B2021 WINDOWS

1 WORK INCLUDED

.1 This Section includes requirements for windows as components of exterior building envelope assemblies.

.2 All systems and products described in this section will have an impact on the buildings operations and overall energy performance. This project is to achieve the CAGBC's Zero Carbon Building Standard: Design Certification, which includes requirements for Thermal Energy Demand Intensity (TEDI). The performance of the building envelope affects the buildings' TEDI. As such, the building envelope is to be designed with due regard for the building's TEDI. Refer to Appendix A for CAGBC's Zero Carbon Building Standard.

2 REFERENCES

.1 Aluminum Association (AA):
  .1 AA Designation System for Aluminum Finishes – R2009.

.2 American Architectural Manufacturers Association (AAMA):
  .1 AAMA 2603-13, Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels.
  .2 AAMA 2605-17, Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels.

.3 American Society for Testing and Materials (ASTM):
  .1 ASTM B209-14, Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
  .2 ASTM B221-14, Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles and Tubes.
  .3 ASTM E336-17a, Standard Test Method for Measurement of Airborne Sound Insulation in Buildings.
  .4 ASTM E413-16, Standard Classification for Rating Sound Insulation.

.4 Canadian Standards Association (CSA):
  .1 CSA-A440-00, Windows.
  .2 CSA-A440.4-07 (R2012), Window and Door Installation.
  .3 CAN/CSA-G164-M92(R2003), Hot Dip Galvanizing of Irregularly Shaped Articles.
  .4 CAN/CSA-Z91-17, Health and Safety Code for Suspended Equipment Operations.
  .5 CAN3-S157-05 (R2010), Strength Design in Aluminum.

.5 Canadian Green Building Council (CAGBC):
  .1 Zero Carbon Building Standard: Design Certification

3 GENERAL

.1 Submittals: Make the necessary submittals in accordance with Section GR 33 "Shop Drawings, Product Data, Samples and Mock-Ups".

.2 If requested, submit samples to the Owner's Representative, of each aluminum finish and each type of glass proposed for use. Use the same materials and finishes as for the actual installation.

.3 Mock-Ups: Construct the necessary mock-ups in accordance with Section GR 33 "Shop Drawings, Product Data, Samples and Mock-Ups". Make available for review by the Owner's Representative upon request.

4 QUALIFICATIONS

.1 The windows shall be supplied by one manufacturer with minimum ten years' experience in the manufacture of windows similar to those proposed for the Project.

.2 The work shall be executed by a company licensed by the window manufacturer as an approved installer.

5 DESIGN REQUIREMENTS

.1 "Design Requirements (DR)" govern this Section.

.2 Architectural Context: Locate and design windows, including finishes and colours, to be appropriate to the architectural context and acceptable to the applicable regulating authorities.

.3 Design windows to conform to the applicable requirements of CSA-A440.

.4 Design and locate windows to accommodate provision for cleaning the entire exterior surface of each window by means of a suitable window cleaning cradle or other equivalent system conforming to CAN/CSA-Z91 "Safety Code for Window Cleaning Operations".

6 PERFORMANCE CRITERIA

.1 Structural:
- .1 Structural performance shall be based on CAN3-S157 and a maximum deflection of 1/175 of the span under maximum design loading.
- .2 Wind loads to be based on climatic data for the location of the Project, according to Local Building Codes.
- .3 Design and size components to withstand seismic loads and sway displacement as calculated in accordance with NBC / OBC.

.2 Windows shall meet or exceed the following performance classification requirements of CSA Standard CAN/CSA-A440 Windows:
- .1 Air infiltration:
  - .1 Fixed windows: FIXED
  - .2 Operable vents: A3
- .2 Water infiltration: B7
- .3 Wind load resistance: C5
- .4 Condensation resistance temperature index:
  - .1 Fixed windows:
    - .1 If: 66
    - .2 Ig: 68
  - .2 Operable vents: 56.2 minimum.

.3 Sound Control:
- .1 The windows shall be designed and constructed to provide the following STC ratings when field-tested in accordance with ASTM E336 and classified in accordance with ASTM e413:
  - .1 Office windows: STC 38.
  - .2 Plant windows: STC 30.

.4 The design shall allow for an ambient temperature range of -35°C to +35°C without causing buckling, stresses on glass, failure of seals, undue stress on structural elements, reduction of performance or other detrimental effects.

.5 Ensure no vibration harmonics, wind whistles, noises caused by thermal movement, thermal movement transmitted to other building elements, loosening, weakening, or fracturing of attachments or components of system occur.

.6 Glazing:
- .1 Design glazing to have light transmittance, shading coefficient, and thermal performance characteristics which are consistent with the overall building design with respect to heating and cooling systems and building life cycle costing, with the following minimum characteristics:

.1 Constructed of one sheet of optically clear low emissivity glass (low E soft coat) and one sheet of heat strengthened or tempered tinted float glass separated by a non-metallic spacer and a layer of dehydrated air.
.2 Sealed unit air space shall be 13mm in width, inert gas fill with argon.
.3 Minimum glass thickness: 6mm per pane.
.4 Minimum total thickness of sealed unit to be 25mm.

