

1 GENERAL

1.01 RELATED REQUIREMENTS

- .1 Section 06 10 00 - Rough Carpentry.
- .2 Section 07 21 19 - Foamed-in-Place Insulation.
- .3 Section 07 27 00.01 - Air Barriers and Vapour Retarders.
- .4 Section 07 92 00 - Joint Sealants.
- .5 Section 08 80 50 - Glazing.
- .6 Section 09 21 16 - Gypsum Board Assemblies.
- .7 Section 09 91 00 - Painting.

1.02 REFERENCES

- .1 American National Standards Organization (ANSI) / Steel Door Institute (SDI)
 - .1 ANSI/SDI A250.3-2007 (R2011), Test Procedure and Acceptance Criteria for Factory Applied Finish Coatings for Steel Doors and Frames.
 - .2 ANSI/SDI A250.8-2003 (R2008), Recommended Specifications for Standard Steel Doors and Frames.
 - .3 ANSI/SDI A250.10-1998 (R2011), Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames.
- .2 American Society for Testing and Materials International (ASTM)
 - .1 ASTM A653/A653M 11, Specification for Steel Sheet, Zinc Coated (Galvanized) or Zinc Iron Alloy Coated (Galvannealed) by the Hot Dip Process.
 - .2 ASTM A780/A780M-09, Standard Practice for Repair of Damaged and Uncoated Areas of Hot Dip Galvanized Coatings.
 - .3 ASTM A879/A879M-12, Standard Specification for Steel Sheet, Zinc Coated by the Electrolytic Process for Applications Requiring Designation of the Coating Mass on Each Surface
 - .4 ASTM A924 / A924M-13, Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.

- .5 ASTM B29 03(2009), Standard Specification for Refined Lead.
- .6 ASTM B749 03(2009), Standard Specification for Lead and Lead Alloy Strip, Sheet and Plate Products.
- .7 ASTM C553-11, Specification for Mineral Fiber Blanket Insulation for Commercial and Industrial Applications
- .8 ASTM C578-12b, Specification for Rigid, Cellular Polystyrene Thermal Insulation
- .9 ASTM C591-12b, Specification for Un-Faced Pre-formed Rigid Cellular Polyisocyanurate Thermal Insulation
- .10 ASTM C592-12, Specification for Mineral Fiber Blanket Insulation and Blanket-Type Pipe Insulation (Metal-Mesh Covered) (Industrial Type)
- .11 ASTM C1289-13e1, Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board
- .12 ASTM D1622-08, Standard Test Method for Apparent Density of Rigid Cellular Plastics.
- .13 ASTM D4726-09, Standard Specification for Rigid Poly(Vinyl Chloride) (PVC) Exterior-Profile Extrusions Used for Assembled Windows and Doors.
- .14 ASTM D6386-10, Standard Practice for Preparation of Zinc (Hot Dip Galvanized) Coated Iron and Steel Product and Hardware Surfaces for Painting.
- .15 ASTM D7396-08, Standard Guide for Preparation of New, Continuous Zinc-Coated (Galvanized) Steel Surfaces for Painting.
- .3 CSA International
 - .1 CAN4 S106-M80, Standard Method for Fire Tests of Window and Glass Block Assemblies
 - .2 CSA G40.20/G40.21 04 (R2009), General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
 - .3 CSA W47.1-09, Certification of companies for fusion welding of steel, Includes Update No. 3 (2011), Update No. 5 (2012).
 - .4 CSA W59 03 (R2008), Welded Steel Construction (Metal Arc Welding).
- .4 Canadian Steel Door Manufacturers' Association (CSDMA)
 - .1 CSDMA, Guide Specification for Installation and Storage of Hollow Metal Doors and Frames, 2012.
 - .2 CSDMA, Recommended Specifications for Commercial Steel Doors and Frames, 2006.

- .3 CSDMA, Selection and Usage Guide for Commercial Steel Doors, 2009.
- .5 National Fire Protection Association (NFPA)
 - .1 NFPA (Fire) 80, Standard for Fire Doors and Other Opening Protectives, 2013 Edition.
 - .2 NFPA (Fire) 252, Fire Tests of Door Assemblies, 2012 Edition.
- .6 Underwriters' Laboratories of Canada (ULC)
 - .1 CAN/ULC S104-10, Standard Method for Fire Tests of Door Assemblies.
 - .2 CAN/ULC S105 09, Standard Specification for Fire Door Frames Meeting the Performance Required by CAN/ULC S104.
 - .3 CAN/ULC S701 11, Standard for Thermal Insulation, Polystyrene, Boards and Pipe Covering.
 - .4 CAN/ULC S702 09-AM1, Standard for Thermal Insulation Mineral Fibre for Buildings, Includes Amendment 1 (January 2012).
 - .5 CAN/ULC S704 11, Standard for Thermal Insulation, Polyurethane and Polyisocyanurate Boards, Faced.

1.03 SYSTEM DESCRIPTION

- .1 Design Requirements:
 - .1 Design exterior frame assembly to accommodate to expansion and contraction when subjected to minimum and maximum surface temperature of -35 degrees C to 35 degrees C.
 - .2 Maximum deflection for exterior steel entrance screens under wind load of 1.2 kPa not to exceed 1/175th of span.
 - .3 Steel fire rated doors and frames: labelled and listed by an organization accredited by Standards Council of Canada in conformance with CAN/ULC S104 to ratings specified or indicated.
 - .4 Provide fire labelled frames for openings requiring fire protection ratings. Test products in conformance with CAN/ULC S104, and listed by nationally recognized agency having factory inspection services.

1.04 ACTION AND INFORMATION SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and data sheets for each type of door and frame specified.
- .3 Shop Drawings:
 - .1 Indicate each type of door, material, steel core thicknesses, mortises, reinforcements, location of exposed fasteners, openings, glazing, arrangement of hardware, fire rating, and finishes.
 - .2 Indicate each type frame material, core thickness, reinforcements, glazing stops, location of anchors and exposed fastenings, reinforcing, fire rating and finishes.
 - .3 Include schedule identifying each unit, with door marks and numbers relating to numbering on drawings and door schedule.
 - .4 Submit test and engineering data, and installation instructions.

1.05 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Waste Management and Disposal:
 - .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

2 PRODUCTS

2.01 PERFORMANCE AND DESIGN REQUIREMENTS

- .1 Perform work in accordance with CSDMA, Recommended Specifications for Commercial Steel Doors and Frames, except as otherwise specified herein.

- .2 Design exterior frame assembly to accommodate to expansion and contraction when subjected to minimum and maximum surface temperature of 35°C to 35°C.
- .3 Maximum deflections for exterior steel entrance doors under wind load of 1.2 kPa not to exceed 1/175th of span.
- .4 Steel fire rated doors and frames: Label and list fire rated doors and frames by an organization accredited by the Standards Council of Canada in conformance with CAN/ULC S104 and CAN/ULC S105 for ratings specified or indicated. Fire labels must be factory applied by the manufacturer.

2.02 MATERIALS

- .1 Steel:
 - .1 Interior Doors and Frames: coated steel sheets to ASTM A924/M924; coating designation to ASTM A653/A653M: Commercial Steel (CS), Type B, ZF180; stretcher levelled.
 - .2 Exterior Doors and Frames and Interior High Humidity Area: coated steel sheets to ASTM A924/M924; coating designation to ASTM A653/A653M: Commercial Steel (CS), Type B, Z275 hot dip galvanized; stretcher levelled.
- .2 Nominal Base Metal Thickness Requirements:
 - .1 Frames: refer to frame fabrication requirements specified in this section.
 - .2 Doors: refer to door fabrication requirements specified in this section.
 - .3 Hardware Reinforcement for Doors and Frames: Carbon steel, welded in place, prime painted, to the following minimum nominal thicknesses:

Hardware Reinforcement	Door (mm)	Frame (mm)
Pivot Hinge:	4.20	4.20
Mortise Hinge:	3.51	3.51
Mortise or Bored Lock or Deadbolt:	1.98	1.98
Flush or Surface Bolt Front:	1.98	1.98
Surface or Concealed Closer:	2.74	2.74
Strike Reinforcements:	1.98	1.98
Hold Open Arm:	1.98	1.98

Hardware Reinforcement	Door (mm)	Frame (mm)
Electronic Hardware Reinforcements:	1.98	1.98
Pull Plates and Bars:	1.30	1.30
Mortar Box:	--	0.84
Surface Exit Devices:	1.98	1.98
Door Surface Hardware Reinforcements:	1.30	1.30
Frame surface hardware reinforcements:	2.74	2.74

2.03 DOOR CORE MATERIALS

- .1 Door Core Materials:
 - .1 Honeycomb: Structural small cell 25 mm maximum. kraft paper honeycomb:
 - .1 Weight: 36.3 kg/ream minimum.
 - .2 Density: 16.5 kg/m3 minimum.
 - .3 Sanded to required thickness.
 - .2 Polystyrene: Rigid extruded, closed cell insulation, fire retardant treated meeting the requirements of ULC S701, Type 4, minimum thermal resistance RSI 0.8/25 mm thickness.
 - .3 Temperature Rise Rated (TRR): core composition shall provide the fire-protection rating and limit the temperature rise on the unexposed side of door at 250oC for 30 or 60 minutes as determined by National Building Code of Canada, 2010. Core shall be tested as part of a complete door assembly in accordance with CAN/ULC S104 covering the Standard Method of Tests of Door Assemblies and shall be listed by a nationally recognized testing agency having a factory inspection service.

2.04 ADHESIVES

- .1 Honeycomb cores and steel components: heat resistant, spray grade, resin reinforced neoprene/rubber (polychloroprene) based, low viscosity, contact cement.
- .2 Polystyrene cores: heat resistant, epoxy resin based, low viscosity, contact cement.

- .3 Interlocking Edge Seam Adhesive: fire resistant, resin reinforced polychloroprene, high viscosity, sealant/adhesive.

2.05 PRIMER

- .1 Touch up primer: Commercial rust inhibitive primer, shop prime coat doors and frames before delivery; grey or red coloured primer; in accordance with Section 09 91 00 - Painting. Clear primer not acceptable; provide primer for field touch-up.

