

1 ASSEMBLY - GENERAL

- 1.1 The work of this section includes the provision of all design, labour, materials, equipment and services required to fabricate and install exterior windows as required for a complete project. The work includes, but is not necessarily limited to, the items referenced herein:
 - 1.1.1 Exterior standard windows
 - 1.1.2 Entrance glazing systems
 - 1.1.3 Glazed curtain wall systems
- 1.2 Provide complete exterior window enclosures including frames, operating units, sealed glazing units; including seals to air/vapour membranes. Provide and install all associated aluminum trims, closure plates and interior window sills as required.
- 1.3 All windows by same manufacturer including curtain wall systems and entrance doors.
- 1.4 Coordinate provision of exterior windows with space data sheets.

2 ASSEMBLY DESIGN CRITERIA

- 2.1 ***Due to the concern for energy efficiency and building operations, there will be no operable windows in this project.***
- 2.2 Consideration should be given for coordinating exterior window systems with the existing campus.
- 2.3 Coordinate glazed curtain window module with interior planning module.
- 2.4 All exterior windows and glazing systems to be designed in accordance with the energy efficiency requirements of the CBIP program.

3 ASSEMBLY COMPONENTS

- 3.1 Exterior Windows
 - 3.1.1 **General:**
 - 3.1.1.1 Submittals: Submit shop drawings of exterior standard windows, glazed curtain windows, and any exterior special windows, for record purposes. Indicate materials and details in scale full size for head, jamb and sill, profiles of components, interior and exterior trim, junction between combination units, elevations of unit, anchorage details, location of isolation coating, description of related components and exposed finishes, fasteners, and caulking.
 - 3.1.1.2 Submit test reports for exterior standard windows, glazed curtain windows and any exterior special windows, from independent testing laboratories, certifying compliance with specifications, for:

- 3.1.1.2.1 Anodized finish.
- 3.1.1.2.2 Air leakage.
- 3.1.1.2.3 Water leakage.
- 3.1.1.2.4 Wind load resistance.
- 3.1.1.2.5 Condensation resistance.
- 3.1.1.3 Provide operation and maintenance data for windows for incorporation into manual specified in Section 01730 - Operation and Maintenance Manual.
- 3.1.1.4 Submit samples in accordance with Section 01340 - Shop Drawings, Product Data, Samples and Mock-ups. Submit one representative model of each type window. Include frame, sash, sill, glazing and weatherproofing method, insect screens, surface finish and hardware. Include 150mm long samples of head, jamb, sill, meeting rail mullions to indicate profile. Submit 300 x 300mm size samples of each glass type.
- 3.1.1.5 Reference Standards: Air infiltration, water resistance and loads to 63-GP-12M.
- 3.1.1.6 Testing Performance: *[CAN/CSA-A440.2-M93]* Energy Performance Evaluation of Windows.
- 3.1.1.7 Warranties: Provide a written guarantee, signed and issued in the name of the Owner stating that the exterior windows and curtain wall systems will be water and weathertight, structurally sound and free from distortion; that the exterior finish will not craze, peel or otherwise corrode, or discolour; develop excessive fading or non-uniformity of colour, will be free from blemishes, or distortion due to thermal movement, or normal movements of the building structure; that gaskets, tape and sealant will be free from deterioration from sunlight, weather or oxidation and from permanent deformation and free of leaks under load; that sealed insulating glass units will be free of condensation, for a period of ten (10) years from the date of final date of completion.
- 3.1.1.8 The *[Design Builder]* hereby warrants the work of insulating glass units, against failure of seal of enclosed air space and deposits on inner face of glass detrimental to vision for ten (10) years.
- 3.1.2 **Design:**
 - 3.1.2.1 Design exterior skin to withstand a wind load of *[97.65kg/m²]* with a maximum deflection of *[L/200]* of the span.
 - 3.1.2.2 Design horizontal members for worst condition of glass gravity loading with deflection not to exceed *[3mm]*. Place setting blocks as determined by glass loading tables.

