SECTION  – structural-sealant glazed curtain walls

1. General
   1. summary
      1. This Section includes requirements for design, supply and installation of a two-sided structural silicone glazed curtain wall system consisting of, but not limited to, the following:
         1. Fixed, low emissivity (Low E) sealed structural glass units.
         2. Structural silicone glazed glass panel joints.
         3. Connections to structural support systems, fasteners, and accessories required for a complete installation of the structural glass system.
      2. Drawings contain details that suggest directions for solving some of the major design requirements; these details can be developed further by the Contractor provided that the final installation adheres to aesthetic criteria established by the drawings and specified dimensions with all elements in planes as drawn, maintaining their relationships with all other building elements.
      3. Work of this Section is intended to be designed and supplied by a single source structural glass manufacturer and installed by a manufacturer trained and approved glazing installer; having experience designing and installing systems of similar complexity and scope to that described in this Section including glass and glazing, and architectural structural steelwork required for complete installation.
      4. Related Requirements:
         1. Section 05 12 00 – Structural Steel Framing.
         2. Section 05 50 00 – Metal Fabrications.
         3. Section 07 92 00 – Joint Sealants.
         4. Section 08 80 00 – Glazing.
   2. definitions
      1. Professional Engineer: The professional engineer hired or contracted to the fabricator or manufacturer to design specialty elements, produce delegated design submittals and shop drawings to meet the requirements of the Project; who is registered in the province of the Work; and who is not the Consultant.
      2. Equal Dimensions: Curtain wall assemblies indicating equal dimensions on the drawings shall be calculated to align with in-place structural elements followed by even division of the space between structural elements. This shall mean that curtain wall materials are evenly spaced between adjacent structural members, not necessarily evenly spaced across the entire wall assembly.
   3. reference standards
      1. American Architectural Manufacturers Association (AAMA):
         1. AAMA 501, Methods of Test for Exterior Walls.
         2. AAMA 501.4, Recommended Static Test Method for Evaluating Curtain Wall and Storefront Systems Subjected to Seismic and Wind Induced Interstory Drifts.
         3. AAMA 501.6, Recommended Dynamic Test Method for Determining the Seismic Drift Causing Glass Fallout from a Wall System.
         4. AAMA 505, Dry Shrinkage and Composite Performance Thermal Cycling Test Procedure.
         5. AAMA 507, Standard Practice for Determining the Thermal Performance Characteristics of Fenestration Systems Installed in Commercial Buildings.
         6. AAMA 1503, Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections.
         7. AAMA CW DG 1 96, Curtain Wall Design Guide.
         8. AAMA RPC 00, Rain Penetration Control: Applying Current Knowledge.
      2. American Society for Testing and Materials (ASTM):
         1. ASTM A167 99 (2009), Stainless and Heat Resisting Chromium Nickel Steel Plate, Sheet and Strip.
         2. ASTM A276/A276M 16, Standard Specification for Stainless Steel Bars and Shapes.
         3. ASTM A653/A653M 15e1, Standard Specification for Steel Sheet, Zinc Coated (Galvanized) or Zinc Iron Alloy Coated (Galvannealed) by the Hot Dip Process.
         4. ASTM A666 15, Standard Specification for Annealed or Cold Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
         5. ASTM A781/A781M 14b, Standard Specification for Castings, Steel and Alloy, Common Requirements, for General Industrial Use.
         6. ASTM A890/A890M 13, Standard Specification for Castings, Iron-Chromium-Nickel-Molybdenum Corrosion Resistant, Duplex (Austenitic/Ferritic) for General Application.
         7. ASTM A957/A957M-15a, Standard Specification for Investment Castings, Steel and Alloy, Common Requirements, for General Industrial Use.
         8. ASTM C920 14a, Standard Specification for Elastomeric Joint Sealants.
         9. ASTM C1135 15, Standard Test Method for Determining Tensile Adhesion Properties of Structural Sealants.
         10. ASTM C1184 14, Standard Specification for Structural Silicone Sealants.
         11. ASTM C1249-06a(2010), Standard Guide for Secondary Seal for Sealed Insulating Glass Units for Structural Sealant Glazing Applications.
         12. ASTM C1265-94(2011), Standard Test Method for Determining the Tensile Properties of an Insulating Glass Edge Seal for Structural Glazing Applications.
         13. ASTM C1401 14, Standard Guide for Structural Sealant Glazing.
         14. ASTM E283 04(2012), Standard Test Method for Determining the Rate of Air Leakage through Exterior Windows, Curtain Walls, and Doors under Specified Pressure Differences across the Specimen.