2.06 PAINT

- .1 Field paint steel doors and frames in accordance with Section 09 91 00 - Painting.

2.07 ACCESSORIES

- .1 Door silencers (bumpers): Black neoprene, to ANSI/BHMA A156.16 Type 6-180; three silencers on strike jambs of single door frames; two silencers on heads of double door frames; screw fastener applied. Stick on bumpers are not acceptable.
- .2 Exterior top and bottom caps: factory-installed PVC; flash at top, recessed at bottom.
- .3 Interior top caps: rigid polyvinylchloride extrusion, to ASTM D4726.
- .4 Fabricate glazing stops as formed channel, minimum 16 mm height, accurately fitted, butted at corners, and fastened to frame sections with counter sunk oval head sheet metal screws.
- .5 Make provisions for glazing as indicated and provide necessary glazing stops.
 - .1 Provide removable glazing beads.
 - .2 Design exterior glazing stops to be tamperproof.
- .6 Metallic paste filler: to manufacturer's standard.
- .7 Fasteners: type 304 stainless steel screws with countersunk flat head.

- .8 Labels for fire doors and door frame: brass plate, riveted to door and door frame.
- .9 Sealants: to Section 07 92 00 - Joint Sealants. Maximum VOC limit 250 g/L to SCAQMD Rule 1168.
- .10 Glazing: Section 08 80 50 - Glazing.

2.08 FRAMES FABRICATION GENERAL

- .1 Fabricate frames in accordance with CSDMA specifications.
- .2 Accurately form frames to profiles indicated. Construct frames straight and free from twist or warp.
- .3 Exterior frames: 1.98 mm minimum welded construction. 50 mm face standard frame profile, throat and frame width to suit wall construction.
- .4 Interior frames: 1.6 mm minimum for single doors; 1.98 mm for frames with opening width in excess of 1220 mm; welded type construction; 50 mm face standard frame profile, throat and frame width to suit wall construction.
- .5 Blank, drill, reinforce and tap frames to receive mortised, templated hardware, security and electrical devices, using templates provided by finish hardware supplier. Reinforce frames for installation of closers. Install stiffener plates or two angle spreaders where required to prevent bending of frame and to maintain alignment when setting. Weld reinforcement in place.
- .6 Protect mortised cutouts with steel guard boxes where required (masonry/concrete construction).
- .7 Conceal fastenings except where exposed fastenings are indicated.
- .8 Provide factory applied touch up primer at areas where zinc coating has been removed during fabrication.
- .9 Provide fire labelled frames for those openings requiring fire protection ratings, as indicated in as scheduled on Drawings.

2.09 FRAME ANCHORAGE

- .1 Provide appropriate anchorage to floor and wall construction.
- .2 Where frames terminate at finished floor, supply floor plates for anchorage to slab. Check depth of extension of finished floor to structural slab and provide jamb extension anchorage as required. Provide 50 mm minimum adjustment
- .3 Locate wall anchors immediately above or below each hinge reinforcement on the hinge jamb, and directly opposite on the strike jamb. Provide three anchors per jamb for frames up to 2300 mm. Add one anchor per jamb for each additional 760 mm or fraction thereof in frame height.
- .4 Locate anchors for frames in existing openings not more than 150 mm from top and bottom of each jambs and intermediate at 660 mm on centre maximum.

2.10 FRAMES: WELDED TYPE

- .1 Welding in accordance with CSA W59.
- .2 Cut frame mitres accurately and weld on inside of frame profile. Fill frame corners, exposed surface depressions and butted joints with air drying paste filler. Sand to a smooth uniform finish. Touch up damaged galvanized finish with zinc rich primer.
- .3 Cope accurately and securely weld butt joints of mullions, transom bars, centre rails and sills.
- .4 Grind welded joints and corners to a flat plane, fill with metallic paste and sand to uniform smooth finish.
- .5 Securely attach floor anchors to inside of each jamb profile.
- .6 Weld in 2 temporary jamb spreaders per frame to maintain proper alignment during shipment.
- .7 Insulate exterior frame components with polyurethane insulation as indicated in Section 07 21 19 - Foamed-in-Place Insulation.

2.11 DOOR FABRICATION GENERAL

- .1 Fabricate steel doors rigid, neat in appearance, and free from defects including warp and buckle; 45 mm thickness of types and sizes indicated on drawing, and as follows:
 - .1 Door faces of all steel doors shall be fabricated without visible seams, free of scale, pitting, coil brakes, buckles and waves.
 - .2 Form edges true and straight with minimum radius suitable for thickness of steel used.
 - .3 Bevel lock and hinge edges 3 mm in 50 mm; confirm requirement with builder's hardware or door swing that could dictate a different bevel.
 - .4 Top and bottom of doors shall be provided with inverted, recessed, nominal 1.60 mm steel end channels welded to each face sheet at 150 mm on centre.
 - .5 Equip exterior doors with factory installed flush PVC top caps.
 - .6 Provide fire labelled doors for those openings requiring fire protection ratings and temperature rise ratings.
 - .7 Fabricate doors with the following clearances:
 - .1 Clearance between door and frame and between meeting edges of doors swinging in pairs shall not exceed 3 mm.
 - .2 Clearance between the bottom of door and floor shall not exceed 19 mm or as required to accommodate specified hardware.
 - .3 Clearance between bottom of door and a raised non combustible sill in accordance with NFPA 80.
 - .4 Clearance between bottom of door and nominal surface of combustible floor coverings in accordance with NFPA 80.
- .2 Fabricate doors with longitudinal edges locked seamed, adhesive assisted. Seams: not visible, grind welded joints to a flat plane, fill with metallic paste filler and sand to a uniform smooth finish. Bevel both stiles of single doors 1 in 16.
- .3 Exterior Doors: Flush, lock seam construction, insulated doors fabricated in accordance with CAN/CGSB 82.5, and as follows:

- .1 Face Sheets: Minimum 1.60 mm base steel sheet thickness.
- .2 Insulation Stiffened Core: Insulated and sound deadened with polystyrene or polyisocyanurate at choice of manufacturer, core laminated under pressure to each face sheet.
- .4 Interior Doors: Flush, lock seam construction, hollow steel doors fabricated in accordance with CSDMA Manufacturing Specifications for Doors and Frames, and as follows:
 - .1 Face sheets: Minimum 1.30 mm base steel sheet thickness.
 - .2 Stiffened and sound deadened with honeycomb core laminated under pressure to each face sheet.
- .5 Fire Rated Doors: Flush, lock seam construction, hollow steel doors fabricated in accordance with CAN4 S104 and NFPA 80, and as follows:
 - .1 Face sheets: Minimum nominal 1.60 mm base steel sheet thickness.
 - .2 Stiffened and sound deadened with honeycomb core laminated under pressure to each face sheet, or Stiffened, insulated and sound deadened with manufacturer's proprietary Temperature Rise Rated (TRR) core material, as required by NBC.
 - .3 Equip pairs of fire labelled doors with minimum 2.74 mm steel surface mounted flat bar astragal, welded to door face; plug welded on face and stitch welded to butt edge of door.
 - .4 Labelled by Underwriters Laboratories of Canada, ITS/Warnock Hersey, or other testing laboratory approved by the authority having jurisdiction.

3 EXECUTION

3.01 MANUFACTURER'S INSTRUCTIONS

- .1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.02 INSTALLATION GENERAL

- .1 Install labelled steel fire rated doors and frames to NFPA 80 except where specified otherwise.
- .2 Install doors and frames to CSDMA Installation Guide.

3.03 FRAME INSTALLATION

- .1 Set frames plumb, square, level and at correct elevation.
- .2 Secure anchorages and connections to adjacent construction.
- .3 Brace frames rigidly in position while building-in. Install temporary horizontal wood spreader at third points of door opening to maintain frame width. Provide vertical support at centre of head for openings over 1200 mm wide. Remove temporary spreaders after frames are built-in.
- .4 Make allowances for deflection of structure to ensure structural loads are not transmitted to frames.
- .5 Caulk perimeter of frames between frame and adjacent material.
- .6 Maintain continuity of air-vapour barrier.

3.04 DOOR INSTALLATION

- .1 Install doors and hardware in accordance with hardware templates and manufacturer's instructions and Section 08 71 00 - Door Hardware.
- .2 Provide even margins between doors and jambs and doors, finished floor and thresholds as follows.
 - .1 Hinge side: 1.0 mm.
 - .2 Latch side and head: 1.5 mm.
 - .3 Finished floor, non-combustible sills and thresholds: 6 mm.
- .3 Adjust operable parts for correct function.

3.05 GLAZING

- .1 Install glazing for doors in accordance with Section 08 80 50 - Glazing.

3.06 FINISH REPAIRS

- .1 Touch up with primer finishes damaged during installation.
- .2 Fill exposed frame anchors and surfaces with imperfections with metallic paste filler and sand to a uniform smooth finish.

3.07 FIELD PAINTING

- .1 Prepare surfaces for field painting to ASTM D6386 and ASTM D7396.
- .2 Field painting: refer to Section 09 91 00 - Painting. Protect weather strips from paint. Provide final finish, free of scratches or other blemishes.

END OF SECTION

1 GENERAL

1.01 RELATED REQUIREMENTS

- .1 08 11 00 - Metal Doors and Frames.
- .2 08 71 00 - Door Hardware.

1.02 REFERENCE STANDARDS

- .1 ANSI/DASMA 102 - American National Standard Specifications for Sectional Overhead Type Doors.

1.03 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for sliding metal doors and hardware and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Shop Drawings:
 - .1 Submit drawings stamped and signed by professional engineer registered or licensed in the province of Nova Scotia, Canada.
 - .2 Indicate each type of door, tracks, arrangement of hardware, required clearances to adjacent construction, dimensions, gauges and finishes, and electrical connections.
- .4 Samples:
 - .1 For each finish product specified, submit two complete sets of color chips, representing manufacturer's full range of available colors and patterns.

