

**Part 1 General**

**1.1 SUMMARY**

.1 Section Includes:

.1 This Section specifies stick built curtain wall frames consisting of fibreglass-reinforced plastic (FRP) pultrusions.

**1.2 REFERENCE**

.1 American Society for Testing and Materials ([ASTM](#)):

- .1 ASTM A653/A653M-04a, Standard Specification for Sheet Steel, Zinc-Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-Dip Process
- .2 ASTM D3917-96(2002)e1 Standard Specification for Dimensional Tolerance of Thermosetting Glass-Reinforced Plastic Pultruded Shapes
- .3 ASTM D3918-96(2003), Standard Terminology Relating to Reinforced Plastic Pultruded Products
- .4 ASTM E90-09, Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.
- .5 ASTM E28304, Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.
- .6 ASTM E33002 (2010), Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights, and Curtain Walls, by Uniform Static Air Pressure Difference.
- .7 ASTM E33100 (2009), Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls, by Uniform Static Air Pressure Difference.
- .8 ASTM E41310, Classification for Rating Sound Insulation.
- .9 ASTM E110500 (2008), Standard Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors, and Curtain Walls, by Uniform or Cyclic Static Air Pressure Difference.

.2 Canadian Standards Association ([CSA](#)):

- .1 CSA G164-M92 (R2003), Hot Dip Galvanizing of Irregularly Shaped Articles
- .2 AAMA/WDMA/CSA 101/I.S.2/A440 – NAFSCSA A440.2-04, Energy Performance Evaluation of Windows and Other Fenestration Systems

.3 Insulating Glass Manufacturer's Alliance ([IGMA](#)):

- .1 TM-3000 (97), Glazing Guidelines for Sealed Insulating Glass Units

.4 Standards Council of Canada/Underwriters Laboratories of Canada (CAN/ULC)

- .1 CAN/ULC S134-13 Standard Method of Fire Test of Exterior Wall Assemblies

.5 American Architectural Manufacturers Association (AAMA):

- .1 AAMA CW-10-12 Care and Handling of Architectural Aluminum from Shop to Site
- .2 AAMA CW1185, Design Wind Loads for Buildings and Boundary Layer Wind Tunnel Testing.
- .3 AAMA 2604 Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Architectural Extrusions

- and Panels.
- .4 AAMA 624-10 Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Fiber Reinforced Thermoset Profiles
- .5 AAMA T1RA104, Sound Control for Fenestration Products.
- .6 AAMA 50105, Methods of Test for Exterior Walls.
- .7 AAMA 50308, Voluntary Specification for Field Testing of Metal Storefronts, Curtain Wall and Sloped Glazing Systems.

### 1.3 SEQUENCING

- .1 Coordinate work of this section with installation of firestopping, vapour retarder placement, flashing placement.

### 1.4 SUBMITTALS

- .1 Submittals shall be in accordance with Section X - Submittal Procedures.
- .2 Shop Drawings:
  - .1 Submit Shop Drawings showing the following information:
    - .1 Plans, elevations and sections for all curtain wall assemblies.
    - .2 Provide elevation views. Indicate components, materials, finishes, location of glazing shims and locations of anchorage.
    - .3 Clearly indicate, in large scale, the following:
      - .1 Sections details showing all window perimeter conditions.
      - .2 Mullion details and frame corner connections, including reinforcement and its fastening if applicable.
      - .3 Sill flashing terminations, in isometric view, including coordination with wall cladding materials.
      - .4 Details showing frame anchorage to wall structure.
      - .5 Details showing air sealing within and around perimeter of framing.
      - .6 Required sizes and tolerances of openings.
    - .4 Provide a letter from window manufacturer identifying the AAMA/WDMA/CSA 101/I.S.2/A440 - NAFSCSA A440.204 requirements.
    - .5 Provide a stress analysis on all tinted heat/absorbing glass and light and heat reflecting glass. Submit prior to ordering glass.