         15. ASTM E330/E330M-14, Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.
         16. ASTM E331 00 (2009), Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference.
         17. ASTM E997 15, Standard Test Method for Evaluating Glass Breakage Probability Under the Influence of Uniform Static Loads by Proof Load Testing.
         18. ASTM E998 12, Standard Test Method for Structural Performance of Glass in Windows, Curtain Walls, and Doors under the Influence of Uniform Static Loads by Nondestructive Method.
      3. Canadian General Standards Board (CGSB):
         1. CAN/CGSB 12.1-M90, Tempered or Laminated Safety Glass.
         2. CAN/CGSB 12.20-M89, Structural Design of Glass for Buildings.
         3. Canadian Standards Association (CSA):
         4. CAN/CSA G40.20/G40.21 04, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steels.
         5. CSA W47.1 03 (R2008), Certification of Companies for Fusion Welding of Steel Structures.
         6. CSA W59 03 (R2008), Welded Steel Construction (Metal Arc Welding).
      4. Canadian Welding Bureau (CWB Group Industry Services):
         1. AWS A2.4-98, Standard Symbols for Welding, Brazing and Nondestructive Examination.
         2. AWS D1.6-2007, Structural Welding Code B Stainless Steel.
      5. The Association for Material Protection and Performance (Formerly The Society for Protective Coatings (SSPC))/National Association of Corrosion Engineers (NACE International):
         1. SSPC SP COM Surface Preparation Commentary for Steel and Concrete Substrates.
         2. SSPC PS Guide 12.00, Guide to Zinc Rich Coating Systems.
   4. ADMINISTRATIVE REQUIREMENTS
      1. Coordination: Coordinate installation of structural glass curtain wall system with work specified in other Sections to ensure proper placement and installation of the following:
         1. Coordinate structural framing assembly requirements with glass and glazing requirements specified in this Section; design and provide structural framing assembly and structural glass curtain wall as a single source responsibility.
         2. Structural connections and supports of structural glass curtain walls; provide loading and deflection criteria to tension framing assemblies to prevent excessive movements, and glass-to-glass or glass-to-metal contact.
         3. Vapour barriers, insulation and flashing so that air, vapour and thermal barrier of building are intact and moisture will be diverted to the exterior.
         4. Sealants so that ambient and surface temperatures are greater than 5 deg C from time of application until sealants have cured.
      2. Pre-Construction Meetings: Schedule and conduct a pre-construction meeting at project site in accordance with Section 01 31 19 – Project Meetings, with Contractor and Subcontractors responsible for fabrication and erection of structural glass curtain wall, Trade Contractors affected by Work of this Section and the Consultant; agenda for meeting will include but not me limited to, the following:
         1. Review methods and procedures related to installation of structural glass curtain wall systems.
         2. Review glazing procedure and schedule including method of delivery and handling of glass, and installation of glazing materials.
         3. Review structural load limitations.
         4. Review and finalize construction schedule and verify availability of materials, installer's personnel, equipment, and facilities needed to make progress and avoid delays.
         5. Review location and alignment of vertical and horizontal elements as they relate to the aesthetic criteria indicated on the Drawings, and the technical requirements indicated on the shop drawings.
   5. SUBMITTALS
      1. Submit submittals in accordance with Section 01 33 00 – Submittal Procedures.
      2. Action Submittals: Provide the following submittals before starting any Work of this Section:
         1. Product Data: Submit product data indicating construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of product indicated, in addition to the following specific requirements:
            1. Corrosion Protection: Indicate thickness and type of corrosion protection coating.
         2. Shop Drawings: Submit shop drawings prepared by or under the supervision of Professional Engineer detailing fabrication and assembly of curtain wall systems clearly indicating all construction details including, but not limited to, the following:
            1. Layout of complete glazed structure in relation to adjacent work including walls, columns, beams, slabs and other structures.
            2. Connections and anchor requirements.
            3. Design loads.
            4. Materials, attachments devices and accessories including necessary tolerances.
            5. Connections to adjacent air and vapour membranes.
            6. Sealant locations.
            7. Seal of a Professional Engineer registered in the Province of the Work for details requiring structural design for load bearing, or life and health safety.