1.04 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Operation and Maintenance Data: submit operation and maintenance data for sliding metal doors for incorporation into manual.

1.05 QUALITY ASSURANCE

- .1 **Certifications:** product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.
- .2 **Single-Source Responsibility:** Provide doors, tracks, motors, and accessories from one manufacturer for each type of door. Provide secondary components from source acceptable to manufacturer of primary components.
- .3 **Installer Qualifications:** Authorized representative of the manufacturer with minimum five years' documented experience.

1.06 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
- .2 **Delivery and Acceptance Requirements:** deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
 - .1 Apply temporary protective coating to finished surfaces. Remove coating after installation.
 - .2 Use coatings that are easy to remove and residue free.
 - .3 Leave protective covering in place until final cleaning of building.
- .3 **Storage and Handling Requirements:**
 - .1 Store materials off ground and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect sliding metal doors from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.
- .4 **Packaging Waste Management:** remove for reuse and return of pallets, crates, padding, and packaging materials as specified in Construction Waste Management Plan in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

2 PRODUCTS

2.01 DOOR DESIGN CRITERIA

- .1 Door Assembly: Metal/foam/metal sandwich panel construction. Doors comply with ANSI/DASMA 102 - American National Standard Specifications for Sectional Overhead Type Doors.
- .2 Size: See Drawings. Door is to be 25 mm higher than finished door opening and extend 25 mm beyond jamb on either side of finished door opening width.
- .3 Section Joints: 6.3 mm ship-lap.
- .4 Section Thickness: 45 mm .
- .5 Exterior Steel: Pre-painted 0.48 mm , hot-dipped galvanized.
- .6 Interior Steel: Pre-painted 0.41 mm , hot-dipped galvanized.
- .7 End Caps: 1.6 mm hot dipped galvanized steel.
- .8 Standard Springs: 50,000 cycles.
- .9 Insulation: Foamed in place CFC-free and HCFC-free polyurethane, fully encapsulated. Thermal Value: R=16.
- .10 Colors: to be selected from samples submitted as per paragraph 1.03.
- .11 Wind load Design: ANSI/DASMA 102 standards to meet applicable code.
- .12 Hardware: Zinc coated steel hinges and fixtures. Ball bearing rollers with hardened steel races.
- .13 Lock: Interior mounted slide lock.
- .14 Seals: Standard continuous, replaceable dual seals between sections. Bottom seal: 102 mm vinyl retained in aluminum extrusion. Jamb seal: Dual fin vinyl/aluminum.
- .15 Track: Provide track as recommended by manufacturer to suit loading required and clearances available.
- .16 Operation: Electric. Drawbar.

2.02 HARDWARE

- .1 Counterbalance system

- .1 Spring assembly: oil-tempered torsion springs, min. 50,000 cycles.
- .2 Spring: sized to suit cycles
- .3 Shaft: 25 mm solid CRS shaft with full length keyway.
- .4 Wire rope: Aircraft type 7x19 construction with a safety factor of 5:1 minimum
- .2 Hardware: include all required hardware and zinc plated fasteners.
 - .1 Hinges: Linear style 11-gauge (3 mm) zinc coated steel.
 - .2 Track 75 mm , rolled from 12-gauge galvanized steel.
 - .3 Mount: Continuous adjustable track angle ADCA. Bolted type, field adjustable to ensure weather tight seal, fabricated from 13 gauge (2.4 mm) commercially galvanized steel, designed to provide continuous track support for full opening height.
 - .4 Track hangers: perforated type, 32 x 32 mm angles, roll formed from 14-gauge galvanized steel.
 - .5 Horizontal track curve: 406 mm radius.
 - .6 Rollers: Hardened steel outer race, 73 mm diameter, with ten 8 mm ball bearings and 11 mm diameter axles.
 - .7 Roller brackets: fabricated from commercially galvanized steel. Graduated type design to suite the slope in the vertical track to ensure weathertight seal; 13 gauge.
 - .8 Horizontal angle: full length.

3 EXECUTION

3.01 EXAMINATION

- .1 Verification of Conditions: verify conditions of existing construction are acceptable for door, track and electrical installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect construction in presence of Departmental Representative.
 - .2 Verify electric power is available and of correct characteristics.
 - .3 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
 - .4 Proceed with installation only after unacceptable conditions have been remedied.

3.02 MANUFACTURER'S INSTRUCTIONS

- .1 Compliance: comply with manufacturer's written data, including

product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.

- .2 Install doors, tracks and operating equipment complete with necessary hardware, weatherstripping, anchors, hangers, brackets, and accessories, in accordance with manufacturer's instructions.
- .3 Adjust door components to ensure smooth operation. Do not allow traffic through overhead door opening until adjustment and cleaning is complete.

3.03 FIELD QUALITY CONTROL

- .1 Have manufacturer of products supplied under this Section review Work involved in handling, installation/application, protection and cleaning of its products, and submit written reports in acceptable format to verify compliance of Work with Contract.
- .2 Manufacturer's Field Services:
 - .1 Obtain written reports from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product within 3 days of review and submit.
 - .2 Submit manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.

3.04 CLEANING

- .1 Clean in accordance with Section 01 74 11 - Cleaning.
- .2 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

3.05 PROTECTION

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by overhead metal door installation.

END OF SECTION

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SECTION 08 36 16
SECTIONAL OVERHEAD DOORS

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1.01 RELATED REQUIREMENTS

- .1 Section 06 10 00 - Rough Carpentry.
- .2 Section 07 21 13 - Board Insulation.
- .3 Section 07 21 16 - Blanket Insulation.
- .4 Section 07 21 19 - Foamed-in-Place Insulation.
- .5 Section 07 27 00.01 - Air Barriers and Vapour Retarders.
- .6 Section 07 92 00 - Joint Sealants.
- .7 Section 08 80 50 - Glazing.

1.02 REFERENCES

- .1 Aluminum Association (AA)
 - .1 AA DAF 45-03(R2009), Designation System for Aluminum Finishes.
- .2 American Architectural Manufacturers Association (AAMA)
 - .1 AAMA CW-10-04, Care and Handling of Architectural Aluminum From Shop to Site.
 - .2 AAMA CW-11-85, Design Wind Loads and Boundary Layer Wind Tunnel Testing.
 - .3 AAMA 611-98, Voluntary Specifications for Anodized Finishes Architectural Aluminum.
 - .4 AAMA 612-02, Voluntary Specifications, Performance Requirements, and Test Procedures for Combined Coatings of Anode Oxide and Transparent Organic Coatings on Architectural Aluminum.
 - .5 AAMA 2603-02, Voluntary Specification Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels.
 - .6 AAMA 2604-05, Voluntary Specification Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels.
- .3 ASTM International (ASTM)
 - .1 ASTM A123/A123M-09, Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

- .2 ASTM A167-99(2009), Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
- .3 ASTM A653/A653M-09a, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- .4 ASTM B209-07, Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
- .5 ASTM B221-08, Specification for Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
- .6 ASTM E283-04, Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.
- .7 ASTM E330-02, Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights, and Curtain Walls, by Uniform Static Air Pressure Difference.
- .8 ASTM E331-00(2009), Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls, by Uniform Static Air Pressure Difference.
- .9 ASTM E413-04, Classification for Rating Sound Insulation.
- .10 ASTM E1105-00(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.
- .4 CSA Group (CSA)
 - .1 AAMA/WDMA/CSA 101/I.S.2/A440-11 - NAFS - North American Fenestration Standard/Specification for Windows, Doors, and Skylights.
 - .2 CSA G40.20/G40.21-04(R2009), General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
 - .3 CSA S136-07, North American Specification for the Design of Cold Formed Steel Structural Members.
 - .4 CAN/CSA S157/S157.1-05, Strength Design in Aluminum/Commentary on CAN/CSA-S157, Strength Design in Aluminum.
 - .5 CSA W59.2-M1991(R2008), Welded Aluminum Construction.
- .5 Environmental Choice Program (ECP)
 - .1 CCD-045-95(R2005), Sealants and Caulking Compounds.

- .2 CCD-047-98(R2005), Architectural Surface Coatings.
- .3 CCD-048-98(R2006), Surface Coatings - Recycled Water-borne.
- .6 Green Seal Environmental Standards (GS)
 - .1 GS-11-2008, 2nd Edition, Paints and Coatings.
- .7 National Research Council Canada (NRC)
 - .1 National Building Code of Canada 2015 (NBC).
- .8 Society for Protective Coatings (SSPC)
 - .1 SSPC - Paint 20-02(R2004), Zinc Rich Coating, Type I - Inorganic and Type II - Organic.
 - .2 SSPC - Paint 25-97(R2004) BCS, Zinc Oxide, Alkyd, Linseed Oil and Primer for Use Over Hand Cleaned Steel Type 1 and Type 2.

1.03 DESIGN RESPONSIBILITY

- .1 The design, engineering, procurement, fabrication and erection of the curtain wall assemblies as required to meet specifications shall be the complete responsibility of the Contractor.

1.04 ADMINISTRATIVE REQUIREMENTS

- .1 Coordination: coordinate work of this Section with installation of air barrier placement, vapour retarder placement, and flashing placement.

1.05 ACTION AND INFORMATION SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and technical data sheets.
 - .2 Submit product data indicating construction details, material descriptions, dimensions of individual components and profiles, finishes, anchorage and fasteners, glass and infill, internal drainage details.
- .3 Shop Drawings:

- .1 Submit drawings and all design calculations stamped and signed by professional engineer registered or licensed in Province of Nova Scotia, Canada.
- .2 Indicate system dimensions, door hardware, framed opening requirements and tolerances, adjacent construction, anchor details anticipated deflection under load, affected related Work, weep drainage network, expansion and contraction joint location and details, and field welding required.
- .4 Delegated Design Submittals:
 - .1 Include framing member structural and physical characteristics, calculations, dimensional limitations, special installation requirements.
- .5 Test Reports:
 - .1 Submit substantiating engineering data, test results of previous tests by independent laboratory which purport to meet performance criteria, and supportive data.