### 1.5 QUALITY ASSURANCE

- .1 Standards And Tests:
  - .1 All tests of this Section do not need to be performed if documentation is submitted from a recognized testing agency showing relevant testing numbers.
  - .2 Glazing Unit and Frame:
    - .1 Submit, with shop drawings, test data, from a recognized testing agency, that shows the following window performance characteristics:
      - .1 Thermal transmission coefficient;

- .2 Condensation resistance; and
- .3 Sound transmission loss characteristic.
- .2 Tests shall have been conducted in accordance with CAN/CSA-A440-M90 and must meet the standards Item 2.3 Window Performance Ratings of this section on a representative sample of a complete window unit (frame plus glazing unit).
- .3 Submit with shop drawings data showing glazing unit shading coefficient and visible light transmission values. Values shall be derived using recognized computer analysis programs such as WINDOW 6.
- .4 Pressure test each glazing unit to verify the air tightness of all joints such as those between glass panes and spacers and air vapour barrier; submit, upon request, reports showing test results for each glazing unit.

.2 MockUps:

- .1 Construct mockups in accordance with Section X - Quality Control.
- .2 Locate where directed by Consultant.
- .3 Curtain Wall Mock-up:
  - .1 Testing shall comply with and be conducted in accordance with the procedures laid out in AAMA Standard 501, Method of Test for Metal Curtain Walls.
  - .2 Test mock-up curtain wall for resistance to air infiltration, resistance to static and dynamic water penetration and structural performance under uniform loading.
  - .3 The mock-up curtain wall will be assumed to have passed these tests if its performance is shown to be as good as, or better than, the following:

Air Infiltration	0.2 L/s/m2 at 300 Pa differential
Water Penetration	Water Leakage Test Pressure Differential of 720 kPa

- .4 When accepted, mockup will demonstrate minimum standard for this work. Mockup may remain as part of finished work.

.3 Certification:

- .1 Provide written certification by a Professional Engineer registered in the area having jurisdiction that the curtain wall system complies with the applicable Building Code and that it is suitable for use on this building.

**1.6 DELIVERY, STORAGE, AND HANDLING**

- .1 Deliver, store, handle and protect materials in accordance with Section X - Basic Product Requirements.
- .2 Handle work of this section in accordance with AAMA CW10-12 Care and Handling of Architectural Aluminum from Shop to Site.
- .3 Protect prefinished surfaces with strippable coating. Do not use adhesive papers or sprayed coatings which bond when exposed to sunlight or weather.

- .4 Protect fibreglass composite surfaces from water exposure en route to site and on-site.
- .5 Waste management and disposal:
  - .1 Separate waste materials for reuse and recycling in accordance with Section X.

## 1.7 AMBIENT CONDITIONS

- .1 Do not install sealants when ambient and surface temperatures are less than 5°C.
- .2 Maintain this minimum temperature during and after installation of sealants.

## 1.8 WARRANTY

- .1 Then the manufacturer will, within 20 working days, supply and install a replacement Unit.

## Part 2 Products

### 2.1 ACCEPTABLE MATERIAL

- .1 GlasCurtain: Installed by:
  - .1 Ferguson Glass – <http://ferguson.ca>
  - .2 All Weather Windows – <http://awwcommercial.com>
  - .3 Glass 8 – <http://glass8.ca>
  - .4 Geo Glass – <http://geoglass.ca>
  - .5 Edge Glass – <http://edgeglass.ca/>
  - .6 Vitrierie A&E Fortin <http://www.vitrierieaefortin.com/>
  - .7 Norglass <https://norglass2002.ca/>

### 2.2 DESIGN CRITERIA

- .1 Design curtain wall to equalize both positive and negative pressure between outside air cavities surrounding insulating glass units.
- .2 Design curtain wall to provide drainage from spaces around insulating glass units to exterior.
- .3 Design windows to protect drainage openings from direct entrance of winddriven rain by use of baffles or other protection.
- .4 Design components to minimize and accommodate thermally induced movement.
- .5 Curtain wall system constructed so that glazing unit can be removed and replaced from outside of building.

### 2.3 CURTAIN WALL PERFORMANCE

- .1 Values shall be derived using recognized computer analysis programs such as WINDOW 6
- .2 Thermal Transmission Coefficient: per ASTM C236-87/AAMA 1503.1-1988;
  - .1 U-Value =  $0.90 \text{ W/m}^2\text{K}$  ( $0.16 \text{ Btu/ft}^2\text{F}$ ) for overall system (glazing unit plus frame).
- .3 Sound transmission loss characteristic as measured by ASTM E90-09: 36-44.
- .4 Flame spread certification, as required, per CAN/ULC-S134.