         3. Samples: Submit samples for each type of exposed finish required, in manufacturer's standard sizes for Consultants verification of specified finishes; and fabricated 12" x 12" sample of each vertical to horizontal intersection of specified systems, indicating details of the following:
            1. Glass seals and edges.
            2. Joinery.
            3. Anchorage.
            4. Expansion provisions.
            5. Glazing.
      3. Informational Submittals: Provide the following submittals during the course of the work:
         1. Certificates:
            1. System Certificate: Statement signed by glass manufacturer clearly stating that glass used on project are part of manufacturers system and are acceptable to manufacturer and that they have reviewed contract documents and are able to issue warranty incorporating all components for system; letters signed by installer for this section are not acceptable.
            2. Welding Certificate: Submit copies of welder certificates certifying that welders are certified and have the necessary experience to complete work specified in this Section.
         2. Source Quality Control Submittals: Submit design notes and calculations signed and sealed by delegated design professional engineer including the following:
            1. Analysis for all pertinent load cases live, dead, wind, thermal and seismic data.
            2. Reactions at supports and maximum deflections.
            3. Calculations for support and other details as necessary; use actual calculations for the project, historical test reports will not be acceptable.
            4. Size glass panels using finite element analysis.
         3. Site Quality Control Submittals: Submit a report completed by, and signed and sealed by Professional Engineer as required by site services for manufacturer's representative identified later in this Section.
   6. PROJECT CLOSEOUT SUBMISSIONS
      1. Operation and Maintenance Data: Submit manufacturer's written instructions for maintenance and adjustment procedures; include name of original installer and contact information in accordance with Section 01 33 00 – Submittal Procedures.
      2. Record Documentation: Submit as constructed information in accordance with Section 01 33 00 – Submittal Procedures.
   7. QUALITY ASSURANCE
      1. Qualifications: Provide proof of qualifications when requested by Consultant:
         1. Sole Source Responsibility: Obtain glass and glazing materials, and system design, materials, supply and installation from a single source manufacturer using manufacturers certified installer; system must be manufactured from one source, glass cannot be supplied by one manufacturer and hardware from another manufacturer.
         2. Manufacturer: Use a manufacturer having a minimum of ten (10) years experience in designing and manufacturing structural glass system similar in scope and complexity as those required for Work of this Section.
         3. Installer: Use installers having a minimum of three (3) years of experience with installation of structural glass system similar in scope and complexity as that required for Work of this Section, and that are certified by the manufacturer of the structural glass system.
         4. Materials: Use glazing materials and framing sealants that are chemically compatible with each other and with materials used during glass fabrication.
         5. Professional Engineer: Retain a Professional Engineer, registered in the province of the Work, to design fabrication and erection of the Work of this Section in accordance with applicable Building Code and Contract Documents requirements including, but not limited to, the following:
            1. Perform design, engineering and fabrication of structural glass system under a single source responsibility; outsourcing, subcontracting, or joint ventures to achieve a single source will not be acceptable.
            2. Seal and signature to shop drawings and design submittals.
            3. Site review and certification of installed components.
   8. DELIVERY, STORAGE AND HANDLING
      1. Delivery and Acceptance Requirements: Deliver materials with components clearly labelled and inventoried indicating position within building construction; time delivery of material to site to ensure uninterrupted progress of work.
      2. Storage and Handling Requirements: Store and handle materials and components to prevent damage in accordance with manufacturer's written instructions and as follows:
         1. Store units at site on raised wood pallets protected from the elements and corrosive materials; do not remove from crates or other protective covering until ready for installation.
         2. Store all glass units vertically on end with solid bearing full thickness of sealed units.
         3. Store factory finished components in a manner that will prevent surfaces from being damages or scratched.
   9. SITE CONDITIONS
      1. Site Measurements: Verify dimensions of other construction by site measurements before fabrication and indicate measurements on shop drawings where curtain wall systems are indicated to fit to other construction.