1.06 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Operation and Maintenance Data: submit operation and maintenance data for glazed aluminum curtain wall for incorporation into manual.

1.07 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Handle work of this Section in accordance with AAMA CW-10.
 - .2 Store materials off ground in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

- .3 Store and protect aluminum glazed curtain wall components from damage and nicks, scratches, and blemishes.
- .4 Protect prefinished aluminum surfaces with wrapping. Do not use adhesive papers or sprayed coatings which bond when exposed to sunlight or weather.
- .5 Replace defective or damaged materials with new.

1.08 AMBIENT CONDITIONS

- .1 Install sealants when ambient and surface temperature is above 5 degrees C minimum.
- .2 Maintain this minimum temperature during and for 48 hours minimum after installation of sealants.

1.09 WARRANTY

- .1 For the work of this Section, the 12 month warranty period prescribed in Subsection GC 32.1 of General Conditions "C" is extended to 24 months.

2 PRODUCTS

2.01 SYSTEMS

- .1 Description:
 - .1 Vertical glazed aluminum curtain wall system includes thermally broken tubular aluminum sections with self-supporting framing, shop fabricated, factory prefinished, vision glass, insulated spandrel infill; related flashings, anchorage and attachment devices.
 - .2 Assembled system to permit re-glazing of individual glass (and infill panel) units from exterior without requiring removal of structural mullion sections.
 - .3 Walls of aluminum frames shall be not less than 1.8 mm thick, suitable alloy and proper temper for extruding and adequate structural characteristics; and suitable for finishing as specified.
 - .1 Frame size as per Engineered shop drawings
 - .2 Designed for double-glazed insulating glass units, 25 mm thick.
 - .3 4-sided captured system, with insulating glass units and glazed spandrel panels.

- .4 System include glazed aluminum entrances; 300 mm bottom rail, 90 mm vertical stiles, and 90 mm top rail; designed for double-glazed insulating glass units, 25 mm thick.
- .2 Performance Requirements:
 - .1 General Performance: Comply with performance requirements specified, as determined by testing of glazed aluminum curtain walls representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.
 - .1 Glazed aluminum curtain walls shall withstand movements of supporting structure including, but not limited to, story drift, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads. Failure also includes the following:
 - .1 Thermal stresses transferring to building structure.
 - .2 Glass breakage.
 - .3 Loosening or weakening of fasteners, attachments, and other components.
 - .2 Meet the requirements of the National Building Code 2015 plus amendments and the National Energy Code of Canada for Buildings (NECB).
 - .2 Retain a professional engineer registered in province of Work, experienced in structural design in glass and aluminum window units, connections to door units and connections to building, to ensure the adequacy of the structural aspects of the design, manufacture, and installation of complete assembly.
 - .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 Climatic Data included in National Building Code 2015 plus amendment, 1:50 year probability.
 - .4 Design and size components to withstand seismic loads and sway displacement as calculated in accordance with National Building Code 2015 plus amendments.
 - .5 Structural-Test Performance: Test according to ASTM E330 and TAS 202 as follows:
 - .1 When tested at positive and negative wind load design pressures, assemblies do not evidence deflection exceeding $L/175$ of clear span.

- .2 A static air load of 1915 Pa shall be applied in the positive and negative direction.
 - .1 When tested at 150% of positive and negative wind-load design pressures, assemblies, including anchorage, do not evidence material failures, structural distress, and permanent deformation of main framing members exceeding 0.2% percent of clear span.
 - .2 Minimum test duration according to ASTM E330 is 10 seconds.
- .6 Size glass units and glass dimensions to limits established in CAN/CGSB 12.20.
- .7 Provide system to accommodate, without damage to components or deterioration of seals:
 - .1 Movement within system.
 - .2 Movement between system and perimeter framing components.
 - .3 Dynamic loading and release of loads.
 - .4 Deflection of structural support framing.
 - .5 Shortening of building concrete structural columns.
 - .6 Creep of concrete structural members.
- .8 Sound attenuation through wall system (exterior to interior): STC 30, measured in accordance with ASTM E90 and ASTM E1425.
- .9 Limit air infiltration through assembly to 0.3 L/s/m² maximum of wall area, measured at a reference differential pressure across assembly of 300 Pa as measured in accordance with ASTM E283.
- .10 Vapour seal with interior atmospheric pressure of 25 mm sp, 22 degrees C, 40% RH: No failure.
- .11 Water leakage: none, when measured in accordance with ASTM E331, at differential pressure across assembly of 720 Pa.
- .12 Ensure interior surfaces have no condensation before exposed edges of sealed units reach dew point temperatures.
- .13 Thermal Transmittance (U-factor): Glass and framing areas shall have U-factor of no greater than 0.33 with 25 mm High Performance (HP) Glass as determined according to NFRC 100-2010.

- .14 Temperature Index (I-value), to CSA A440: ≥ 65 . During testing, equilibrium conditions of $-30 \pm 1^{\circ}\text{C}$ for the weather-side air temperature and $20 \pm 1^{\circ}\text{C}$ for the room-side air temperature shall be maintained. Variations in determining I-value will be considered if equilibrium conditions are similar, with a temperature delta of 50 ± 2 degrees Celsius.
- .15 Ensure interior surfaces do not develop condensation before exposed edges of sealed units reach dew point temperatures.
- .16 Ensure curtain wall system can withstand temperature differential of 85 degrees C and is able to accommodate interior and exterior system expansion and contraction without damage to components or deterioration of seals.
- .17 Drain water entering joints, condensation occurring in glazing channels, or migrating moisture occurring within system, to the exterior by a weep drainage network.
- .18 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.
- .19 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.
- .20 Tolerances:
 - .1 Design and install the curtain wall to accommodate tolerances of related work not included in this section. This requirement is in addition to building structure movements and deflections.
 - .2 Fabricate components to provide a plumb, square, level and true installation, and to accommodate allowable tolerances for work of other sections upon which work of this section depends.

2.02 MATERIALS

- .1 Aluminum Materials:
 - .1 Extruded aluminum: to CSA HA-Series 6063 alloy, T5 or T6 temper, free from perceptible distortions, waves, twists, buckling or other deficiencies of appearance or performance.
 - .2 Sheet, unexposed: utility sheet to CSA HA-Series 6063 alloy, T5 or T6 temper.
 - .3 Sheet, exposed: to ASTM B209/B209M, anodizing quality to AA-1100 series.
 - .4 Reinforcing Members: Aluminum, nonmagnetic stainless steel, or nickel/chrome-plated steel complying with ASTM B456 for Type SC-3 severe service conditions, or zinc-coated steel or iron complying with ASTM B633 for SC-3 severe service conditions or other suitable zinc coating; provide sufficient strength to withstand design pressure indicated.
 - .5 Sheet and plate: to ASTM B209/B209M, anodizing quality, alloy and temper suitable for purpose and finish required, special hardness for flat panel application, re-squared saw cut edges, free from perceptible distortions, waves, twists, buckling or other deficiencies in appearance or performance.
 - .1 Panels, copings, soffits, sills, trims, closures and other such components shall be minimum 3 mm thick; 1.5 mm thickness may be used for flashings. Finish to match exterior curtain wall finish.
 - .6 Extruded bars, rods, profiles, and tubes: In accordance with ASTM B221/B221M, and AA-6063-T5 or T6 temper, anodizing quality.
 - .7 Aluminum extruded structural pipe and tubes: In accordance with ASTM B429, and AA6063-T6 temper, anodizing quality.
 - .8 Structural Profiles: In accordance with ASTM B308/B308M, anodizing quality.
 - .9 Aluminum welding: to CSA W59.2.
- .2 Steel: to CSA G40.20/G40.21, 300W hot dipped galvanized after fabrication to ASTM A653/A653M, minimum coating of 600 g/m² shapes to suit mullion sections.

- .3 Galvanizing, unless otherwise specified: hot dipped galvanizing, with minimum zinc coating of 600 g/m2 to ASTM A653/A653M.
- .4 Stainless steel: to ASTM A167, Type 304 or 316; of one type throughout.
- .5 Anchors: 3-way adjustable hot-dip galvanized cast iron.
- .6 Fasteners: to ASTM A167, stainless steel, type 304 as recommended by curtain wall manufacturer selected to prevent galvanic action with the components fastened, of suitable size to withstand imposed loads.
- .7 Anti-rotation spacers: manufacturer's extruded aluminum spacers with integral gaskets as required at frame transitions and termination points, including at dual-glazed framing to single-pane spandrel panel transitions.
- .8 Grout fill for anchor pockets: non-shrink.
- .9 Primers and Adhesives: as recommended by curtain wall manufacturer.
- .10 Thermal barrier consists of 25 mm separation between the interior and exterior metal members in a typical condition, while maintaining a continuous watertight seal. Thermal barrier assembly shall be tested to the thermal cycling requirements of ASTM E2692 and show no sign of degradation following the test.
 - .1 Thermal separators (thermal break): Thermal separator shall be extruded of a silicone compatible elastomer that provides for silicone adhesion, of size to conform to the extruded aluminum members or other locations where required, and having a minimum tensile strength of 14 MPa and Durometer A Hardness of 60, ± 5 .
- .11 Concealed flashing: manufacturer's standard corrosion resistant, non staining, non bleeding flashing compatible with adjacent materials.
- .12 Transition membranes: full-length mechanically anchored, extruded silicone rubber transition membrane to perimeter of frame profile to provide continuous air/vapour retarder to adjacent wall construction, compatible with adjacent materials and systems.