## 2.4 OPERABLE FRAME AND SASH PERFORMANCE

- .1 Meet or exceed requirements of AAMA/WDMA/CSA 101/I.S.2/A440 - NAFS, and the following performance requirements:
- .2 Air Tightness Rating, Operable Windows: A3.
- .3 Water Tightness Rating: B7.
- .4 Wind Load Resistance Rating: C4.
- .5 Forced Entry: F2, pass test for resistance to forced entry.
- .6 Glazing: as indicated in this Section.
- .7 Overall Operable Window U-Value: maximum  $1.0 \text{ W/m}^2 \text{ K}$  ( $0.18 \text{ Btu/ft}^2 \text{ F}$ )

## 2.5 MATERIAL AND CONSTRUCTION, CURTAIN WALL FRAME

- .1 Construction:
  - .1 General:
    - .1 Pultruded fibreglass composite (FRP) frame.
    - .2 Butt joints secured with screws into screw ports or spigot-blocks and sealed with sealant.
    - .3 Complete system to act as a rain screen so as to drain to exterior any water entering the frame cavity.
  - .2 Pressure Plate System:
    - .1 Pultruded fibreglass composite (FRP) pressure plate.
    - .2 Prefinished snap-on extruded aluminum cap.
- .2 Flashings: aluminum finish to match curtain wall mullion sections where exposed, gravel stop edge to exterior parapet side, secured with concealed fastening method.
  - .1 Finish exposed surfaces of aluminum components in accordance with AA DAF45.
    - .1 Clear anodize finish to Architectural Class I.
    - .2 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 CAN/CSAA440/A440.1, for coating Classes 1, 2 and 3 respectively.
- .3 Firestopping: refer to Drawing X for fire stopping and smoke seal performance criteria.
- .4 Air/Vapour Barrier: Specified in Section X – Roofing and Building Siding
- .5 Material:
  - .1 Composite: Pultruded FRP (Fibreglass-Reinforced Plastic)
  - .2 Air Seal Gasket: EPDM extrusions.
  - .3 Compression and Wedge Gaskets: EPDM extrusions.
  - .4 Fasteners & Keys: Aluminum, stainless steel, die cast zinc, cadmium plated steel.
  - .5 Back Section: 145 mm x 61.5 mm (standard Therm profile) or 253 mm x 64 mm (ThermXL profile)

- .6 Pultruded FRP (Fibreglass-Reinforced Plastic) pressure plates
- .7 Caps: 63.5 mm x 19mm aluminum caps
- .8 Finish:
  - .1 Interior Back Sections: Factory-applied spray paint to AAMA 624-10:
    - .1 Standard colour: Grey, white, or black
    - .2 Optional colour: Paint-to-sample
  - .2 Exterior Caps:
    - .1 Standard finish: Clear anodic finish, Architectural Class I
    - .2 Optional finish: Colour indicated on Drawings:
      - .1 Coloured anodic finish, Architectural Class I
      - .2 Powder Coating to AAMA 2604

## 2.6 MATERIAL, GLASS AND GLAZING

- .1 Insulating Glass Units: meet or exceed requirements of CAN/CGSB12.8. Units shall be certified by the Insulated Glass Manufacturers Alliance (IGMA). Use two stage seal method of manufacture, as follows:
  - .1 Primary Seal: polyisobutylene sealing compound between glass and metal spacer/separator, super spacer bar or TDSE Intercept.
  - .2 Secondary Seal: polyurethane, silicone or polysulphide base sealant, filling gap between the lites of glass at the edge up to the spacer/separator and primary seal.
- .2 Spacer/separator to provide continuous vapour barrier between interior of sealed unit and secondary seal.
- .3 Curtain Wall and Window Unit Composition: Manufacturer to provide composition to meet performance requirements specified above.
  - .1 Design glass seals to prevent moisture accumulation for life of product.
  - .2 44 mm O/A thickness, vision sealed unit with one of the following two systems (the specified three- and two-coating systems are considered equivalent, both achieve 0.67 W/m<sup>2</sup>K centre-of-glass U-value or lower):
    - .1 Three low-e coatings
      - .1 6 mm clear, heat strengthened glass, Solarban 60 on #2
      - .2 13 mm air space w/ argon gas, black technoform spacer bar
      - .3 6 mm clear, heat strengthened glass, Solarban 60 on #4
      - .4 13 mm air space w/ argon gas, black technoform spacer bar
      - .5 6 mm clear annealed glass, Pilkington Energy Advantage on #6
    - .2 Two low-e coatings
      - 1. 6 mm clear, heat strengthened glass, Solarban 70XL on #2
      - 2. 13 mm air space w/ argon gas, black technoform spacer bar
      - 3. 6 mm clear, heat strengthened glass, Solarban 70XL on #4
      - 4. 13 mm air space w/ argon gas, black technoform spacer bar

