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**Part 1            General**

**1.1            REFERENCES**

- .1    American Society for Testing and Materials International (ASTM)
  - .1        ASTM A653/A653M-10, Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- .2    Canadian General Standards Board (CGSB)
  - .1        CAN/CGSB-1.181-99, Ready-Mixed Organic Zinc-Rich Coating.
  - .2        CGSB 41-GP-19Ma-84, Rigid Vinyl Extrusions for Windows and Doors.
- .3    Canadian Standards Association (CSA International)
  - .1        CSA-G40.20-04/G40.21-04, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
  - .2        CSA W59-03(R2008), Welded Steel Construction (Metal Arc Welding).
- .4    Canadian Steel Door Manufacturers' Association (CSDMA)
  - .1        CSDMA, Recommended Specifications for Commercial Steel Doors and Frames, 2006.
- .5    National Fire Protection Association (NFPA)
  - .1        NFPA 80-07, Standard for Fire Doors and Fire Windows.
- .6    Underwriters' Laboratories of Canada (ULC)
  - .1        CAN/ULC-S704-11, Standard for Thermal Insulation, Polyurethane and Polyisocyanurate Boards, Faced.

**1.2            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.

**1.3            SUBMITTALS**

- .1    Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2    Provide shop drawings: in accordance with Section 01 33 00 - Submittal Procedures.
  - .1        Indicate each type of door, material, steel core thicknesses, mortises, reinforcements, location of exposed fasteners, openings, glazed, arrangement of hardware and finishes.
  - .2        Indicate each type frame material, core thickness, reinforcements, location of anchors and exposed fastenings and reinforcing and finishes.
  - .3        Include schedule identifying each unit, with door marks and numbers relating to numbering on drawings and door schedule.

#### **1.4 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.

### **Part 2 Products**

#### **2.1 MATERIALS**

- .1 Hot dipped galvanized steel sheet: to ASTM A653M, ZF75, minimum base steel thickness in accordance with CSDMA Table 1 - Thickness for Component Parts.
- .2 Reinforcement channel: to CSA G40.20/G40.21, Type 44W, coating designation to ASTM A653M, ZF75.

#### **2.2 DOOR CORE MATERIALS**

- .1 Stiffened: face sheets welded, insulated core.
  - .1 Polyurethane: to CAN/ULC-S704 rigid, modified poly/isocyanurate, closed cell board. Density 32 kg/m<sup>3</sup>.

#### **2.3 ADHESIVES**

- .1 Polystyrene and polyurethane cores: heat resistant, epoxy resin based, low viscosity, contact cement.

#### **2.4 PRIMER**

- .1 Touch-up prime CAN/CGSB-1.181.
  - .1 Maximum VOC limit 50 g/L.

#### **2.5 PAINT**

- .1 Field paint steel doors and frames in accordance with Section 09 91 99 – Painting for Minor Works. Protect weatherstrips from paint. Provide final finish free of scratches or other blemishes.
  - .1 Maximum VOC emission level 50 g/L.

#### **2.6 ACCESSORIES**

- .1 Exterior top and bottom caps: steel.
- .2 Metallic paste filler: to manufacturer's standard.

#### **2.7 FRAMES FABRICATION GENERAL**

- .1 Fabricate frames in accordance with CSDMA specifications.

- .2 Fabricate frames to profiles and maximum face sizes as indicated.
- .3 Exterior frames: 1.6 mm welded, thermally broken type construction.
- .4 Blank, reinforce, drill and tap frames for mortised, templated hardware, and electronic hardware using templates provided by finish hardware supplier. Reinforce frames for surface mounted hardware.
- .5 Protect mortised cutouts with steel guard boxes.
- .6 Prepare frame for door silencers, 3 for single door, 2 at head for double door.
- .7 Manufacturer's nameplates on frames and screens are not permitted.
- .8 Conceal fastenings except where exposed fastenings are indicated.
- .9 Provide factory-applied touch up primer at areas where zinc coating has been removed during fabrication.
- .10 Insulate exterior frame components with polyurethane insulation.

## **2.8 FRAME ANCHORAGE**

- .1 Provide appropriate anchorage to hangar door structure.
- .2 Locate each anchor immediately above or below each hinge reinforcement on hinge jamb and directly opposite on strike jamb.
- .3 Provide 2 anchors for rebate opening heights up to 1520 mm and 1 additional anchor for each additional 760 mm of height or fraction thereof.