- .13 Gaskets: glazing gaskets shall be silicone-compatible EPDM to ASTM C864, with dimensional tolerances and durometer hardness and of suitable size and shape to meet the requirements of the specifications and their specific application, designed to remain flexible at low temperatures, and provides for silicone adhesion; heat-resistant where required due to proximity of heating units.
- .14 Isolation coating: alkali resistant bituminous paint.
- .15 Primer for ferrous metals: CISC/CPMA 2-75.
- .16 Zinc chromate primer, by PPG Industries, Inc. or similar.
- .17 Touch up primer for galvanized steel: organic zinc rich primer, by Sherwin Williams Company of Canada Ltd. or similar.
- .18 Insulation for miscellaneous voids and cavities: to Section 07 21 13 - Board Insulation or Section 07 21 16 - Blanket Insulation, selected as required to suit conditions and location, friction fit, or held in place by miscellaneous metal angle or sheet metal flashing, as required.
- .19 Flexible flashing, flexible air/vapour retarder:
 - .1 Flashing as recommended by the curtain wall manufacturer, compatible with adjacent materials and systems.
 - .2 Adhesive, tapes, primers and sealant: as recommended by the flexible flashing manufacturer.
- .20 Sheet metal air/vapour barrier to be bonded to glazing frame and extended behind mounting frame. Seal to maintain continuity of seal. Install flexible flashing with continuous metal retaining strip to lap to interior wall assembly.
 - .1 Sheet metal for metal air/vapour barriers and air seals: ASTM A653 / A853M, minimum 1 mm sheet steel, galvanized, stretcher levelled, minimum coating weight 380 g/m².
- .21 Sealants, including primer, joint filler: as specified in section 07 92 00, augmented as follows:

- .1 Sealants used in structural joints shall have adequate strength to retain insulating units to the metal framing or each other under design conditions.
- .2 Sealants shall be from the same manufacturer for all work of this Section.
- .3 Materials used in the work shall be resistant to rodents, vermin, mildew, fungus and algae.
- .4 Components in contact with opacifying coat at glass spandrel panels:
 - .1 Contact the opacifying coating manufacturer for confirmation of compatibility of sealant to the coating.
 - .2 Use neutral cure silicone components only in spandrel cavity. Do not use neoprene gaskets or setting blocks etc..
 - .3 Contact the opacifying coat manufacturer for a list of approved compatible list of sealants and materials, and tapes and gaskets.
- .22 Flashing: matching aluminum flashing as recommended by manufacturer, and as follows:
 - .1 Flashing: roll formed aluminum, 0.5 mm thick, mill finish.
 - .2 Aluminum sheet to conform to Federal Specification QQ-A-359, Alloy 3003.
- .23 Insulating glass units: to Section 08 80 50 - Glazing.
- .24 Joint Sealants: to Section 07 92 00 - Joint Sealants.
- .25 Air barrier and vapour retarder: to Section 07 27 00.01 - Air Barriers and Vapour Retarders.

2.03 FABRICATION - GENERAL

- .1 Do not start fabrication until samples, shop and erection drawings have been reviewed.
- .2 Execute fitting and assembly in the shop with the various parts or assemblies ready for erection at the building site.

- .3 Take field measurements and levels required to verify or supplement those shown on the drawings for the proper layout and installation of the work. Coordinate dimensional tolerances in adjacent building elements and confirm prior to the commencement of the Work.
- .4 Weld aluminum, where required, with inert metal arc equipment. Welders to qualify according to CSA W47.2. Make exposed welds continuous and flush with adjacent surface. Do not mar surface finishes with welds in back of exposed aluminum. Do not deform the exposed metal and finish way by welding.
- .5 Weld steel, where required, to CSA W59. Welded joints to be of adequate strength and durability with jointing tight and flush. Welders to be fully approved by the Canadian Welding Bureau and to comply with CSA W47.1. Where it is necessary to weld components already galvanized, remove galvanizing for 50 mm around weld.
- .6 Equip perimeter framing with factory installed air and vapour barrier material as required for sealing to building air and vapour barrier, and as follows:
 - .1 Material: identical to, or compatible with, building air barrier and vapour retarder materials to provide required air tightness and vapour diffusion control throughout exterior envelope assembly.
 - .2 Material width: adequate to provide required air tightness and vapour diffusion control to building air barrier and vapour retarder from interior.

2.04 FABRICATION - FRAMING MEMBERS

- .1 Fabricate members to the profiles shown on the drawings. Wall thickness of extrusions to be as required to meet the design requirements. Frames that are to receive insulating glass units shall have a continuous thermal break.
- .2 Accurately machine file and fit, and rigidly frame together joints, corners and mitres. Match components carefully to produce perfect continuity of line and design. Make exterior joints watertight and interior joints airtight in accordance with specified allowances. Metal in contact to have hairline joints. Locations of exposed joints to be subject to the approval of the Departmental Representative.

- .3 Reinforce frames and assemblies by concealed means as necessary to meet the specified design requirements and as shown. Reinforcing to be hot-rolled mild steel and be securely anchored to horizontal and vertical members by approved positive mechanical means.
- .4 Seal hairline joints at junctions of frame members. Gun-inject sealant from inside ensuring a continuous seal of the joint. Ensure that bead in the glazing space does not impair seating of glazing materials. Remove excess sealant that is forced onto face of frame assembly.
- .5 Develop drainage holes with moisture path to exterior.
- .6 Prepare components to receive anchor devices. Fabricate anchorage items.
- .7 Arrange fasteners, attachments, and jointing to ensure concealment from view.
- .8 Cope, notch and drill to provide minimum tolerance throughout system and to fit with hairline joints.
- .9 Conceal interconnecting members and fastenings in completed assembly. Provide pressure-equalizing holes in members and condensation drains.
- .10 Provide for vertical expansions and construction joints as necessary and install air cut-offs in continuous vertical members to prevent stack effect of enclosed air columns.
- .11 Jointing and intersections of metals shall be accurately cut, fitted to a tolerance of 0.8 mm, in true planes with adequate concealed beads where required.
- .12 Fabricate sections to accommodate and interface with work of other trades by means of rabbets, interlocks, miscellaneous angles, trim and filler sections as required.
- .13 Brake form parapet caps and sills out of 3 mm thick aluminum sheet.
- .14 Provide internal reinforcement in horizontal window mullions to satisfy wind loads and to maintain rigidity.
- .15 Isolate aluminum in contact with other metals, masonry, concrete, plaster or mortar to prevent corrosion.

- .16 Verify wall openings and adjoining air and vapour seal materials are ready to receive work of this section.
- .17 Beginning installation means acceptance of site conditions.
- .18 Provide airtight vapour seals in curtain wall framing.

2.05 FINISHES

- .1 Aluminum finishes:
 - .1 Exposed aluminum: refer to Exterior Materials and Finish Schedule.
 - .1 Anodized finishes: to Aluminum Association (AA) Architectural Class I.
 - .2 Unexposed aluminum: Mill finish.
- .2 Colour appearance to be uniform with no variations detectable by the naked eye at a distance of 1525 mm under natural lighting.
- .3 Apply one coat of bituminous paint to concealed aluminum and steel surfaces in contact with cementitious or dissimilar materials.

3 EXECUTION

3.01 EXAMINATION

- .1 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts are acceptable for aluminum curtain wall installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate in presence of Departmental Representative.
 - .2 Verify dimensions, tolerances, and method of attachment with other work.
 - .3 Verify wall openings and adjoining air barrier and vapour retarder materials are ready to receive work of this Section.
 - .4 Inform Departmental Representative of unacceptable conditions immediately upon discovery.

3.02 PREPARATION

- .1 Coordinate dimensions, tolerances, and method of attachment with other work.

- .2 Supply anchorage devices and inserts to the appropriate sections where required for building in or casting-in-place and instruct as to proper location and position. Anchors shall have three-way adjustments.
- .3 Remove dust and other loose material from openings.

3.03 INSTALLATION

- .1 Compliance: comply with AAMA CWG-1-89 and ASTM E2112 recommendations, and manufacturer's printed installation instructions, standard and job-specific details, and data sheets.
- .2 Use only concealed fasteners, type 304 or 316 stainless steel, unless otherwise specified.
- .3 Erect all work plumb and true and in proper alignment and relationship to established lines and grades.
- .4 Devices for anchoring the frame assemblies shall have sufficient adjustment to permit correct and accurate alignment. After alignment, positively secure anchorage devices to prevent movement other than those designed for expansion and contraction. Take into consideration climatic conditions prevailing at time of installation.
- .5 Group components with shop applied finishes so that those that relate most closely to one another, with regard to colour and appearance, shall be installed adjacent to each other.
- .6 Coordinate work of this section with, and provide connection for, compartmentalization of air spaces provided under other sections.
- .7 Apply a continuous bead of sealant to all joints and air/vapour barrier junctions with adjacent construction. Liberally butter screw fastenings with sealant.
- .8 Apply silicone sealant and foam rubber joint plugs (end dams) as required at frame corners to fill and seal the joinery.
- .9 Provide airtight seals at penetrations in air/vapour barriers.

- .10 Isolate metal air/vapour barriers with thermal breaks and spacers.
- .11 Locate vapour barrier on the warm-in-winter side of the insulation.
- .12 Protect exterior finished surfaces by installing Snap-On caps only when building is closed in, and when the possibility of damage due to construction has been minimized, to the approval of the Departmental Representative.

3.04 FIELD GLAZING

- .1 Install glass and insulating glass units to Section 08 50 00 - Glazing.

3.05 SEALANTS

- .1 Joint Sealants: to Section 07 92 00 - Joint Sealants.

3.06 SITE TOLERANCES

- .1 Erection tolerances for frame assemblies relate to the structural grid of the building and apply to each individual assembly as follows:
 - .1 Vertical position: +3 mm.
 - .2 Horizontal position: +3 mm.
 - .3 Deviation from plumb: 3 mm maximum each plane.
 - .4 Racking of face: 6 mm maximum.
 - .5 Racking in elevation: Nil.
 - .6 Offset from true alignment between two identical members abutting end to end in line: 0.8 mm.
 - .7 Tolerances shall not be accumulative.
 - .8 Erection tolerances for operable elements: consistent with smooth operation and weatherproof performance.

3.07 FIELD QUALITY CONTROL

- .1 Manufacturer's Field Services:
 - .1 Obtain written reports from manufacturers of curtain wall and glass verifying compliance of Work in handling, installing, applying, protecting and cleaning of products, and submit written reports in acceptable format to verify compliance of Work with Contract within 3 days of review.