      2. Established Dimensions: Establish dimensions and proceed with fabricating curtain wall without site measurements where site measurements cannot be made without delaying the Work, coordinated with other construction to ensure that actual dimensions correspond to established dimensions.
      3. Ambient Conditions: Comply with manufacturers written requirements for ambient and surface temperature under which products can be installed and verify joint conditions are suitable for installation of materials.
   10. WARRANTY
       1. Provide manufacturers written warranty, signed and issued in the name of Owner, to replace the following items for defective material and workmanship for the time stated from date of Substantial Performance:
          1. Structural glass system members and structural glazing: Failure of performance requirements specified in this Section; 3 years; written warranties excluding coverage from nickel sulphide inclusions will not be accepted in replacement of heat soak testing required for this Section.
          2. Sealed Glass Units: Misting, dusting and seal failure; as indicated in Section 08 80 00 – Glazing.
          3. Joint Sealants: Failure to maintain seal; 3 years.
          4. Structural Silicone Glazing: 10 years.
          5. Finishes: Failure specified finishes not attributable to normal weathering; 20 years.
       2. Failures will be considered as, but are not limited to, the following:
          1. Structural failures including excessive deflection, loosening or weakening of fasteners, attachments, and other components.
          2. Noise or vibration created by wind, thermal and structural movements.
          3. Thermal stresses transferred to building structure.
          4. Adhesive or cohesive sealant failures.
          5. Water leakage.
          6. Failure of operating components to function normally.
2. Products
   1. manufacturers
      1. Acceptable Materials Manufacturers: Subject to compliance with requirements specified in this Section and as established by the Basis of Design Materials, manufacturers offering products that may be incorporated into the Work include; but are not limited to, the following:
         1. Alumicor Limited: Thermawall 2600.
         2. Kawneer Canada Ltd: 1600 Wall System 2.
   2. DESCRIPTION OF WORK
      1. Responsibility: Professional Engineer is responsible for designing structural glass system based on design loads and reactions provided by the Consultant and verifying that safety factor is appropriate for intended installation and meets requirements of the Authority Having Jurisdiction.
      2. Design Requirements: Design and size system components in accordance with CGSB 12.20 and ASTM E330; free from defects impairing strength, durability and appearance including anchorage capable of withstanding specified loading without failure, and as follows:
         1. Appearance: Design system components and glass system to provide a flush appearance where glass panels abut adjacent glass panels; systems that incorporate additional exposed metal stiffeners and girts will not be permitted.
         2. Exposed Fasteners: Fabricated from same materials design to prevent high stress concentration at glass connection points, colour and finish as material as that to which they are applied and having exposed surfaces with same inherent texture and colour for similar locations throughout system.
         3. Wind (Horizontal) and Structural (Vertical) Loads: Design and fabricate assemblies and systems to resist loads required by Building Code.
         4. Engineering Design: Use Professional Engineer, registered in the province of the Work, and that has experience in the work required by this Section to prepare structural calculations and design details.
      3. Design Loads and Performance Criteria: Design curtain wall framing system capable of withstanding design loads within limits and under design loads indicated in this Section, and as follows:
         1. Structural Deflection and Movement: Allow for movement and deflection of structural support framing; design tension framing system connections to accommodate structural deflections such that loading is not transferred to glass curtain wall system:
            1. Building Movement: Design for movements of supporting structure including twist, column shortening, long term creep, and deflection from uniformly distributed and concentrated live loads and storey drift under combined wind and gravity loads in accordance with the Building Code.
            2. Lateral Loads: Design for q50 wind loads using low importance factors listed in the Building Code for deflection and strength, modified by the appropriate exposure, gust and pressure (internal and external) factors in accordance with Building Code structural commentaries.
            3. Periodic Maintenance Equipment Loads: Account for loads arising from window cleaning or other maintenance equipment.
            4. Deflection of Framing Members: Limit deflection to the following requirements with full recovery of glazing materials:

Deflection Normal to Wall Plane: Limited to L/175 of clear span for spans up to 14', and to L/240 of clear span plus 1/4" for spans greater than 14' or an amount that restricts edge deflection of individual glazing lites to 19 mm, whichever is less.

Deflection Parallel to Glazing Plane: Limited to amount not exceeding an amount that reduces glazing bite to less than 75% of design dimension and that reduces edge clearance between framing members and glazing or other fixed components to less than 1/8".

Limit length of cantilever deflection to 2/175 length of the cantilevered member where framing members overhang an anchor point.

* + - 1. Thermal Loads and Movement: Allow for glass movement arising from thermal changes as follows, accounting for surface temperatures of materials due to both solar heat gain and night-time sky heat loss:
         1. Normal Ambient Temperature Range: 40 deg C based on 16 deg C ambient winter and 24 deg C ambient summer; adjust calculations to account for colour treatments or coatings on curtain wall framing members and glass
         2. Structural Movement: Allow for thermal movement with no buckling of structural components, stress on glass, glazing edge seal failure, sealant failure, excess stress on curtain wall framing, anchors and fasteners, or reduction of performance in accordance with AAMA 505.
      2. Building Envelope Performance Criteria: Design glass and glazing systems to allow for the following:
         1. Air Infiltration: Design system for maximum air leakage of 0.03 L/m2 of fixed wall area when tested in accordance with AAMA 501 or ASTM E283 at a minimum static air pressure differential of 300 Pa
         2. Water Penetration Under Static Pressure: Design system for zero water penetration when tested in accordance with AAMA 501 or ASTM E331 at a minimum differential static pressure of 20% of positive design wind load, but not less than 475 Pa
         3. Average Thermal Conductance: Design system having average insulation factor of not more than 2.6 W/m2\_K when tested in accordance with AAMA 1503
  1. METALLIC MATERIALS
     1. Aluminum:
        1. Extrusions: AA6063-T5 alloy, anodizing quality, conforming to ASTM B221-92a.
        2. Plate and Sheet: AA1100-H14 alloy, anodizing quality unless otherwise indicated, minimum 0.125" thick, conforming to ASTM B209-92a.
        3. Sills: AA6061.T6 alloy, anodizing quality, conforming to ASTM B221-92a.
        4. Exposed surfaces of aluminum shall be free of die marks, scratches, blisters, or other blemishes, whether left unfinished or finished.
        5. Aluminum Welding Materials: Conforms to CSA W59.2.
     2. Structural Steel Supports: Fabricate structural steel supports forming a part of structural glass system so that they are mechanically connected in the site to prevent damage the paint finish arising from welding operations, and as follows:
        1. Rolled Sheet or Strip: CSA G40.20/G40.21.
        2. Structural Shapes, Plates and Bars: CSA G40.20/G40.21.
        3. Surface Preparation: Select surface preparation methods in accordance with recommendations in SSPC SP COM and prepare surfaces in accordance with applicable SSPC standard required for architecturally exposed steel.
        4. Fabricate mechanical connections to provide a clean aesthetic appearance.
     3. Brackets and Reinforcements: Manufacturer's standard high strength stainless steel type with non staining, non-ferrous shims for aligning system components.
     4. Accessories: Provide manufacturer's standard corrosion resistant, non staining, non-bleeding accessory components compatible with adjacent materials:
        1. Finish exposed portions to match framing system.
        2. Use slips joint linings, spacers, and sleeves at movement joints of material and type recommended by manufacturer.