- 3.1.2.3 Window system shall provide:
 - 3.1.2.3.1 Such gaskets, baffles, overlaps and seals as required to provide a barrier to effectively deter rain water entry into the cavities of the system.
 - 3.1.2.3.2 The necessary "air seals" to minimize air passage from the system cavities into the building and vice-versa, to assure adequate pressure equalization of the system cavities with the outside.
 - 3.1.2.3.3 The "air and vapour seals" required to minimize air borne vapour exfiltration from the building into the system cavities.
 - 3.1.2.3.4 Opening between these cavities and the outside of sufficient cross-section to provide pressure equalization. All openings must be effectively baffled or otherwise guarded to minimize direct water entry.
- 3.1.2.4 Thermally, the grid members shall have a resistance to heat transfer equal to or better than that of the area along the bottom of the 25mm sealed glass units.
- 3.1.2.5 Air infiltration shall not exceed industry standards of $[0.145 \text{ l/s/m}^2]$ at $[0.075 \text{ kpa}]$ pressure difference.
- 3.1.2.6 There shall be no water infiltration into the building under design wind loads.
- 3.1.2.7 No condensation shall form on any interior surfaces of the aluminum members before any of the exposed area of the 25mm sealed units reaches the dew point temperature.
- 3.1.2.8 Design framing system to accommodate expansion and contraction with respect to thermal and structural movement. Make allowance for deflection of structure. Ensure that structural loads are not transmitted to windows.
- 3.1.2.9 Provide vertical expansion and construction joints, designed for baffled overlaps with a compressed resilient air seal laid in between the mullion ends.
- 3.1.2.10 Curtain Wall Systems:
 - 3.1.2.10.1 Vertical glazed aluminum curtain window system includes thermally broken tubular aluminum sections with self supporting and supplementary support framing, shop fabricated, factory prefinished, vision glass, insulated metal panel spandrel infill, column covers, and louvres; related flashings, anchorage and attachment devices.

- 3.1.2.10.2 Assembled system to permit re-glazing of individual glass (and infill panel) units without requiring removal of structural mullion sections.
- 3.1.2.10.3 Design and size components to withstand dead and live loads caused by pressure and suction of wind, acting normal to plane of system as calculated in accordance with NBC and as measured in accordance with [ASTM E 330-90]. Design and size components to withstand seismic loads and sway displacement as calculated in accordance with OBC.
- 3.1.2.10.4 Limit mullion deflection to flexure limit of glass and 19mm; with full recovery of glazing materials.
- 3.1.2.10.5 Size glass units and glass dimensions to limits established in [CAN/CGSB- 12.20-M89].
- 3.1.2.10.6 Design structural support framing components to [CSA S157-M83] under direct supervision of a Professional Structural Engineer experienced in design of this Work and licensed in the Province of Ontario.
- 3.1.2.10.7 Provide system to accommodate, without damage to components or deterioration of seals for the movement within system, movement between system and perimeter framing components, dynamic loading and release of loads, deflection of structural support framing, shortening of building concrete structural columns and creep of concrete structural members.
- 3.1.2.10.8 Sound attenuation through wall system (exterior to interior): [STC 45] min., measured in accordance with [ASTM E 413-87(1994)].
- 3.1.2.10.9 Vapour seal with interior atmospheric pressure of 25 mm sp, 22°C, 40% RH: No failure.
- 3.1.2.10.10 Water leakage: none, when measured in accordance with [ASTM E 331-93] and [ASTM E 1105-93].
- 3.1.2.10.11 System to provide for expansion and contraction within system components caused by a cycling temperature range of 95 deg C over a 12 hour period without causing detrimental affect to system components.
- 3.1.2.10.12 Drain water entering joints, condensation occurring in glazing channels, or migrating moisture occurring within system, to the exterior by a weep drainage network.

- 3.1.2.10.13 Maintain continuous air barrier and vapour retarder throughout assembly, primarily in line with inside pane of glass and heel bead of glazing compound. Position thermal insulation on exterior surface of air barrier and vapour retarder.
- 3.1.2.10.14 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.

3.1.3 **Materials / Finishes:**

3.1.3.1 Materials: to *[CAN3-A440-M90]* and:

- 3.1.3.1.1 Extruded aluminum: Aluminum Association Alloy AA6063-T5, anodized quality.
- 3.1.3.1.2 Sheet aluminum: Aluminum Association Alloy AA1100-H14, anodized quality.