## **2.9 FRAMES: WELDED TYPE**

- .1 Welding in accordance with CSA W59.
- .2 Accurately mitre or mechanically joint frame product and securely weld on inside of profile.
- .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.

## **2.10 DOOR FABRICATION GENERAL**

- .1 Doors: swing type, flush, with provision for glass and/or louvre openings as indicated.

- .2 Exterior doors: insulated core construction.
- .3 Fabricate doors with longitudinal edges welded. Seams: grind welded joints to a flat plane, fill with metallic paste filler and sand to a uniform smooth finish.
- .4 Blank, reinforce, drill doors and tap for mortised, templated hardware and electronic hardware.
- .5 Factory prepare holes 12.7 mm diameter and larger except mounting and through-bolt holes, on site, at time of hardware installation.
- .6 Reinforce doors where required, for surface mounted hardware. Provide flush steel top caps to exterior doors.
- .7 Provide factory-applied touch-up primer at areas where zinc coating has been removed during fabrication.
- .8 Manufacturer's nameplates on doors are not permitted.

## **2.11 DOORS: INSULATED CORE CONSTRUCTION**

- .1 Form face sheets for exterior doors from 1.6 mm sheet steel with polyurethane core laminated under pressure to face sheets.

## **2.12 THERMALLY BROKEN DOORS AND FRAMES**

- .1 Fabricate thermally broken doors by using insulated core and separating exterior parts from interior parts with continuous interlocking thermal break.
- .2 Thermal break: rigid polyvinylchloride extrusion conforming to CGSB 41-GP-19Ma.
- .3 Fabricate thermally broken frames separating exterior parts from interior parts with continuous interlocking thermal break.
- .4 Apply insulation.

## **Part 3 Execution**

### **3.1 MANUFACTURER'S INSTRUCTIONS**

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

### **3.2 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.

### **3.3 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.

### **3.4 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 and thresholds as follows.
  - .1 Hinge side: 1.0 mm.
  - .2 Latchside and head: 1.5 mm.
  - .3 Thresholds: 13 mm.
- .3 Adjust operable parts for correct function.

### **3.5 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.

**END OF SECTION**

**Part 1 General**

**1.1 SUMMARY**

- .1 Provide an unobstructed opening, electrically operated, horizontal, slide to one side, bottom rolling hangar door.
- .2 The door assembly shall consist of one anchored group of 4 leaves, each of which when fully closed, will provide a weather tight enclosure of the entire opening.
- .3 Work under this Section includes the following:
  - .1 All structural design of the hangar doors and all collateral work shall be provided including the top door guides, bottom rails with structural supports and anchors, connection and setting door frames, bracket pick-up system, all seals, bumpers and hardware, hanging head flashing and all other flashing as required for an operable and weather tight installation, girts for support of insulation, exterior and interior metal wall panels, framed openings for personnel door, and openings for rotating beacon warning lights.
  - .2 All electrical work required for the operation of the doors to the indicated source of power at the hangar wall, including but not limited to; all necessary wiring, conduit, fittings, junction boxes, limit switches, devices, push buttons, control panels, warning lights, audible alarms, control trolley busway, power busway, disconnect switches and electrical cables.
  - .3 Structural steel framing and bracing for door leaves.
  - .4 Bracket door pick up system.
  - .5 Bottom wheels, axles and bearings.
  - .6 Top guide roller assemblies.
  - .7 Top guide tracks, top guide roller access panels, closure plates, weather-stripping and stops.
  - .8 Bumpers, tractor pulls, interleaf bumpers, and track cleaners.
  - .9 Electrical controls, pushbuttons, limit switches, and interlocks.
  - .10 Electrification trolley, contacts, and other items required for complete power system.
  - .11 Field wiring materials and field wiring labour on the doors, including installation of the cable system.
  - .12 Prime coat of shop paint.
  - .13 Erection, installation and commissioning of doors.
  - .14 Maintenance and operation manuals.
  - .15 Guarantee of complete installation.
  - .16 Coordination with related trades and approval of door track rail system and top guide supporting steel installation.
  - .17 The door manufacturer shall position the doors in the full closed position to ensure full engagement of the weathering and mark the finished floor with tape for painting.