.2 Design the glazing in the plant to provide a Light Diffusing Power (LDP) of 0.80 or better as defined by Advanced Glazings Ltd. LDP measurement procedures.
.3 Size glass units and glass dimensions to limits established in the NBC / OBC.
.4 In addition to the requirements of the NBC / OBC, glass thicknesses and cavity widths shall be sufficient to provide the specified sound control performance.
.5 Double glazing to be employed on windows and frames,
.6 Low e-coating on second surface of window.

.7 Thermal shock:
.1 Determine the full range of temperature conditions to which the glazing will be subjected after installation.
.2 Coordinate frame and glass dimensions to ensure that adequate provision is made to permit sealed thermal units to expand and contract without breakage.

.8 Bird-friendly glazing:
.1 Use a combination of the following strategies to treat a minimum of 85 per cent of all exterior glazing within the greater of first 12m of the building above grade or the height of the mature tree canopy (including balcony railing, clear glass corners parallel glass and glazing surrounding interior courtyards and other glass surfaces):
.1 Low reflectance, opaque materials may include spandrel glass with one of the following: Solid back-painted frit or silicone backing opaque coatings OR; Reflective or low-e coatings that have an outside reflectance of 15 per cent or less.
.2 Spandrel glass with reflective or low-e coatings that have an outside reflectance of greater than 15 per cent should be used in combination with other strategies.
.3 Visual markers applied to glass with a maximum spacing of 100mm x 100mm. Visual markers consist of opaque points or patterns on the exterior or interior surfaces of glass. Visual markers must have a minimum width 5mm and a maximum spacing of 100mm x 100mm.
.4 Ceramic frit patterns must have a strong contrast (e.g. white). Grey frit does not provide a strong contrast and is not permitted. Patterns on the first (exterior) surface are the most effective and in combination with low reflectance glass are the most visible and effective.
.5 Building-integrated structures to mute reflections on glass surfaces: these include opaque awnings, sunshades, exterior screens, shutters, grilles and overhangs or balconies that provide shading below a projection (assume 1:1 ratio of treatment below a projection) to mute reflections. Shade cast by the building or adjacent buildings cannot be included as a bird collision deterrence strategy

.9 Sealants:
.1 Design sealant joints for thermal movement of component materials caused by ambient temperature range of +35°C to -35°C without causing buckling, failure of joint seals, or other detrimental effects.
.2 Select sealant to suit the specific project conditions, with careful adherence to the manufacturer's instructions for application.
.3 Provide sealant colour to match adjacent surfaces. Provide sealant resistant to ultra-violet degradation or fading.

7 WARRANTY

.1 For the work of this Section, the 12-month warranty specified in the General Conditions of the Contract is extended to a period of 5 years from the date of issuance of the certificate of Substantial Completion.

.2 For sealed thermal glazing units, the 12-month warranty specified in the General Conditions of the Contract is extended to a period of 10 years from the date of issuance of the Substantial Completion.

8 MATERIALS

.1 Aluminum:
  .1 Alloy and temper recommended by aluminum fabricator and finisher with not less than the strength and durability properties of the following alloys and tempers:
    .1 Extruded bars, shapes, and moldings: To ASTM B221, 6063-T5 alloy and temper.
    .2 Plate and Sheet: To ASTM B209, alloy and temper suitable for purpose and finish.
  .2 Provide material free from surface blemishes where exposed to view in the finished assembly. Exposed-to-view surfaces exhibiting pitting, seam marks, roller marks, stains, discolourations or other imperfections are not acceptable.

.2 Steel clips and reinforcement: hot dipped galvanized with 380 g/m^2 (1 oz/ft^2) zinc coating to CAN/CSA-G164.

.3 Fasteners: Fasteners in contact with aluminum to be stainless steel 300 Series, stainless steel 400 Series, cadmium plated or aluminum.

.4 Zinc primer: inorganic zinc rich, ready-mix primer for touch-up of damaged galvanized surfaces.

.5 Glass:
  .1 Sealed double-glazing units meeting the specified design and performance criteria.
  .2 In the vicinity of doors and in other areas vulnerable to breakage, provide heat strengthened or tempered safety glass. Conform to NBC / OBC requirements.

.6 Glazing materials:
  .1 Glazing gaskets shall be extruded, black, closed cell or dense elastomer of durometer appropriate to the function.
  .2 Glazing tapes shall be macro-polyisobutylene, highly adhesive and elastic with continuous built-in shim.

.7 Isolation coating: alkali resistant bituminous paint to SSPC Paint-12. Provide a heavy coating to isolate concealed aluminum surfaces from contact with dissimilar materials.