- .2 Submit manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.
- .3 Ensure manufacturer's representative of curtain wall and of glass is present before and during critical periods of installation and construction of field joints.
- .4 Schedule site visits to review Work at stages listed:
 - .1 After delivery and storage of products, and when preparatory Work on which Work of this Section depends is complete, but before installation begins.
 - .2 Once during progress of Work at 50% complete.
 - .3 Upon completion of Work after cleaning is carried out.

3.08 ADJUSTING

- .1 Replace defective materials and materials damaged due to faulty installation, careless handling or other causes resulting from work of this section.
- .2 Upon completion of the work and just prior to final review, or at a time as directed, inspect units for damage and correct same immediately.

3.09 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
 - .1 Leave Work area clean at end of each day.
 - .2 Remove protective material from prefinished aluminum 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.
 - .5 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

- .2 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.10 PROTECTION

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by glazed aluminum curtain wall installation.

END OF SECTION

1 GENERAL

1.01 RELATED REQUIREMENTS

- .1 Section 05 50 00 - Metal Fabrications.
- .2 Section 06 10 00 - Rough Carpentry.
- .3 Section 07 84 00 - Fire Stopping.
- .4 Section 08 11 00 - Metal Doors and Frames.

1.02 REFERENCES

- .1 ANSI A117.1 - American National Standard for Accessible and Useable Buildings and Facilities.
- .2 ANSI/BHMA A156.1, "Butts and Hinges" (copyrighted by BHMA, ANSI approved).
- .3 ANSI/BHMA A156.2 - American National Standard for Bored and Preassembled Locks & Latches.
- .4 ANSI/BHMA A156.4 - American National Standard for Door Controls - Closers.
- .5 ANSI/BHMA A156.6, "Architectural Door Trim" (copyrighted by BHMA, ANSI approved).
- .6 ANSI/BHMA A156.7, "Template Hinge Dimensions" (copyrighted by BHMA, ANSI approved).
- .7 ANSI/BHMA A156.8, "Door Controls - Overhead Holders" (copyrighted by BHMA, ANSI approved).
- .8 ANSI/BHMA A156.13 - American National Standard for Mortise Locks and Latches Series 1000.
- .9 ANSI/BHMA A156.15 - Life Safety Closer/Holder/Release Devices.
- .10 ANSI/BHMA A156.16 - Auxiliary Hardware.
- .11 ANSI/BHMA A156.18 - Materials and Finishes.
- .12 ANSI A156.28 - American National Standard for Keying Systems
- .13 NFPA 80 - Standard for Fire Doors, Fire Windows.

- .14 NFPA 252 - Standard Methods of Fire Tests of Door Assemblies.
- .15 Underwriters Laboratories (UL). - Fire Resistance Directory.
- .16 ANSI/UL 10C - Standard for Safety for Positive Pressure Fire Tests of Door Assemblies.
- .17 NBC - National Building Codes or Canada

1.03 PERFORMANCE REQUIREMENTS

- .1 Fire Rated Openings: Provide door hardware listed by UL or Intertek Testing Services (Warnock Hersey Listed), or other testing laboratory approved by applicable authorities.
 - 1. Comply with NFPA 80 for fire ratings indicated, based on testing according to NFPA 252.
 - 2. Comply with UL10C, Positive Pressure Fire Tests of Door Assemblies.
- .2 Accessibility Requirements: Comply with requirements of Local building code, and Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities.

1.04 ACTION AND INFORMATION SUBMITTALS

- .1 Submit under provisions of Section 010000.
- .2 Product Data: Manufacturer's catalog cuts on each product to be used.
- .3 Shop Drawings: Indicate locations and mounting heights of each type of hardware, schedules, electrical characteristics and connection requirements.
- .4 Schedule:
 - 1. Submit schedule indicating each type of hardware for each door.
 - 2. List manufacturer's name with each manufacturer's hardware number together with finishes in US standards.
 - 3. Show door number/location, handing, door and frame material, manufacture and catalog numbers, all finishes and keying information. Explain fully all abbreviations.
- .5 Shop Drawings:
 - 1. Indicate locations and mounting heights of each type of hardware.

2. Supply templates to door and frame manufacturer(s) to enable proper and accurate sizing and locations of cut-outs for hardware.
 3. Detail any conditions requiring custom extended lip strikes, or any other special or custom conditions.
 4. Wiring diagrams including point to point and riser diagrams, function statements and system descriptions for all electrical hardware
- .6 Verification Samples: For each finish product specified.
1. If required by the Architect, submit one sample of each type of typical hardware required illustrating style, color, and finish.
 2. Approved samples may be incorporated into Work.
- .7 Closeout Submittals:
1. Project Record Documents: Schedule showing actual locations of installed cylinders and their master key code.
 2. Parts lists and maintenance instructions including data on operating hardware, lubrication requirements, and inspection procedures related to preventative maintenance.
 3. Keys: Deliver with identifying tags to Owner by security shipment direct from hardware supplier.

1.05 QUALITY ASSURANCE

- .1 Manufacturer Qualifications: A manufacturer with a minimum of ten years experience manufacturing door hardware.
- .2 Supplier Qualifications: A supplier with a minimum of two years demonstrated experience in the sale and distribution of builders' hardware for commercial projects and who has successfully completed at least three projects of similar complexity to the project specified.
- .3 Hardware Supplier Personnel: Employ Architectural Hardware Departmental Representative (AHC) or equally qualified person to supervise and prepare all schedules, details, and services required for the project.

- .4 Hardware Supplier: to provide 3 job site visits for inspection of the hardware. One is before the hardware is installed, the second one is during the install and the last one is on completion of the install. Each inspection is to have a certified AHC complete the inspection and report any issues at the time of inspection.

1.06 DELIVERY, STORAGE, AND HANDLING

- .1 Package hardware items individually with necessary fasteners and installation templates when necessary; label and identify each package with door opening code to match hardware schedule.
- .2 Store products in manufacturer's unopened packaging until ready for installation.
- .3 Protect materials from exposure to moisture. Do not deliver until after wet work is complete and dry.
- .4 Store materials in a dry, warm, ventilated weathertight location.

1.07 PROJECT CONDITIONS

- .1 Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.08 WARRANTY

- .1 Provide factory warranty against defects in material and workmanship as follows:
 - 1. Overhead Surface Closers, Grade 1, 25 Year Warranty.
 - 2. Mortise locks, Grade 1, 10 Year Warranty.

1.09 MAINTENANCE MATERIALS

- .1 Provide special wrenches and tools applicable to each different or special hardware component.

1.10 COORDINATION

- .1 Coordinate work with other directly affected components involving manufacture or fabrication of internal reinforcement for door hardware and recessed items.
- .2 Coordinate work with other directly affected components involving electrical wiring and components.

2 PRODUCTS

2.01 HINGES AND PIVOTS

- .1 Hinges: ANSI A156.1, full mortise template type complying with following general requirements unless otherwise scheduled.
 - 1. Widths: Sufficient to clear trim projection when door swings 180 degrees.
 - 2. Number: Furnish minimum three hinges to 90 inches (2286 mm) high, four hinges to 120 inches (3048 mm) high for each door leaf.
 - a. Fire Rated Doors to 86 inches (2184 mm) high: Minimum three ball bearing hinges.
 - b. Residential Wood Doors: Furnish minimum two hinges.
 - 3. Size and Weight: 4-1/2 inch (114 mm) heavy weight typical for 1-3/4 inch (44 mm) doors.
 - a. Doors over 40 inches (1 016 mm) wide: Extra heavy weight ball or oilite bearing hinges.
 - b. Doors 1-3/8 inch (35 mm) Thick: 3-1/2 inch (89 mm) size.
 - c. Doors 2 inch (50 mm) Thick: 5 inch (125 mm) extra heavy weight ball or oilite bearing.
 - d. Doors over 48 inches (1 220 mm) wide: 5 inch (125 mm) extra heavy weight ball or oilite bearing.
 - 4. Pins: Furnish nonferrous hinges with non-removable pins (NRP) at exterior and locked outswinging doors, non-rising pins at interior doors.

2.02 MORTISE LOCKSETS AND DEADBOLTS

- .1 Lockset: Mortise Series.
 - 1. Standards:
 - a. ANSI Conformance - ANSI A156.13, Operational Grade 1, Security Grade 1.

- b. U.L. and C.U.L. listed for use on 3-hour fire-rated doors and for all positive pressure applications.
- c. U.L. and C.U.L. listed for UL 10B/10C.
- d. Lever trim meets A117.1 and ADA requirements.
- 2. Features:
 - a. Stainless steel latch.
 - b. Stainless steel dead bolt.
 - c. Hardened steel rollers in dead bolt.
 - d. Security spacer between inside and outside lever.
 - e. Steel lock case and internal components.
 - f. Full length face plate.
 - g. All trim through-bolted through the lock case.
 - h. Accepts interchangeable core cylinders.
- 3. Function:
 - a. As noted on the hardware schedule attached to this section.

2.03 KEYING

- .1 Keying:
 - 1. Keying: Provide master keyed Dorma Series as directed by architect.
 - 2. Construction keyed
- .2 Keys:
 - 1. Nickel silver. Stamp keys with "DO NOT DUPLICATE".
 - 2. Supply keys in the following quantities:
 - a. 15 construction keys.
 - b. 2 keys for every cylinder.
 - c. 6 master and sub-master keys

2.04 SURFACE DOOR CLOSERS

- .1 Closers used in conjunction with overhead stops and holders shall be templated and coordinated to function properly. Properly detail closers to meet application requirements by providing drop plates, brackets, etc. to meet application and installation requirements as indicated.
- .2 Heavy Duty Series: ANSI A156.4, Grade 1, heavy duty surface door closer.
 - 1. Models for interior and exterior applications features adjustable spring sizes from 1 to 6 and meets ANSI A117.1 and ADA for barrier-free accessibility.

2. Compliant with UL10C for positive pressure.
3. Non-handed.
4. Featuring full range spring power adjustment and backcheck, with a narrow projection full cover and flatform style arm.
5. Door control also features a backcheck positioning adjustment for parallel arm applications, to maintain an ANSI backcheck range similar to regular and top jamb applications.
6. Independent sweep and latch non-critical closing speed adjustment.