## **1.2 REFERENCES**

- .1 American Gear Manufacturers Association (AGMA).
  - .1 AGMA No. 7 (ISO Viscosity Grade 460).
- .2 American Institute of Steel Construction (AISC).
  - .1 AISC Steel Construction Manual, 14<sup>th</sup> edition.
- .3 American Society of Civil Engineers (ASCE).
  - .1 ASCE 7-05, Minimum Design Loads for Buildings and Other Structures.
- .4 American Society for Testing Materials International (ASTM).
  - .1 ASTM A36/A36M-08, Standard Specification for Carbon Structural Steel.
  - .2 ASTM A572/A572M-12, Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel.
  - .3 ASTM A653/A653M-11, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- .5 Canadian General Standards Board (CGSB).
  - .1 CAN/CGSB-1.105-M91, Quick-Drying Primer.
- .6 Canadian Standards Association (CSA International).
  - .1 CAN/CSA-G40.20/G40.21-04(2009), General Requirements for Rolled or Welded Structural Quality Steel.
  - .2 CSA-S136-07(R2012), Cold Formed Steel Structural Members.
- .7 Health Canada/Workplace Hazardous Materials Information System (WHMIS).
  - .1 Material Safety Data Sheets (MSDS).
- .8 Institute of Electrical and Electronics Engineers (IEEE).
- .9 National Electrical Code (NEC).
- .10 National Electrical Manufacturers Association (NEMA).
  - .1 NEMA-ICS 6-1993(R2006), Enclosures.
- .11 National Fire Protection Association (NFPA).
  - .1 NFPA 70-2011, National Electrical Code.

## **1.3 DESIGN CRITERIA**

- .1 The hangar doors shall be designed by the manufacturer in accordance with the criteria specified. Doors shall operate without binding, interference, or damage to weather stripping. Doors shall fit closely and be free from warping.
- .2 Design Load:
  - .1 External wind loads to be based on 50 year mean recurrence and internal wind load of not less than one-half of the external wind load.

- .2 The maximum deflection of the door leaves, due to design wind loads, shall be limited to the height of the door divided by 240. The deflection due to design wind load shall not exceed length divided by 240 for any door member.
- .3 Fiber stresses due to combined dead load and wind load shall not exceed the recommended design stresses for the material used and type of loading sustained.
- .4 Each horizontal rolling door leaf acting as a unit and all components of the leaf shall be designed to resist all wind and seismic loads indicated or specified. The doors shall be designed so they will not flutter more than plus or minus 6 mm from the vertical position at the top of the horizontal rolling doors. The doors shall be complete with all collateral structural steel and related anchorages and shall include, but not be limited to, bottom door rails, top door guides, end closure pieces, and door guide bracing.
- .5 Design doors as a system to withstand the upward and downward deflections of the cantilevered structure supporting and bracing the top of the hangar door system.
  - .1 Positive deflection (wind uplift): 80 mm.
  - .2 Negative deflection (live load): 150 mm.
  - .3 North-South lateral deflection: 60 mm wind and 60 mm seismic.
  - .4 East-West lateral deflection: 60 mm wind and 60 mm seismic.
- .3 Connections: Design connections at top and bottom guide rails to withstand an external and internal wind load of not less than 171 kg/m<sup>2</sup> (35 psf), or the design wind load for the building, whichever is greater, and a seismic load equal to 0.5 times the weight of the door.
- .4 Performance: Maximum leakage rate of installed shall not exceed 6.8 m<sup>3</sup>/hr per lineal 300mm (4 cfm per lineal foot) of door leaf. Flow rates are at a pressure difference of 7.6mm (0.30 inch) of water.
- .5 Engineering design: provide calculations for structural members covering components and collateral work, including computer programmed designs, with complete explanation of computer programs used. Submittals shall be accompanied by stress values, the design criteria and procedures used and attesting to the adequacy and accuracy of the design.
- .6 All design calculations and drawings shall be signed and sealed by a qualified professional engineer registered or licensed in the Province of Saskatchewan.
- .7 Anchored group doors: each group of leaves shall have a traction-drive operating unit located in the lead leaf of the group and driving both wheels of the lead leaf. The leaves in each group shall start to move at the same time and arrive at their fully open or fully closed positions simultaneously. Necessary cables, fittings, sheaves, housings, guards, pickups, brackets, anchors, and miscellaneous hardware shall be provided. Provide doors that require operating personnel to walk with the leaf as it moves.

## 1.4 SUBMITTALS

- .1 Product Data:
  - .1 Submit manufacturer's printed product literature, specifications and data sheet in accordance with Section 01 33 00 - Submittal Procedures.