.8 Operable Window Hardware:
  .1 Sash hardware:
    .1 Heavy duty 4-bar hinges.
    .2 Positive stop and adjustable friction shoe.
    .3 Heavy duty cam hardware, c/w handles and keepers.
  .2 Sliding window hardware: Tracks, handles, catches, and counterbalance mechanism (vertical sliders only) to provide easy, smooth operation and conform to the specified performance requirements.
  .3 Locking devices to provide windows conforming to CSA-A440, F1 forced entry classification.

.9 Screens:
  .1 Frame: Extruded aluminum, rigidly joined at corners, finish to match window frame.
  .2 Screen: 18 x 16 glass fibre mesh.
  .3 Splines: extruded elastomer, removable to permit re-screening.

.10 Weather-stripping: Weather-strip operable windows to provide specified performance with regard to air and water infiltration and condensation resistance.

9 FABRICATION

.1 Fabricate framing from aluminum alloy extrusions of suitable profiles to provide windows which conform to the specified design and performance criteria.

.2 Fixed and sash framing shall be two-part construction integrated with a thermal break to form a rigid composite assembly without the use of fasteners or other thermal bridging elements.

.3 The composite frame assembly shall have a minimum resistance to shear between the aluminum and the thermal break materials of 4815 N/100mm.

.4 Dry shrinkage of the thermal break shall not exceed 0.10% of the framing member length.

.5 Fixed framing shall be securely connected with concealed fasteners to produce a rigid assembly with tight, hairline joints. Operating vent sashes shall be constructed of suitable extrusions to rigid assemblies, distortion-free and warp-free under service conditions, with a tight interface with the fixed framing in closed position.

.6 All framing joints shall be accurately machined to allow site assembly and sealing, providing neat weathertight connections.

.7 Glass stops shall be lock-in screwless type.

.8 Fabricate units square and true with maximum tolerance of plus or minus 1.5mm for units with a diagonal measurement of 1800mm or less and plus or minus 3mm for units with a diagonal measurement over 1800mm.

.9 Glazing:
- .1 All glazing pockets shall be vented, pressure-equalized and drained to the exterior.
- .2 An elastomeric air-seal gasket shall be installed around the full perimeter of the glass and seated at corners with silicone sealant, properly adhered to the air seal gasket.

.10 Brace frames to maintain squareness and rigidity during shipment and installation.

.11 Provide structural anchors with an allowance for adjustment and welded after final window unit alignment. Touch-up with zinc-rich coating immediately following the alignment and fastening operation.

10 FINISHES

.1 Finish exposed surfaces of aluminum components as follows:
- .1 Exterior surfaces: One or more of the following:
  - .1 Fluoropolymer coating system conforming to AAMA 605.2, three-coat system as follows:
    - .1 Primer.
    - .2 Colour coat.
    - .3 Clear topcoat.
  - .2 Electrolytically deposited, anodic finish with integral colour, designation AA-M12-C22-A42, Architectural Class I, in accordance with Aluminum Association Designation System for Aluminum Finishes.
  - .3 Electrolytically deposited, clear anodic finish, designation AA-M12-C22-A41, Architectural Class I, in accordance with Aluminum Association Designation System for Aluminum Finishes.

.2 Interior surfaces: One or more of the finishes specified above for exterior finishes or one or more of the following:
- .1 Acrylic spray coating system conforming to AAMA 603.8.
- .2 Electrolytically deposited, anodic finish with integral colour, designation AA-M12-C22-A32, Architectural Class II, in accordance with Aluminum Association Designation System for Aluminum Finishes.
- .3 Electrolytically deposited, clear anodic finish, designation AA-M12-C22-A31, Architectural Class II, in accordance with Aluminum Association Designation System for Aluminum Finishes.

11 INSTALLATION

.1 Install in accordance with CSA-A440.4 and the reviewed shop drawings.

.2 Isolate aluminum from the following components by means of isolation coating:

.1 Dissimilar metals except stainless steel, zinc, or white bronze of small area.
.2 Concrete, mortar, and masonry.
.3 Wood.

.3 Connect the window frame at the perimeter to the building air barrier system to maintain the continuity of the air seal.

.4 Make allowance for deflection of the building structure, to prevent structural loads from being transmitted to windows.

.5 Arrange components to prevent a perceptible variation in colour.

.6 Set all frames and glazing material in their proper location, level, square, plumb, at proper elevations and in proper alignment with other work. Fasten securely.

.7 Seal the perimeter of the windows against adjacent materials, on the interior and exterior. Conceal sealant within the assembly where possible. Colour of exposed sealant to match finish.

.8 Check and adjust insert ventilators for proper operation.

.9 Touch-up field welds and anchoring brackets with 2 coats of galvanized zinc-rich paint. Surfaces must be clean, free of grease, paint, mill scale and rust prior to application of touch-up.

.10 Inspect the entire assembly for gaps in the air seal and make good.

END OF SECTION B2021