2.05 MISCELLANEOUS TRIM

- .1 Push/Pulls: ANSI A156.6; push plates minimum 0.050 inch (1.27 mm) thick.
 1. Type:
 - a. Provide as indicated on the Schedule.
 2. Size: Push plates shall be ANSI J302, size 4 inches (102 mm) by 16 inches (406 mm), thickness .050 inch.
 3. Size: Pull plates shall be ANSI J405, size 4 inches (102 mm) by 16 inches (406 mm), thickness .050 inch.
 4. Cut plates for cylinder or thumb piece when used with deadlock.
 5. Provide with through bolts to secure from opposite door face.
 6. Finish: As specified in the Door Hardware Schedule.
- .2 Flush Bolts: ANSI A156.16 Grade 1 top and bottom flush bolts, with dust-proof floor strike.
 1. Provide as indicated on the Schedule.
 2. Finish: As specified in the Door Hardware Schedule.
- .3 Kickplates, Mop Plate, Armor Plates: ANSI A156.6, metal; height indicated in Schedule by 1 inch (25 mm) less than door width:
 1. Provide as indicated on the Schedule.
- .4 Stops: Provide for all doors to control the desired limit of opening helping to prevent damage to adjacent walls, columns, equipment, the door or its hardware
 1. Provide floor or wall stops when overhead stops have not been listed except in areas where their location would impede traffic. Stops of correct height shall be used on exterior and interior doors.

2. Doors with surface closers may be provided with dead stop arms
3. Use roller type stops in areas where the interfering swing of one door may cause damage through contact with another door.
4. Wall Stops: ANSI A156.1, Grade 1, with no visible screws:
 - a. Provide as indicated on the Schedule.
 - b. Finish: As specified in the Door Hardware Schedule.
5. Floor Stops: ANSI A156.1 Grade 1:
 - a. Provide as indicated on the Schedule.
 - b. Finish: As specified in the Door Hardware Schedule.

3 EXECUTION

3.01 EXAMINATION

- .1 Do not begin installation until substrates have been properly prepared.
- .2 Verify doors and frames are ready to receive door hardware and dimensions are as indicated on shop drawings.
- .3 Verify electric power is available to power operated devices and is of correct characteristics.
- .4 If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 INSTALLATION

- .1 Install in accordance with manufacturer's instructions.
- .2 Coordinate mounting heights with door and frame manufacturers. Use templates provided by hardware item manufacturer.
- .3 Install with fasteners provided by hardware item manufacturer.
- .4 Adjust hardware for smooth operation.

3.03 PROTECTION

- .1 Protect installed products until completion of project.

- .2 Touch-up, repair or replace damaged products before Substantial Completion.

3.04 DOOR HARDWARE SCHEDULE

Hardware Group 1, Exterior Door (101C)

- 1-Continuous Hinge, ABH A110HD C (sized to suit)
- 1-Exit Device, 9500 32D x 9500TEH 70 26D
- 1-Cylinder SFIC 26D, type to suit (keyed as directed)
- 1-Door Closer, 1900 A x DP1900
- 1-OH Stop, ABH 9022A 32D
- 1-Kickplate, 151234 32D
- 1-Threshold, DS6000A x DS176AT (sized to suit)
- 1-Weather Seal, DS130C (size to suit)
- 1-Door Sweep, DS148C (size to suit)

Hardware Group 2, Exterior Entry Door (101D)

- 1-Continuous Hinge, ABH A110HD C (sized to suit)
- 1-Exit Device, 9500 32D x 9500TEH 70 26D
- 2-Cylinders SFIC 26D, type to suit (keyed as directed)
- 1-Automatic Operator, OMEGA OA100 A
- 2-Push Buttons, Camden CM-7536/4
- 1-Electric Strike, Camden CX-ED1259L 32D
- 1-Keyswitches, Camden CM-1260 (on/off switch)
- 1-OH Stop, ABH 9022A 32D
- 1-Kickplate, 151234 32D
- 1-Threshold, DS6000A x DS176AT (sized to suit)
- 1-Weather Seal, DS130C (size to suit)
- 1-Door Sweep, DS148C (size to suit)
- 1-Wiring Diagram

Note: Requires 120VAC conduit/wiring above the doorway for electrified hardware components.

Note: Requires 12V/24V conduit/wiring to/from all electrified hardware components.

Note: 12V/24V/120VAC Electrical Wiring and Conduit by Division 26. Final termination, hook up and commissioning by door hardware supplier (Section 087100).

Noted: All electrified hardware to be installed by a manufacturers certified technician, and all auto operator installers to be AAADM certified.

Hardware Group 3, Washroom (102)

3-Hinges, BB179 454 32D
1-Lockset, DM42 x Indicator SS 32D
1-OH Stop, ABH 9022A 32D
1-Kickplate, 151234 32D

Hardware Group 4, Electrical (103)

3-Hinges, BB179 454 26D
1-Lockset, DM80 SS 26D
1-Cylinder SFIC 26D, type to suit (keyed as directed)
1-Door Closer, 1900 A x DP1900
1-OH Stop, 9022A 32D
1-Kickplate, 151234 32D
1-Smoke Seal, DS66B (sized to suit)

Door Number and Hardware Group Schedule

Door #	Hardware Group #
101A	NA (Overhead Door by Others)
101B	NA (Overhead Door by Others)
101C	1
101D	2
102	3
103	4

END OF SECTION

1 GENERAL

1.01 RELATED REQUIREMENTS

- .1 Section 08 11 00 - Metal Doors and frames.
- .2 Section 08 44 13 - Glazed Aluminum Framing Systems

1.02 REFERENCES

- .1 ASTM International
 - .1 ASTM C542 05 (2011), Specification for Lock Strip Gaskets.
 - .2 ASTM D790 10, Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.
 - .3 ASTM D1003 11, Test Method for Haze and Luminous Transmittance of Plastics.
 - .4 ASTM D1929 11, Test Method for Determining Ignition Temperature of Plastics.
 - .5 ASTM D2240 05(2010), Standard Test Method for Rubber Property Durometer Hardness.
 - .6 ASTM E84 11a, Test Method for Surface Burning Characteristics of Building Materials.
 - .7 ASTM E330 02(2010), Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.
 - .8 ASTM C1503-08, Standard Specification for Silvered Flat Glass Mirror.
- .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB 12.1 M90, Tempered or Laminated Safety Glass.
 - .2 CAN/CGSB 12.3 M91, Flat, Clear Float Glass.
 - .3 CAN/CGSB 12.8 97 AMEND, Insulating Glass Units.
- .3 Canadian Standards Association (CSA International)
 - .1 CSA A440-11, NAFS - North American Fenestration Standard/Specification for Windows, Doors, and Skylights, Includes Update No. 1 (2014).
 - .2 CSA A440.2-14/A440.3-14, Fenestration energy performance/User guide to CSA A440.2-14.
 - .3 CAN/CSA A440.4-07 (R2012) - Window, Door, and Skylight Installation
 - .4 CSA Certification Program for Windows and Doors 2000

- .4 Environmental Choice Program (ECP)
 - .1 CCD-045-95(R2005), Sealants and Caulking Compounds.
- .5 Glass Association of North American (GANA)
 - .1 GANA Glazing Manual (50th Anniversary Edition).
 - .2 GANA Laminated Glazing Reference Manual (2009 edition).
 - .3 GANA Guide to Architectural Glass (2010).

1.03 ACTION AND INFORMATION SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for glass, sealants, and glazing accessories, and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Samples:
 - .1 Submit for review and acceptance of each unit.
 - .2 Samples will be returned for inclusion into work.
 - .3 Submit duplicate 300 mm x 300 mm size samples of glass products and insulating glass units.
- .4 Certificates: submit product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.
- .5 Test Reports: certified test reports showing compliance with specified performance characteristics and physical properties.
 - .1 Submit testing and analysis of glass under provisions of Section 01 45 00 - Quality Control.
 - .2 Submit shop inspection and testing for glass.

1.04 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Operation and Maintenance Data: submit operation and maintenance data for glazing for incorporation into manual.

1.05 QUALITY ASSURANCE

- .1 Certificates: product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.
- .2 Test Reports: certified test reports showing compliance with specified performance characteristics and physical properties.
 - .1 Provide testing and analysis of glass under provisions of Section 01 45 00 - Quality Control.
 - .2 Provide shop inspection and testing for glass if requested by Departmental Representative.

1.06 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect glazing and frames from damage.
 - .3 Protect prefinished aluminum surfaces with wrapping or strippable coating.
 - .4 Replace defective or damaged materials with new.

1.07 AMBIENT CONDITIONS

- .1 Ambient Requirements:
 - .1 Install glazing when ambient temperature is 10 degrees C minimum. Maintain ventilated environment for 24 hours after application.
 - .2 Maintain minimum ambient temperature before, during and 24 hours after installation of glazing compounds.

