1.0.

.6 Shear modulus: 1.0.

.4 Minimum design safety factors for dynamic or impact loads are to be twice the values for static service loads.

.2 Loads:

.1 Uniform live load: minimum 4.8 kPa.

.2 Static and dynamic loads for equipment.

.3 Hardware:

.1 Provide Type 316 stainless steel bolts.

.2 Grating support angles attached to the face of concrete walls are to be Type 316 stainless steel.

.4 Handrail and guards:

.1 Structural criteria:

.1 Apply load to produce maximum stress and deflection in each component.

.2 Top rail and posts of handrails and guardrails: capable of withstanding the following load cases applied with a safety factor of 2.0:

.1 Concentrated horizontal load of 1.0 kN applied at any point along the top rail. Transfer this load through supports to structure.

.2 Uniform horizontal load on the top rail of 1.5 kN/m. Transfer this load through supports to structure.

.3 Uniform vertical load on top rail of 1.5 kN/m.

.3 Elements of railing systems: design for loading specified by applicable Law.

.4 Concrete anchors for handrail wall brackets: not to exceed International Code Council ES report allowable loads for actual spacing, edge distance, and embedment, with concrete strength of 30 MPa.

.5 Concrete anchors: in accordance with International Code Council ES report allowable load values for size, length, embedment, spacing, and edge distance to match required loads shown in calculations.

.2 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 nighttime sky heat loss.

.3 Temperature change range: minus 40°C minimum to plus 40°C maximum.

.3 Rail and posts:

.1 45 mm nominal square or round tubing posts.

.2 30 mm to 43 mm nominal round rails and 45 mm for square rails.

.3 Maximum post spacing: 1.5 m.

.4 Clearance between rails: less than 200 mm for non-public areas and 100 mm for public areas.

.4 Kickplates: corrugated 125 mm by 13 mm by 3 mm thick or 125 mm by 14 mm thick at all guardrail locations.

.5 Kickplate connectors and splices: continuous with provision for expansion and contraction without distortion or buckling.

.6 Hardware: Type 316 stainless steel bolts are to be provided.

.5 Ladders and cages:

.1 Ladder criteria:

.1 Ladders able to support 1.32 kN concentrated live load.

.2 Side rails: 45 mm square tubes, 4 mm thick.

.3 Rungs: minimum 25 mm diameter thermal cure rod with pigmented epoxy, non-skid grit surface, or 32 mm minimum diameter pultruded, fluted, non-slip surface of vinyl ester resin.

.2 Cage criteria:

.1 Top and bottom hoops: 75 mm minimum width by 6 mm minimum thickness.

.2 Intermediate hoops: 50 mm minimum width by 6 mm minimum thickness.

.3 Hoops manufactured by open-mold hand layup process.

.4 Vertical connecting straps to hoops:

.1 Pultruded channels: 50 mm wide by 6 mm thick or 50 mm wide by 14 mm.

.2 Maximum spacing: 225 mm.

.5 Maximum vertical distance between hoops: 1070 mm.

.3 Type 316 stainless steel bolts are to be provided for attaching ladder cage vertical bars to hoops, ladder hoops to brackets, ladder cage brackets to the ladder, and wall brackets.

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

.5 All rungs are to be both mechanically attached to the ladder with stainless steel rivets and chemically bonded with epoxy.

3. EXECUTION

3.1 General

.1 Install in accordance with Manufacturer's recommendations and as required by the Final Design.

.2 Install plumb or level, rigid, and neat.

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

.4 Provide and install expansion and contraction connections.

END OF SECTION

FIBREGLASS REINFORCED PLASTIC GRATING

1. GENERAL

1.1 Summary

.1 This Section specifies Fibreglass Reinforced Plastic Grating (FRP).

1.2 Standards

.1 All codes and standards to be latest edition unless noted otherwise.

.2 American Society for Testing and Materials (ASTM):

.1 ASTM A276 - Standard Specification for Stainless Steel Bars and Shapes.

.2 ASTM D635 - Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position.

.3 ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

.4 ASTM F593 - Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs.

1.3 Submittals

.1 Provide submittals in accordance with Section 01300 and the following:

.1 Manufacturer's descriptive literature for materials.

.2 Product data: catalogue information and catalog cuts showing materials, design tasks, and showing load, span, and deflection; include Manufacturer’s specifications.

.3 Grating: show dimensions, weight, size, and location of connections to adjacent grating, supports, and other work.

.4 Grating supports: show dimensions, weight, size, location, embedment, and anchorage to supporting structure.

.5 Sample: each type of grating.

2. PRODUCTS

2.1 Performance Criteria

.1 Design requirements:

.1 Exterior surfaces of grating are to have a synthetic surfacing veil.

.2 Performance requirements:

.1 Design:

.1 Design FRP grating in accordance with the following minimum requirements:

.1 Live loads for FRP grating: 4.8 kPa minimum.

.2 Maximum live load deflection: 6 mm.

.3 Stair tread is to be designed for minimum uniform load of 4.8kPa or minimum concentrated load of 135 kg (1325 N) on area of 2500 mm^2 located in center of tread, whichever produces greater stress.

.2 Corrosion resistance: FRP grating shall be suitable for continuous service as required by Final Design for concentration by weight and maximum temperature for the following parameters:

.1 Chlorine gas (Wet or Dry).

.2 Chlorine solution.

.3 Hydrogen sulfide.

.4 Hypochlorite solution.

.5 Hypochlorous acid.

.6 Potassium permanganate.

.7 Sodium hydroxide.

.8 Sulfuric acid.

2.2 Materials

.1 Molded type:

.1 FRP grating shall be open-molded fibreglass grating made in one piece by interweaving continuous, thoroughly wetted, glass strand with vinylester resin with UV inhibitor additives.

.2 Load bars in both directions with equal stiffness.

.3 Square mesh, 38 mm maximum spacing for 38 mm thick grating; 50 mm maximum spacing for 50 mm thick grating.

.4 Skid-resistant surface: grit adhesively bonded, Manufacturer’s standard.

.5 Flame spread less than 25 as measured by ASTM E84.

.6 Meet self-extinguishing requirements of ASTM D635.

.7 Colour to be Manufacturer's standard.

.8 All stair treads are to be minimum 38 mm thickness and have anti-slip grit top and integral abrasive bull nosing.

.9 Grating to be attached with Type 316 stainless steel clips.

.10 All cut ends, holes and abrasions of FRP shapes are to be sealed with resin to prevent moisture wicking.

.2 Hold-down clamps: ASTM A276 Type 316 stainless steel.

.3 Bolts and connectors: corrosion resistant FRP or ASTM F593 Type 316 stainless steel.

2.3 Fabrications

.1 Field measure areas to receive grating. Verify dimensions of new fabricated supports and fabricate to dimension required for specified clearances.

3. EXECUTION

3.1 General

.1 Install in accordance with Manufacturer's recommendations and as required by the Final Design.

.2 Undertake commissioning phases as specified in the Schedule 18 Technical Requirements.

.3 Provide adequate quantities of resin sealing kits comprised of pre-measured quantities of thixotropic resin and catalyst, mixing containers, chip brushes, and stirring sticks are to be provided by the fabricator. Seal field cut holes, edges, and abrasions.

.4 Installation of FRP grating to be as recommended by the FRP grating fabricator.

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

.6 Install each grating section such that it is easily removable.

END OF SECTION