     5. Anchors: Three-way adjustable anchors that accommodate fabrication and installation tolerances in material and finish compatible with adjoining materials and recommended by manufacturer.
     6. Concealed Flashing: Manufacturer's standard corrosion resistant, non staining, non-bleeding flashing compatible with adjacent materials.
  2. ALUMINUM ENTRANCE SWING DOORS
     1. Manufacturers extruded aluminum glazed doors for manual swing operation, reinforced as required to withstand traffic conditions.
     2. Door Type:
        1. Construction: medium stile, thermally broken frame sections.
        2. Glazing Method: Square stops for sealed glazing, with non-removable glazing stops on outside of door.
        3. Basis of Design Material: Alumicor Insuldoor Entrance Doors Series 400A, or Kawneer 360 Insulclad Thermal Entrances Series.
  3. STRUCTURAL GLASS ACCESSORIES
     1. Provide laminated structural glass as indicated in Section 08 80 00 - Glazing.
     2. Sealants: Use manufacturers recommended sealant compounds as follows:
        1. Structural Sealant: Neutral curing silicone formulation meeting requirements of ASTM C1184; compatible with system components with which it comes in contact, specifically formulated and tested for use as structural sealant in accordance with ASTM C1135, and as follows:
           1. Colour: Black.
           2. Type: Manufacturer's standard single component.
           3. Minimum Tensile Strength: As required to meet design loading limitation.
           4. Modulus of Elasticity: As required by structural glass system design to meet performance requirements.
           5. Structural silicone sealants shall be designed and certified by manufacturer.
           6. Coordinate sealant compatibility with materials specified for sealed unit fabrication specified in Section 08 80 00 - Glazing.
  4. FABRICATION
     1. Fabricate components that have the following characteristics when assembled:
        1. Sharp profiles, straight and free of defects or deformations.
        2. Accurately fitted joints with ends coped or mitred.
        3. Physical and thermal isolation of glazing from framing members.
        4. Accommodations for thermal and mechanical movements of glazing and framing to prevent glazing to glazing contact and to maintain required glazing edge clearances.
        5. Structural sealant joints that do not carry gravity loads of glazing.
        6. Provisions for site replacement of glazing from exterior; include accommodations for using temporary support devices to retain glazing in place while sealant cures.
     2. Fabricate aluminum assemblies of extruded sections to sizes and profiles indicated.
        1. Ensure vertical and horizontal members are tubular extrusions designed for shear block corner construction.
        2. Mullion depth sizes as indicated.
        3. Cap depth sizes: 19mm (3/4").
        4. Structural silicone joints where indicated.
        5. Ensure caps for mullion assemblies are constructed without gap.
     3. Weld fabricated glass support components in concealed locations to greatest extent possible to minimize distortion or discoloration of finish; remove weld spatter and welding oxides from exposed surfaces by de scaling or grinding, polish welds in exposed locations to match adjacent finishes.
     4. Code each part for easy identification on site after fabrication, cross referenced to their locations in the Project and referenced to the Shop Drawings and to shipping lists.
     5. Size glass joint width to meet calculated movement and function.
     6. Fabricate detail components and flashings from stainless steel sheet for interfaces between structural glass curtain walls and adjacent construction.
  5. FINISHES
     1. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
     2. Protect finish with strippable protective film.