3.1.3.2 Exterior metal sills: extruded aluminum and brake formed aluminum sheet metal of type and size as detailed to suit job conditions; minimum *[2mm]* thick, complete with joint covers, jamb drip deflectors, chairs, anchors and anchoring devices.

3.1.3.3 Aluminum panels and interior trims: sheet aluminum; minimum *[3mm]* thick.

3.1.3.4 Fasteners: tamperproof aluminum, concealed.

3.1.3.5 Steel reinforcing: to *[CAN/CSA-G40.21]*, as required.

3.1.3.6 Isolation coating: alkali resistant bituminous paint.

3.1.3.7 Thermal separation: rigid polyvinyl chloride keyed into aluminum pressure glazing plate.

3.1.3.8 Insulation: semi-rigid fibreglass.

3.1.3.9 Metal back pan/vapour barrier: *[0.759mm]*, G90 galvanized sheet liner.

3.1.3.10 Weather stripping: flexible vinyl spine with durometer rating 60 + 5.

3.1.3.11 Window type: Fixed window units

- 3.1.3.11.1 Fixed units with double glazed insulating units, *[152.4mm]* frame depth c/w rain screen and pressure equalization chamber.

- 3.1.3.11.2 Acceptable material: *[Kawneer Custom 518, Commercial Aluminum Custom 435, Alumicor Limited Custom 970, Lessard Beaucage Lemieux Custom 4600, Lorlea Custom 594, Fulton Custom 5100]*.
- 3.1.3.12 Window Type: Fixed curtain wall units:
 - 3.1.3.12.1 Fixed units *[63.5mm x 101.6]* main tubes with *[50mm]* deep cap sections, and "V" cap sections with double-glazing.
 - 3.1.3.12.2 Acceptable material: *[Kawneer Custom 1600, Commercial Aluminum Custom 435, Alumicor Limited Custom 970, Lessard Beaucage Lemieux Custom 4600, Lorlea Custom 594, Fulton Custom 5100]*.
- 3.1.3.13 Window Type: Pedestrian Bridge units:
 - 3.1.3.13.1 Fixed units *[133mm]* frame depth with double-glazing.
 - 3.1.3.13.2 Acceptable material: *[Kawneer Custom 518, Commercial Aluminum Custom 435, Alumicor Limited Custom 970, Lessard Beaucage Lemieux Custom 4400, Lorlea Custom 594, Fulton Custom 5100]*.
- 3.1.3.14 Classification rating: to *[CAN3-A440-M84]*.
 - 3.1.3.14.1 Air leakage: *[A3]*
 - 3.1.3.14.2 Water leakage: *[B3]*
 - 3.1.3.14.3 Wind load resistance: *[C3]*
 - 3.1.3.14.4 Condensation resistance: *[D2]*
- 3.1.3.15 Exterior of all window framing: integral colour anodic finish, designation *[AA-M23-C22-A42]*. Finish exposed surfaces of aluminum components in accordance with Aluminum Association Designation System for Aluminum Finishes - 1980.
- 3.1.3.16 Appearance and properties of anodized finishes designated by the Aluminum Association as Architectural Class 1, Architectural Class 2, and Protective and Decorative shall meet requirements of *[CGSB 63-GP-2M+Amdt-Apr-86]*, for coating Classes 1, 2 and 3 respectively.
- 3.1.3.17 Provide structural steel reinforcement for strength, stiffness and connections as required to achieve design criteria and performance.
- 3.1.3.18 Equip window frames with site installed air/vapour membrane for sealing to building air/vapour membrane. Material identical to, or compatible with, building air/vapour membrane or adequate to permit sealing to building air/vapour membrane from interior.