5. 6 mm clear annealed glass
  - .3 Acceptable coating manufacturers:
    - .1 Vitro/PPG Industries
    - .2 AGC Glass Company North America, Inc.
    - .3 Guardian Industries
    - .4 Pilkington Group Limited
  - .4 Composite Door glazing: Insulating Glass unit, refer to Section X - Glazing.
  - .5 Provide low-E coating as required to meet performance requirements.
  - .6 Glazing Gaskets for Sections: neoprene, thermoplastic rubber or EPDM, flexible at minimum design temperature, and as follows:
    - .1 Profiled with a minimum of three (3) fins to contact glazing and to mechanically key into window frame and sash glazing stops, at interior and exterior of glass units.
    - .2 Removable without special tools and without dismantling of window frames.
    - .3 Designed to maintain pressure contact against glass units through design temperature range.
    - .4 Coextruded material is not acceptable.
  - .7 Glazing Gaskets for FRP Sections: Manufacturer's standard.
  - .8 Other Glazing Accessories: setting blocks to CAN/CSAA440.

## 2.7 INSULATED SPANDREL AREAS

- .1 Spandrel glass: to CAN/CGSB12.9, back-painted glass, low-e, clear, and 6 mm thick.
  - .1 Type: Heat strengthened.
  - .2 Class: AFloat.
  - .3 Organic – applied silicone elastomeric coated.
  - .4 Form: MMonolithic
  - .5 Colour: 3-967 Black Grey, Opaci-Coat 300, ICD Inc.
- .2 Acceptable materials:
  - .1 [Opaci-Coat-300](#), Industrial Control Development Inc.
  - .2 [Span-Kote](#), Span-Kote Industries
  - .3 [Envatherm](#), Lenmak Exterior Innovations Inc.
- .3 Maintain full thermal separation at frame section within spandrel areas to be same or better (lower conductance) than in vision areas.
- .4 Back Pan: Satin coated steel in accordance with ASTM A653, 0.91 mm base metal thickness, formed into a pan shape to fit into glazing throat with back of pan flush with inside face of back section.
- .5 Insulation: secure insulation in place with manufacturer's standard fixing system to back face of back pan, with front face of insulation at same depth as exterior face of frame thermal break.
  - .1 Thickness: minimum 125 mm.

- .1 Sub-frame section: minimum 100 mm.
- .2 Shoulder: minimum 25 mm.
- .2 Thermal Insulation Core: CavityRock DD, Roxul

## **2.8 ACCESSORIES**

- .1 Steel Reinforcement: sheet steel to ASTM A653M, hot dip galvanized, minimum Z275 coating designation.
- .2 Joint Sealants: Dow Corning 795, Black.
- .3 Insulating Foam Sealant: one-part polyurethane, closed cell foam, skin-forming type, expanding maximum 25%.
- .4 Foam Backer Rod: extruded closed cell backer rod, oversize 30 to 50%.
- .5 Flashing: prefinished sheet aluminum, brake formed as indicated on drawings, 1.5 mm thick, concealed fastened.

## **2.9 FABRICATION, CURTAIN WALL FRAME**

- .1 Difference in length between opposite parallel sides of curtain wall panel shall be no more than:
  - .1 1.5 mm (0.06 inches) for panels with a diagonal measurement of 1800 mm (72 inches) or less
  - .2 3.0 mm (0.12 inches) for panels with a diagonal measurement over 1800 mm (72 inches).
- .2 Difference in length between the two diagonal measurements of a curtain wall panel shall be no more than:
  - .1 3.0 mm (0.12 inches) for panels with a diagonal measurement of 1800 mm (72 inches) or less
  - .2 4.5 mm (0.18 inches) for panels with a diagonal measurement more than 1800 mm (72 inches).
- .3 Seal fibreglass framing joints with butylpolyisobutylene or silicone sealant. Mitre and sash joints at corners.
- .4 Steel reinforce vertical and horizontal components of FRP window units as required by Consultant and structural design.
- .5 Continuously and uniformly compress length of gaskets during installation, to compensate for linear shrinkage.