SPEC NOTE: Select Class 1 finish for highly corrosive exterior environments (sea salt). Select Class 2 finish for standard exposure.

* + 1. Clear Anodized Finish:
       1. Class I Finish: Architectural Class I, clear coating 0.018 mm or thicker in accordance with AAMA 611.
       2. Class II Finish: Architectural Class II, clear coating 0.010 mm or thicker in accordance with AAMA 611.
    2. **[Light Bronze] [Medium Bronze] [Dark Bronze] [Black]** Coloured Anodized Finish:
       1. Class II Finish: Architectural Class II, integrally coloured or electrolytically deposited colour coating 0.010 mm or thicker in accordance with AAMA 611.

SPEC NOTE: Select 2 coat for standard exterior projects; 3 coat for high end finish, corrosive exterior environments; acrylic enamel for interior projects.

* + 1. High Performance Organic Finish:
       1. Two (2) Coat PVDF or FEVE Coating:
          1. Manufacturer's standard 2 coat, thermo-cured system consisting of specially formulated inhibitive primer and colour topcoat and apply coating to exposed metal surfaces in accordance with AAMA 2605 and with coating and resin manufacturers' written instructions.
          2. Colour: **[As indicated in Section 09 06 05 – Product and Finish Schedule.”] [As selected by Consultant from manufacturer's full product range.]**
          3. Basis of Design Materials: PPG Duranar.
       2. Three (3) Coat Fluoropolymer Thermo-setting Enamel:
          1. All aluminum entrance and storefront framing exposed in the finished work shall have three coat fluoropolymer thermo-setting enamel conforming to AAMA 605.2-90, minimum 1.6 mils dry film thickness.
          2. Pre-treat aluminum after fabrication and apply primer and finish coats in strict accordance with manufacturer's written instructions.
          3. Colour: **[As indicated in Section 09 06 05 – Product and Finish Schedule."][As selected by Consultant from manufacturer's full product range.]**
          4. Basis of Design Materials: PPG 'Duranar XL.
    2. Acrylic Enamel Finish:
       1. One (1) Coat Acrylic Extrusion Coating:
          1. AA C12 Chemical Finish, cleaned with inhibited chemicals; C40 Chemical Finish, conversion coating; Rx Acrylic Coating, manufacturer's standard single coat factory spray applied acrylic coating; prepare, pre-treat and apply coating to exposed metal surfaces to 0.020 mm or thicker in accordance with AAMA 2603 and with coating manufacturer's written instructions.
          2. Colour: **[As indicated in Section 09 06 05 "Product and Finish Schedule.”] [As selected by Consultant from manufacturer's full product range.]**
          3. Basis of Design Materials: PPG Duracron.
    3. Steel (Concealed):
       1. Hot-dip galvanized in accordance with CAN/CSA-G164, with minimum coating of 2 oz./sq.ft., or zinc rich paint.
    4. Isolate where necessary to prevent electrolysis due to dissimilar metal-to-metal contact or metal-to-masonry and concrete contact. Use bituminous paint, butyl tape or other approved divorcing material.