1.08 WARRANTY

- .1 Provide manufacturers guarantee for the following types of glass listed, against defects in materials and workmanship for the period indicated, commencing from the date of Substantial Performance of Work.
 - .1 Sealed Glass Units: Replace units that exhibit failure of hermetic seal under normal use evidenced by partial or complete obstruction of vision by dust, moisture, or film on interior surface of glass: 2-Years from date of Contract Completion

2 PRODUCTS

2.01 MATERIALS

- .1 Required Edge Treatments:
 - .1 Concealed edges: flat belt ground and seamed.
- .2 Design Criteria:
 - .1 Provide continuity of building enclosure vapour and air barrier using glass and glazing materials as follows:
 - .1 Utilize inner light of multiple light sealed units for continuity of air and vapour seal.
 - .2 Size glass to withstand wind loads, dead loads and positive and negative live loads as measured in accordance with ANSI/ASTM E330.
 - .3 Limit glass deflection to 1/200 with full recovery of glazing materials.
- .3 Flat Glass:
 - .1 Type 'LT': laminated tempered glass. to CAN/CGSB 12.1, transparent, glazing quality, 6 mm minimum thickness overall; 3 mm each pane.
 - .1 Type: 2 tempered laminated.
 - .2 Class: B float.
 - .3 Category: II - 540 J impact resistance.
 - .4 Edge treatment: Polished.
 - .2 Type 'T': tempered glass to CAN/CGSB 12.1, transparent, glazing quality, 6 mm minimum thickness.
 - .1 Type: 2 tempered laminated.
 - .2 Class: B float.
 - .3 Category: II - 540 J impact resistance.
 - .4 Edge treatment: Polished

- .4 Type 'M': silvered mirror glass, to ASTM C1503, mirror quality, 6 mm minimum thickness.
 - .1 Type: 3A-Tempered.
 - .2 Tint: clear.
- .5 Type 'LE': Low-emissivity (LOW-E) coating; Design Concept: Low-E coating on 2nd surface, argon gas filled insulating glass units having the following minimum performance values based on clear + clear glass, each pane 6 mm thick, overall thickness 25 mm:
 - .1 Canadian ENERGY STAR® certified.
 - .2 Cradle-to-Cradle Certified^{cm}.
 - .3 Ultraviolet Transmittance: ≤19%.
 - .4 Visible light transmittance: ≥70%.
 - .5 Solar heat gain coefficient (SHGC): ≤0.38.
 - .6 U-Factor:
 - .1 Winter nighttime u-value: ≤0.29.
 - .2 Summer daytime u-value: ≤0.27.
 - .7 Shading coefficient: ≥0.44.
 - .8 Light to Solar Gain (LSG): ≥1.85.

2.02 SEALED INSULATING GLASS

- .1 Type 'INS': Double Pane Insulating Glass Units: meet or exceed requirements of CAN/CGSB 12.8. Units shall be certified by the Insulated Glass Manufacturers Alliance (IGMA) - submit certification numbers for each unit supplied to Departmental Representative. Overall unit thickness shall be 25 mm using 6 mm glass thickness for individual panes. 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 two panes of glass at the edge up to the spacer/separator and primary seal.
 - .3 Outboard pane: Type 'T' clear tempered glass, 6 mm thick, with Type LE1 (Low-e) coating on 2nd surface.
 - .4 Inter cavity space: 13 mm space with low-conductivity spacers.
 - .5 Inert gas fill: ≥95% argon filled.
 - .6 Inboard pane: Type 'T' clear tempered glass, 6 mm thick.
- .2 Type 'TGU': Translucent Insulating Glass Units:
 - 1. The Translucent Glazing Unit shall be of a design such as to present a monolithic glass section without visible internal framing, support or another solid member inside

of the perimeter spacer. The ability to use nearly any type or manufacture of architectural flat glass shall enable the visual integration of translucent surfaces with those of nearby vision glass as well as ensuring that the appearance of the translucent glazing surfaces does not deteriorate over the life of the building. The employment of separate technologies for thermal insulation and light diffusion shall be such as to ensure that different thermal insulation specifications do not affect light transmission.

2. TGU Description:

1. Air filled preassembled units consisting of:

1. Two lites of glass;
2. Honeycomb transparent insulation core aligned perpendicular to glazing, for TGU thermal insulation;
3. Translucent, non-woven veils permanently bonded to internal glass surfaces;
4. Continuous perimeter metal spacer bar separated from glass surfaces with foam thermal break;
5. Glass lites connected together with spacer bar using structural silicone sealant.
6. Airspace within TGU filled with air pressure equalized to atmospheric pressure with stainless steel capillary pressure equalization (vent) tube.
7. Glazing unit shall not contain in excess of .01 parts per million by weight each of Volatile Organic Compounds, asbestos, resorcinol-formaldehyde, pheno-resorcinol formaldehyde, urea formaldehyde, CFC, HFC, HCFC, Halon, Benzene, Cadmium (and compounds), Carbon tetrachloride, Cyanide (and compounds), Toluene, Xylenes, Lead, 1,1,1,Trichlorethane, Trichlorethylene, MEK, and MIK

2. Overall thickness and size:

1. Thickness: 64mm plus glass lites.
2. Maximum overall size, edge of glass: 1524mm X 3658mm

3. TGU performance

1. Thermal insulation (U-value): 0.2 (Btu/hr·ft²·°F)
2. Daylight transmittance: 55 %
3. Light Diffusion Power (LDP): excellent

4. Daylight to solar heat gain ratio: LSG=1.08
5. Solar heat gain coefficient (no shade): SHGC=0.51
6. Sound transmittance class (STC) (ASTM E 70-97): 35
7. Maximum color shift: $[2 \Delta E]$ over 5 years.
8. Flame spread (ASTM E 84-05e1): 5.
9. Smoke developed (ASTM E 84-054e1): 10.
10. Spacer resistance to crushing: 500 lbs/lineal Ft.

2.03 ACCESSORIES

- .1 Sealants: in accordance with Section 07 92 00 - Joint Sealants.
- .2 Glazing sealant: Type as recommended by glazing manufacturer as required to meet or exceed performance requirements. Verify compatibility with insulating glass unit secondary sealant.
- .3 Sealant for glazing between edges of glass units: one-component silicone base, non-acidic, non-corrosive qualifying to ASTM C920, and commercially manufactured and designed for structural silicone glazing (SSG)
- .4 Setting blocks: Neoprene, 80 90 Shore A durometer hardness to ASTM D2240, to suit glazing method, glass light weight and area.
- .5 Spacer shims: Neoprene, 50 60 Shore A durometer hardness to ASTM D2240, 75 mm long x one half height of glazing stop x thickness to suit application. Self adhesive on one face.
- .6 Glazing tape:
 - .1 Preformed butyl compound with integral resilient tube spacing device, 10 15 Shore A durometer hardness to ASTM D2240; coiled on release paper; black colour.
 - .2 Closed cell polyvinyl chloride foam, coiled on release paper over adhesive on two sides, maximum water absorption by volume 2%, designed for compression of 25%, to effect an air and vapour seal.
- .7 Glazing splines: resilient polyvinyl chloride, extruded shape to suit glazing channel retaining slot, black colour.
- .8 Glazing clips: manufacturer's standard type.

- .9 Lock-strip gaskets: to ASTM C542.
- .10 Other Glazing Accessories: to CAN/CSA A440.
- .11 Screws, bolts and fasteners: ASTM F738M; Type 304 stainless steel.
- .12 Glass presence markers: easily removable, non-residue depositing.
- .13 Mirror attachment accessories:
 - .1 Stainless steel edge clips, with fastening concealed behind mirror.

2.04 FABRICATION

- .1 Verify glazing dimensions on Site.
- .2 Clearly label each glass light with maker's name, weight, quality, type and certification number. Do not remove labels until after work has been reviewed by Departmental Representative.
- .3 Accurately size glass to fit openings allowing the clearances shown on the following table:

Glass Thickness	Minimum Edge Clearance	Minimum Face Clearance
2 mm	3 mm*	1.5 mm
3 mm	3 mm*	3 mm
4 mm	3 mm*	3 mm
5 mm	6 mm*	3 mm
6 mm	6 mm	3 mm
over 6 mm	6 mm or 75% of the glass thickness, whichever is greater	

* = where any dimension of glass exceeds 760 mm increase minimum edge clearance by 1.5 mm.

- .4 Bite of glass edge in stop:
 - .1 Up to 1270 mm united size: 10 mm minimum.
 - .2 Over 1270 mm united size: 13 mm minimum.

3 EXECUTION

3.01 COMPLIANCE

- .1 Install work in accordance with the Quality Management provisions specified in this section and manufacturer's written instructions.
- .2 Size glass to Building Code requirements and verify glass for openings are correctly sized and are within allowable tolerances. Install glass with full contact and adhesion at perimeter. Maintain edge clearance recommended by glass manufacturer.
- .3 Perform work in accordance with GANA Glazing Manual and GANA Laminated Glazing Reference Manual for glazing installation methods.

3.02 EXAMINATION

- .1 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts are acceptable for glazing installation in accordance with manufacturer's written instructions.
 - .1 Verify that openings for glazing are correctly sized and within tolerance.
 - .2 Verify that surfaces of glazing channels or recesses are clean, free of obstructions, and ready to receive glazing.
 - .3 Visually inspect substrate in presence of Departmental Representative.
 - .4 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
 - .5 Proceed with installation only after unacceptable conditions have been remedied.
 - .6 Commencement of work means acceptance of conditions.

3.03 PREPARATION

- .1 Clean contact surfaces with solvent and wipe dry.
- .2 Seal porous glazing channels or recesses with substrate compatible primer or sealer.
- .3 Prime surfaces scheduled to receive sealant.

3.04 INSTALLATION: EXTERIOR - DRY METHOD (PREFORMED GLAZING)

- .1 Manufacturer's Instructions: comply with manufacturer's written data, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.
- .2 Cut glazing tape to length; install on glazing light. Seal corners by butting tape and sealing junctions with sealant.
- .3 Place setting blocks at 1/3 points, with edge block maximum 150 mm from corners.
- .4 Rest glazing on setting blocks and push against fixed stop with sufficient pressure to attain full contact.
- .5 Install removable stops without displacing glazing tape. Exert pressure for full continuous contact.
- .6 Trim protruding tape edge.

3.05 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
 - .1 Leave Work area clean at end of each day.
 - .1 Remove traces of primer, caulking.
 - .2 Remove glazing materials from finish surfaces.
 - .3 Remove labels.
 - .4 Clean glass using approved non-abrasive cleaner in accordance with manufacturer's instructions.
 - .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.
- .2 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.06 PROTECTION

- .1 Protect installed products and components from damage during construction.
- .2 After installation, mark each light with an "X" by using removable plastic tape or paste.
 - .1 Do not mark heat absorbing or reflective glass units.

- .3 Repair damage to adjacent materials caused by glazing installation.

3.07 SCHEDULE

- .1 Exterior doors: Type 'INS' insulating glass units.
- .2 Translucent Windows: Type 'TGU' monolithic glass units.
- .3 Mirrors: Type 'M' monolithic glass units.

END OF SECTION