- .2 Submit two copies of WHMIS MSDS - Material Safety Data Sheets in accordance with Section 01 33 00 - Submittal Procedures. Indicate VOC's:
  - .1 For caulking materials during application and curing.
  - .2 For door materials and adhesives.
- .2 Shop Drawings:
  - .1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.
  - .2 Indicate each type of door, structural connections, structural properties of members, fasteners, all collateral work, operating systems, operating mechanisms, braking systems, electrical controls, warning and safety devices, emergency operating systems, arrangement of hardware, required clearances, and openings.
  - .3 Indicate engineering design calculations for structural members covering components and collateral work.
  - .4 Indicate motors, all electrical control devices, and all electrical control panels, including schematic diagrams, dimensional drawings of control panels, details of control panel installations, internal wiring diagrams of control panels, and wiring diagrams indicating all external connections between control panels and from control panels to remote control devices.
  - .5 Size, spacings, anchor bolt setting patterns and material requirements for the bottom rails.
- .3 Manufacturer's Instructions:
  - .1 Submit manufacturer's installation instructions in accordance with Section 01 33 00 - Submittal Procedures.
- .4 Manufacturers' Field Reports:
  - .1 Submit copies of manufacturers' field reports in accordance with Section 01 33 00 - Submittal Procedures.

## **1.5 CLOSEOUT SUBMITTALS**

- .1 Provide operation and maintenance data for hangar doors for incorporation into manual specified in Section 01 78 00 - Closeout Submittals. Manuals to contain:
  - .1 Operating instructions.
  - .2 Maintenance instructions.
  - .3 Location of all points to be lubricated, type of lubricant required and frequency of servicing.
  - .4 Checklist of parts to be serviced and adjusted and the frequency of servicing and adjustment.
  - .5 List of spare parts.
  - .6 Manufacturer's catalog for each component in and on the hangar doors.

## **1.6 QUALITY ASSURANCE**

- .1 Regulatory Requirements:
  - .1 Hangar doors: certified by a Canadian Certification Organization accredited by Standards Council of Canada.

- .2 Test Reports: certified test reports showing compliance with specified performance characteristics and physical properties.
- .3 Certificates: product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.
- .4 Pre-Installation Meetings: conduct pre-installation meeting to verify project requirements, manufacturer's installation instructions and manufacturer's warranty requirements.

## **1.7 DELIVERY, STORAGE AND HANDLING**

- .1 Packing, Shipping, Handling and Unloading:
  - .1 Deliver, store, handle, and protect materials in accordance with Section 01 61 00 – Common Product Requirements.
  - .2 Package each item as recommended by the manufacturer and label each item as to item definition and location.
- .2 Storage and Protection:
  - .1 Store packaged materials in original containers or wrapping with manufacturer's seals and labels intact. Store in locations free of dust and moisture.
  - .2 Prevent damage to materials during handling and storage. Keep materials under cover and free from dampness. Remove damaged items and replace.
  - .3 Store materials in area of installation for minimum period of 48 hours prior to installation.

## **1.8 WASTE MANAGEMENT AND DISPOSAL**

- .1 Separate and recycle waste materials in accordance with Section 01 74 19 – Construction/Demolition Waste Management and Disposal.

## **1.9 WARRANTY**

- .1 Provide five-year manufacturer's warranty for hangar doors and all components.
- .2 Include coverage of repair or replacement of components of entire units which fail in materials and workmanship. Failures include, but are not necessarily limited to, structural failures including excessive deflection, excessive leakage or air infiltration, faulty operation of operators and hardware.
- .3 During warranty period, provide repair services when required, and replace any defective or inoperative equipment at no expense to the Owner, including all labour, material, travel or expenses of personnel brought in, and any other costs associated with the solution and correction of the problem.

## **Part 2 Products**

### **2.1 ACCEPTABLE MANUFACTURERS**

- .1 Only hangar door manufacturers with a minimum of 15 years' experience in the manufacture of hangar doors and who are now regularly engaged in the design and

manufacturing of the type of door specified and can submit evidence of ten (10) actual installations of comparable design, construction and size with proven durability will be qualified for work of this section

- .2 The installation supervisor shall be an authorized representative of the door manufacturer. Installers shall be skilled and experienced in the erection of hangar doors of type and size required for this project.