- 3.1.3.19 Polished plate or float glass: to *[CAN2-12.3- M76+Amdt-Jan-80]*, glazing quality, thickness as per design requirements.
- 3.1.3.20 Wired glass: to *[CAN2-12.11-M76]*, type 1, square wire mesh design, style 3, *[6mm]* thick.
- 3.1.3.21 Insulating glass units: sealed units shall be hermetically sealed, constructed of *[two]* sheets of glass conforming to *[CAN-12.8-M76 + Amdt-Jun-79]*, with outer pane of 6mm thick tempered glass and inner pane of 6mm thick optically clean low emissivity float glass separated by a spacer and 13mm air space, argon-filled. Total thickness of unit 25mm.
- 3.1.3.22 Low-E surface to be located on exterior surface of interior pane.
- 3.1.4 **Fabrication/Installation:**
 - 3.1.4.1 Fabricate and install in accordance with *[CAN3-A440-M90]*.
 - 3.1.4.2 All frames shall be factory fabricated. 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.
 - 3.1.4.3 Fabricate interior and exterior trims, frame extensions, facings, closure pieces, soffits and interior sills from brake formed aluminum sheet metal minimum *[3.0mm]* thick to shapes and sizes required, complete with joint covers and anchoring devices.
 - 3.1.4.4 Manufacturer's nameplates on windows are not acceptable.
 - 3.1.4.5 Supply and install aluminum drip flashing at head of window.
 - 3.1.4.6 All assembly screws, fixings or fastenings shall be concealed.
 - 3.1.4.7 Isolate aluminum from following components, by means of isolation coating; dissimilar metals except stainless steel, zinc, or white bronze of small area and concrete, mortar and masonry.
 - 3.1.4.8 Glaze windows with insulating glass units, in accordance with *[CAN3-A440-M90]*.
 - 3.1.4.9 Connect building air vapour barrier to window frames with air vapour barrier to provide an airtight installation.
 - 3.1.4.10 Arrange components to prevent abrupt variation in colour.
 - 3.1.4.11 Install windows plumb, level, square, free from warp, twist or other defect, and anchor securely to provide complete adequate resistance to stresses expected in service.
 - 3.1.4.12 Fill all cavities between window frames and rough openings and mullions with glass fiber insulation loosely packed to fill all voids.

- 3.1.4.13 Secure and shim windows with non-corrosive and inorganic materials. Anchors, slips, blocking, shims, and all other attachments shall be concealed. Provide all fastenings and clips required for positive fastening of frames to concrete block wall.
- 3.1.4.14 Install trims, facings, and closure pieces as required with concealed fasteners. Incorporate weep holes to drain off pocketed water.
- 3.1.4.15 Provide and install all associated trims, closure plates and interior windowsills.
- 3.1.4.16 Install metal sills with uniform wash to exterior, level in length, straight in alignment, with plumb upstands and faces. Use one-piece lengths at each location.

3.2 Window Cleaning Specialties

3.2.1 **General:**

- 3.2.1.1 Comply with Occupational Health and Safety Act and Regulations for window cleaning; Ontario Reg. 527/88 and 714/82. This regulation shall take precedence over *[CSA-Z91-M1980]*.
- 3.2.1.2 Comply with current *[CSA Z91-M1980]*, Safety Code for Window Cleaning.
- 3.2.1.3 Manufacturer shall provide legal liability insurance specifically for all aspects of the installation, design and failure of the Safety Anchor.
- 3.2.1.4 Submit test data from qualified testing agency for structural compliance with regulations and standards. Shop drawings shall bear the seal of a qualified professional engineer registered in the Province of Ontario.
- 3.2.1.5 Supply and install a tie-back and life line anchor system on the building under the supervision of a qualified professional engineer registered in the Province of Ontario.
- 3.2.1.6 Supply required inspection safety logbook for yearly inspections.

3.2.2 **Design:**

- 3.2.2.1 Engineer, design and install an adequate life support system that will be suitable for the building structure and be compatible with accepted window cleaning equipment and accessories.

3.2.3 **Materials / Finishes:**

3.2.3.1 Safety tie backs and life line anchors:

- 3.2.3.1.1 Steel Plate: to *[ASTM Grade A.36]* or better.
- 3.2.3.1.2 Welding: to *[CSA W59]* by welders qualified to *[CSA W47.1]*.

3.2.3.1.3 Tie back and lifeline anchor materials: stainless steel Type 304.

3.2.3.1.4 Acceptable material: *[Pro-Bel, Safety Roof Anchor Company]*.

3.2.4 **Fabrication / Installation:**

3.2.4.1 Install work to meet manufacturer's recommended specifications, true, tightly fitted, and level or flush to adjacent surfaces, as suitable for the installation of each product. Verify that installed products function properly, and adjust them accordingly to ensure satisfactory operation.

End of Section