1. Execution
   1. examination
      1. Verification of Conditions: Verify anchorage and fastening locations before beginning of installation of products specified in this Section:
         1. Installation of structural glass curtain wall assemblies will denote acceptance of site conditions.
   2. PREPARATION
      1. Inserts and Anchorages: Provide inserts and anchoring devices that require setting into concrete or attaching to structural steel, and that are required for installation of Work of this Section sufficiently in advance to prevent delays.
   3. INSTALLATION
      1. Erect structure and accessory items in strict accordance with the manufacturers written installation instructions and reviewed shop drawings, and as follows:
         1. Do not position glass panels by the use of force.
         2. Do not install damaged components.
         3. Fit joints to produce hairline joints free of burrs and distortion.
         4. Rigidly secure joints.
         5. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.
         6. Seal joints watertight.
         7. Touch up paint work with matching air-dry paint as necessary.
      2. Install components plumb and true in alignment with established lines and grades.
      3. Install all door hardware on doors. Test all doors on completion of installation and adjust as required for smooth and efficient operation.
      4. Completed installation shall be of adequate strength to support operating entrances doors and wind loading as specified without glass shaking or vibrating when entrance doors are in use.
      5. Install glazing in accordance with Section 08 80 00 – Glazing; prepare surfaces that will contact structural sealant in accordance with sealant manufacturer's written instructions to ensure compatibility and adhesion that includes, but is not limited to, cleaning and priming surfaces.
      6. Erection Tolerances: Install structural glass systems to the following maximum tolerances:
         1. Plumb: 1/8" in 10' with aggregate total not exceeding 1/4" in 40'.
         2. Level: 1/8" in 20' with aggregate total not exceeding 1/4" in 40'.
         3. Alignment: Limit misalignment of two adjoining glass panes abutting in the same plane as follows:
            1. Limit offset from true alignment to 1/16" where surfaces meet in-line or are separated by reveal or protruding element up to 1/2" wide.
            2. Limit offset from true alignment to 1/8" where surfaces are separated by reveal or protruding element from 1/2" to 1" wide.
            3. Limit offset from true alignment to 6 mm where surfaces are separated by reveal or protruding element of 1" or wider.
         4. Joint Width: Maintain sealant space between glass and adjacent construction to an average of 5/8", with a variation of no more than ±1/8".
         5. Location: Limit variation from plane to 1/8" in 12" with aggregate total not exceeding 1/2" over total length.
   4. SITE QUALITY CONTROL
      1. Manufacturers Site Services: Provide manufacturer's representative during installation; representative shall be knowledgeable of erection process for specified tension framing assemblies and provide the following services during construction:
         1. Observation of installation and quality control measures.
         2. Provide written report indicating observations, procedures, noted deficiencies, corrective measures, and certifying that installation meets requirements of this Section.
      2. Testing Agency: Engage a qualified independent testing and inspecting agency to perform site tests and inspections and prepare test reports.
      3. Testing Services:
         1. Testing and inspecting of representative areas to determine compliance of installed systems with specified requirements shall take place as follows and in successive stages as indicated on Drawings.
         2. Do not proceed with installation of the next area until test results for previously completed areas show compliance with requirements.
         3. Structural Sealant Compatibility and Adhesion:
            1. Test structural sealant in accordance with ASTM C1401, and as follows:

Use destructive test method, Method A, Hand Pull Tab (Destructive) listed in ASTM C1401, Appendix X2.

Test a minimum of two (2) areas on each building face.

Repair installation areas damaged by testing.

Structural Sealant Glazing Inspection: Inspect and evaluate structural sealant glazing in accordance with ASTM C1401 recommendations after installation of curtain wall systems are complete.

Air Infiltration: Test areas indicated on Drawings for air leakage of 1.5 times the rate specified in this Section, but not more than 0.03 L/s m2 of fixed wall area when tested in accordance with ASTM E783 at a minimum static air pressure differential of 300 Pa.

Water Penetration: Test areas indicated on Drawings in accordance with ASTM E1105 at minimum uniform and cyclic static air pressure difference of 0.67 times the pressure specified in this Section, but not less than 300 Pa with no evidence of water penetration.

* + 1. Non-Conforming Work: Touch-up, repair or replace damaged components before declaring Substantial Performance; replace damaged components; additional testing and inspecting; at Contractor, Subcontractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
  1. CLEANING AND PROTECTION
     1. Remove protective coatings and coverings from prefinished components; clean structural components and fittings; remove excess sealants and other substances that detract from finished appearance after completion of installation.
     2. Coordinate protective measures required to prevent damage or deterioration of structural glass system from subsequent construction activities.

END OF SECTION