## 2.2 MATERIALS

- .1 Structural Steel: to ASTM A36/A36M, ASTM A572/A572M, CAN/CSA G40.20/G40.21
- .2 Cold-Formed Steel: to CSA-S136.
- .3 Galvanized Steel Sheet: to ASTM A653/A653M, coating designation G90 galvanized steel sheet, commercial quality.
- .4 Top Guide Rails:
  - .1 Provide hot rolled structural I-beam, wide flange, H-beam, or similar configuration conforming to ASTM A36/A36M. Size, weight, and length shall be as required for door design, wind loads, and building requirements. Bottom flange of upper guide rail shall act as a retainer in conjunction with upper guide roller assemblies so as to prevent doors from accidental disengagement. Web of rail shall be sized to accommodate building deflection, permitting unopposed operation of doors under maximum live load conditions.
  - .2 Top guide rails to hold the top rollers of the hangar doors captive, with other structural steel as required to transfer all design loading to the building structure. The nominal elevation shall be maintained within plus or minus 6 mm. The nominal centre-to-centre dimension shall be maintained within plus or minus 3 mm, with variation from nominal at no greater rate than 3 mm in 6.1 metres. Joints of head guides shall be welded and ground so that adjoining guide surfaces have a smooth transition.
  - .3 Hangar top door guides shall be installed after truss shoring is removed. Top guide tolerances shall be met after dead load is imposed upon building frame.
  - .4 Provide bumpers connected to the upper guide rail to stop each leaf in the open and closed position. Provide neoprene bumpers to make proper contact with the main leaf structure. Bumpers shall be designed to withstand lateral impact loads without damage occurring to the hangar doors or to adjoining structures for the intended door design load the normal operation or in case of the limit switch failure.
- .5 Bottom Rails:
  - .1 Shall be designed by the door manufacturer based on standard ASCE rails as defined in the AISC Steel Construction Manual, unless as a result of the door supplier's analysis, heavier rails are required to bear weight to accommodate the design, thrust and weight loads for the installation.
  - .2 Anchor bolts: to CAN/CSA G40.20/G40.21, Grade 300W, suitable for use intended with double nuts and levelling bottom rail supports.
  - .3 Rails shall be set to elevation within plus or minus 6 mm with variations from elevation at no greater than 3 mm in 6.1 metres. The nominal design relationship

- between top guides and bottom rails shall be maintained without exception. The nominal centre-to-centre dimension shall be maintained within plus or minus 3 mm, with variation from nominal at no greater rate than 3 mm in 6.1 metres.
- .4 Rail supports are factory cut to size and punched hot or cold rolled angles or channels of minimum yield strength of 250 MPa (36,000 psi) for leveling and supporting rails to prevent movement during normal erection, concrete pouring and finish operations.
- .6 Door Frame:
- .1 Jambs shall be cold formed steel channels having a minimum yield strength of 345 MPa (50,000 psi) or hot rolled structural channels per ASTM A36/A36M. Deflection at maximum wind loading shall not exceed L/240. Vertical members shall be continuous throughout the height of the door.
- .2 Door headers shall be cold formed channels having minimum yield strength of 345 MPa (50,000 psi) or hot rolled structural channels per ASTM A36, meeting specified design load requirements. Door header to be fabricated to accept upper guide roller assemblies without modification or alteration.
- .3 Door girts shall be cold formed or hot rolled structural tubing per CSA G40.21 Grade 350W properly spaced to accommodate specified wind load conditions as required. Girts shall be designed for simple span condition and sized to permit exterior cladding, interior sheeting and blanket insulation, without causing jamb interference, abrasion or wear.
- .4 Frames and framing members shall be true to dimensions and square in all directions; no leaf shall be bowed, warped or out of line in the vertical or horizontal plane of the door opening by more than 3 mm in 6.1 metres.
- .5 Diagonal bracing shall be provided for strength, stability, squareness and so that the completed leaf assembly will be adequately braced to withstand assembly, shipping, installation, and operational loads.
- .6 Full depth vertical and horizontal framing members shall be provided at each pedestrian door and each rough window opening.
- .7 Provide necessary structural framing and holes in the door leaf for exit lights, interlock switches, alarm signals and similar items of electrical equipment.
- .8 Provide necessary structural framing for bracket door pick-up system. Provide 60 durometer neoprene bolted to interior pick-up brackets. A minimum of two interior pick-up brackets per leaf shall be installed. Interior pick-up brackets shall be installed a minimum of 2.4 metres above the floor. Coordinate installation of the pick-up brackets with the safety edge installation. Pick up brackets shall not interfere with the correct functioning of the safety edges or weatherstripping.
- .7 Traveling Head Closures: Provide head closures attached to the outboard edges of door leaves so that the spaces between door leaves and adjacent hanging head flashings are closed weather tight when door leaves are at the indicated closed position.
- .8 Door Stops: Provide two mechanical bumpers of 60 durometer neoprene bolted to stop beams imbedded in concrete at the end of each door rail to prevent the leaves from coming in contact with upper end walls. The bumpers shall be mounted parallel to one another on the bumper posts at an elevation above the floor such that they contact only the main bottom horizontal channels of the leaves, which shall be steel reinforced at the points of impact. Provide neoprene bumpers with suitable stops also at the door guides above, to make similar contact with the upper part of the door leaves.