## **Part 3 Execution**

### **3.1 INSTALLATION, GENERAL**

- .1 Erection Tolerances: Erect all component parts within the following tolerances:
  - .1 Variations from plumb or angle shown:
    - .1 3 mm maximum variation in storey height or 3050 mm run, non-cumulative.
  - .2 Variations from level or slopes shown:
    - .1 3 mm maximum variation in any column-to-column space or 6100 mm run, non-cumulative.

- .3 Variations from theoretical calculated position as located in plan or elevation in relation to established floor lines, column lines and other fixed elements of the structure, including variations from plumb and level:
  - .1 6 mm maximum variation in any column-to-column space, floor-to-floor height or 6100 mm run.
- .4 Offsets in end-to-end or edge-to-edge alignment of consecutive members:
  - .1 1.5 mm maximum offset in any alignment.
- .5 Attach and seal building air-vapour barrier to curtain wall frame as detailed on drawings to maintain continuity of building envelope air-vapour barrier.
- .2 Attach to structure to permit sufficient adjustment to accommodate construction tolerances and other irregularities.
- .3 Provide alignment attachments and shims to permanently fasten system to building structure. Clean weld surfaces; apply protective primer to field welds and adjacent surfaces.
- .4 Align assembly plumb and level, free of warp or twist. Maintain assembly dimensional tolerances and align with adjacent work.
- .5 Provide thermal isolation where components penetrate or disrupt building insulation.
- .6 Install sill flashings.
- .7 Coordinate attachment and seal of perimeter air barrier and vapour retarder materials.
- .8 Pack fibrous insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.
- .9 Install operating sash in accordance with Section X - Glazing, to interior wet/dry method of glazing.
- .10 Install glass and infill panels in accordance with Section X - Glazing, to exterior wet/dry method of glazing.

### **3.2 INSTALLATION, GLAZING**

- .1 Clean sealing surfaces at perimeter of glass and sealing surfaces of rabbets and stop beads before applying splines or gaskets. Use solvents and cleaning agents recommended by manufacturer of sealing materials.
- .2 Install glazing gaskets uniformly with accurately formed corners and bevels. Ensure that proper contact is made with glass and rabbet interfaces.
- .3 Support both lites of glass thermal units on leveled setting blocks, 4 or 6 mm minimum, spaced as recommended by glass manufacturer. Provide at least one setting block at quarter points from each corner. For casement windows, locate setting blocks closer to corners as recommended by manufacturer.
- .4 Center glass thermal units in glazing rabbet to maintain 6 mm minimum clearance between edges of glazing and plastic framing at sill or 4 mm minimum clearance between edges of glazing and plastic framing at sill if glazing bite incorporates a drainage channel with a depth of 3 mm minimum.
- .5 Size glass thermal units to ensure exposed face of spacer is in line with glazing stops.
- .6 Use spacers and shims in accordance with glass manufacturer's recommendations.

- .7 **\*\*\*IF USING TWO-SIDED SSG (STRUCTURAL SILICONE GLAZING) SYSTEM\*\*\*  
SEALANT GLAZING (WET)**
  - .1 Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure.
    - .1 Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.
  - .2 Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.
  - .3 Tool exposed surfaces of sealants to provide a substantial wash away from glass.

**3.3 MANUFACTURER'S FIELD SERVICES**

- .1 Curtain wall product manufacturer to provide field review of the installation of their Products.
- .2 Monitor and report installation procedures – report any installation under unacceptable conditions to Owner.

**3.4 ADJUSTING**

- .1 Adjust operating sash for smooth operation.

**3.5 CLEANING**

- .1 Remove all excess and scrap material and equipment involved in this installation
- .2 Remove protective material from prefinished aluminum surfaces and painted fibreglass surfaces
- .3 Wash down surfaces with a solution of mild detergent in warm water, applied with soft, clean wiping cloths. Take care to remove dirt from corners. Wipe surfaces clean.
- .4 Remove excess sealant by moderate use of mineral spirits or other solvent acceptable to sealant manufacturer.

**3.6 PROTECTION**

- .1 Protect finished Work from damage.

**END OF SECTION**