.9 Wheel Assemblies:

- .1 Wheels shall be fabricated of carbon steel conforming to ASTM A36/A36M.
- .2 Provide each door leaf with a minimum of two bottom steel plate wheel assemblies, having a minimum tread diameter as required for the actual wheel loading. Wheels shall be designed to adequately carry the load and to permit removal without taking the door leaves from their position on the rails. Where the height-to-width ratio of the door leaf exceeds three, wheel assemblies shall be vertically adjustable. Provide removable access panels at all wheel assemblies.
- .3 Treads: Shall be machined concentric with the bearing seats and to fit ASCE rails. The clear distance between flanges shall not exceed the width of the rail by more than 3 mm at the tread, and no more than 6 mm at the edge of the flange. Machine internal bearing seats accurately for a press fit. Heat treat wheels 460 mm or larger in diameter to obtain a rim hardness of 320 Brinnel.
- .4 Bearings: Each wheel shall be provided with two tapered roller or spherical bearings. Bearing units shall be mounted in the wheel assembly so that both the vertical dead loads and the horizontal wind loads can only be transmitted from the leaf to the wheel through the bearings. Bearings shall be provided with seals to retain the grease and prevent the entrance of dirt and shall be equipped with approved type non-leak, high-pressure throat or surface check lubricating fittings recessed into the interior metal wall panels, convenient for lubrication without removing covers.

.10 Top Guide Rollers:

- .1 Each rolling door leaf shall be provided with a minimum of two telescoping or vertical floating type top roller assemblies. Rollers shall have factory-sealed, lifetime-lubricated roller or ball bearings. Each assembly shall consist of horizontal and vertical steel rollers held captive by the top roller guides and mounted on a track connected to a vertical steel post, which in turn slides within sleeve bearings attached to the door leaf framing.
- .2 Roller assemblies shall be capable of resisting the required wind and operating loading and shall be designed to permit vertical movement of the structure above in addition to the movement attributable to the required wind and dead loading.
- .3 Roller assemblies shall be accessible and removable through the top of the guide system.

.11 Supports:

- .1 Wheel Carriages: the wheels for each leaf shall be mounted in specially constructed, welded and machined-wheel carriages, stress relieved after welding and before boring. The ends of the finished and full assembled wheel carriages shall be 100% welded or bolted into the bottoms of the main vertical framing members of the door leaf sections.
- .2 Motor-Operator Drive Base Supports: bases shall be supported on rigid structural leaf framing designed to prevent deflection or torsional rotation under the loads imposed during operation of the rolling doors. The supports shall locate the bottom of the operating equipment high enough above the driven wheels so that the wheels can be removed from the leaves. The drive base support framing shall be designed so that the drive base and operating equipment can be easily adjusted with separate pressure and tension members to maintain proper tension in the roller chain drive. Slotted hole adjustments are not acceptable.

- .3 Ballast Supports: frame the leaf area immediately adjacent to the motor operator units and driven wheels to receive the necessary weight to achieve a coefficient of adhesion of 0.25 between the driven wheels and a dry rail so that the doors will start without slippage.
- .12 Hardware:
  - .1 Weatherstripping:
    - .1 Design weatherstripping and components to prevent rubbing, wiping abrasion or similar defacing of exposed finished surfaces of the hangar doors or other parts of the building during operation of the hangar door system.
    - .2 Provide adjustable and readily replaceable material. Provide on vertical edges, sills and heads to provide a weather tight installation.
    - .3 Neoprene: Use flap-type, two-ply, cloth-inserted neoprene or extruded, double flap, single or dual opposed solid neoprene material on vertical edges and sills. The two-ply material shall have a minimum thickness of 3 mm and shall be retained continuously for its full length and secured with rust-resistant fasteners 300 mm on centre. Extruded weather stripping with heavy center section shall be attached at 300 mm on centre, but continuous bar may be omitted. Clearance between metal parts on vertical edges of leaves and between leaves and jambs which are to be weather-stripped shall be as indicated.
    - .4 Metallic: Form head weather stripping material between each leaf and the top guide system of not lighter than 1.61 mm (16ga) galvanized sheet steel or flap-type, cloth-inserted neoprene.
    - .5 Hanging Head Flashing: Provide cloth-inserted neoprene weathering fastened to top of door leaves to engage the hanging head flashing when doors are closed.
    - .6 Rail Wipes: Suitable and removable rail wipers shall be provided to clear debris from the railhead and the wheel flange grooves as the leaves are moving. The wipers shall be located at the ends of each leaf.
    - .7 Toe Guards: Attach an adjustable, full-length, flexible toe guard, reaching to the floor, to the interior bottom edge of each door leaf.
    - .8 Weathering: Each door leaf shall be weather tight over the entire surface exposed to the exterior, in all door configurations. Spaces between and all around each door leaf, including spaces adjacent to the fixed opening jambs, heads and floor, shall be tightly closed with flexible material with an average crack opening of not more than 1.6 mm.
  - .2 Fasteners: Self-drilling zinc-coated or cadmium-plated steel.
  - .3 Tractor Pulls: Provide tractor pulls so that leaves can be towed by a tractor or similar equipment in the event of power failure. The tractor pulls shall be designed for drive force to tow doors or 2270 kg whichever is greater. Minimum thickness steel plate shall be 10 mm.
- .13 Cable System for Anchored Group Doors:
  - .1 Cable system shall be concealed in the door leaves.
  - .2 The minimum size for the cable which interconnects the leaves shall be 9.5 mm; the cables shall be improved plow steel with lubricated hemp centres or wire rope

cores. Sheaves over which the cables operate shall have a diameter of at least 18 mm cable diameters and either sealed ball or roller type bearings or graphite bronze bearings of a sufficient capacity for the operating loads. Grease fittings shall be provided for the sheave bearings unless permanently lubricated bearings are used.

- .14 Access Panels: provide flat metal access panels on interior side of door leaves, at motor operator, and at each wheel as required for maintenance and servicing. Access panels shall be removable type at wheels and hinged type at operator units and storage compartments. All edges of access panels shall be sealed. Removable type panels shall be fastened on all edges. Hinged type access panels shall be equipped with keyed alike locks to limit unauthorized access to operator units. Fabricate access panels of minimum 3mm galvanized steel sheet. The clear unsupported area of access panels shall not exceed 2.3 square metres.
- .15 Insulation: in accordance with Section 07 21 16 - Blanket Insulation.
- .16 Prefinished metal siding on exterior: in accordance with Section 07 46 13 - Preformed Metal Siding.
- .17 Prefinished metal liner panel on interior: in accordance with Section 07 46 13 - Preformed Metal Siding.
- .18 Sealants: in accordance with Section 07 92 00 - Joint Sealants.
- .19 Personnel doors and frame: in accordance with Section 08 11 00 - Metal Doors and Frames.
  - .1 Provide each personnel door with an electrical interlock switch.
- .20 Windows: in accordance with Section 08 50 00 - Windows.
- .21 Personnel door hardware: in accordance with Section 08 71 00 - Door Hardware.
- .22 Glazing: in accordance with Section 08 80 50 - Glazing.
- .23 Shop primer: to CAN/CGSB-1.105.

## **2.3 ELECTRICAL**

- .1 Electrical motors, controller units, remote pushbutton stations, relays and other electrical components: to CSA approval.
- .2 Drive unit: mount on lead panel of door system so as to drive both of the bottom rollers of each powered leaf. Unitized assembly, consisting of either a separate motor and gear reducers or a gearhead motor, high-speed shaft brake, and necessary roller chains and sprockets. After the components are mounted, aligned and tightened into position on the drive bases, steel blocks shall be fitted around the feet of the components and welded to the drive base to prevent the components from changing alignment.
- .3 Drive system: designed to move powered leaf at an approximate speed of 14 metres per minute at zero wind load conditions, operable at full speed up to and including a maximum wind load of 39 kg per square metre.

- .4 Motor: ball-bearing, totally enclosed, squirrel cage type of sufficient size and horsepower to operate the door leaves at not more than 75 percent of rated capacity.
- .5 Gear reducers: helical bevel, high-efficiency type, fan-cooled, internally lubricated, with an AGMA service factor of 1.5. A high helix angle shall allow reversal of effort through the gears without damage to the units. The gears shall be non-self-locking. The reducers shall be furnished with the proper quantity of AGMA No. 7 compound gear-reduces oil. The reducers shall be filled in the field after installation in the doors.
- .6 Drive and pinion sockets: shall be highest quality hardened steel of suitable size, thickness, and number of hardened cut teeth for the speed and service.
- .7 Roller chains: shall be precision stainless steel single strand, fatigue resistant, heat treated, and shall have a minimum 5:1 safety factor under normal operating conditions.
- .8 Drive bases: shall be adjustable and shall be designed to rigidly support drive components without deflection or torsional rotation under operating loads.
- .9 Variable-frequency drive: VFD shall produce an adjustable-frequency, adjustable-voltage, pulse width modulated three phase, 600V, sine wave output when powered from a three-phase, 600V 60Hz input. The drive shall be suitable for use with NEMA Design B, AC induction motors with a 1.15 service factor. Drives shall be designed, constructed, and tested in accordance with NEMA, UL, NEC, and IEEE standards. Drives and all supplied options shall be UL approved and listed according to UL 508. Drives shall be solid state, reversing motor, electronic, and programmable for time and value of motor speeds and shall maintain constant torque characteristics over the motor speed range. Drives shall be factory wired, with overload and under voltage protection, equipped with electrical interlocks and with transformers and relays for control circuits, all enclosed in a (NEMA ICS6, Type 4, wet location) enclosure with a disconnect switch, capable of being locked in the OFF/OPEN position. Power voltage shall be 600V, three-phase and control voltage shall be 60 hertz. One complete variable frequency drive will be provided for each power operator.
- .10 Relay: a programmable relay which will allow the hangar doors to start from a full closed position and run at half speed for 1 metre, then ramp up to full speed. At 1 metre from full open position, doors are to ramp down and run at half speed before stopping.
- .11 Operating mechanism: covered on interior of door leaf by a hinged covered door at operator locations.
- .12 Trolley duct: provide the required number of trolley duct conductors for the hangar door's door system, including warning and safety devices.
- .13 Power supply: 600V, 3 phase, 60 Hz.
- .14 Mounting brackets: galvanized steel, size and thickness to suit conditions.
- .15 Control transformer: for 24 VAC control voltage.
- .16 Braking System: Shall be designed to ensure stoppage of the door leaves under normal, dry rail conditions, within the safety edge over travel limit. The braking system shall be a magnetic, spring-set, solenoid-released brake. Provide a hand release to release the brake



when it becomes necessary to move the door leaf with an outside force. The hand release shall be an automatic reset type so that the brake will be operable during subsequent electrical operation of the door. Brakes shall be capable of stopping the door leaf when running at full speed within 125 mm after the brake is applied. The electric brake shall be mounted higher than 1.2 metres above the hangar floor. A permanent placard shall be installed indicating instruction for brake release to operate door by tractor pull. A back-up wheel or track braking system shall be designed and installed to engage in the event of an equipment failure of the drive mechanism. The back-up brake system shall also have a manual release.

- .17 Anchored Group Controller Unit: Lead door leaf shall have control station at leading edge 1.2 metres above the floor and approximately 300 mm from the edge, to avoid interference with the weatherstripping, but still permit hand access when door leaves are stacked in the open position. Control stations shall be heavy-duty, with constant switch hold down pressure, mushroom type pushbuttons, requiring operator to walk group of door leaves open or closed while depressing the button. Each control station shall include push buttons clearly marked "OPEN" and "CLOSE". Provide a spring loaded cover over the switches to prevent accidental activation of the doors. Controls shall be weather tight with convenient hand access when doors are stacked fully open. Interior push buttons shall be mushroom head type, mounted in heavy duty, water tight, oil-tight enclosures conforming to NEMA ICS 6, Type 4. A permanent placard shall be installed near the hangar door control location indicating complete operating instructions for the hangar doors. Provide electrical interlocks to protect equipment and personnel during emergency operation by towing.
- .18 Operator Disconnect Switch: Provide a three-pole disconnect switch for the drive motor not more than 1.2 metres above the hangar floor behind an access panel.
- .19 Limit Switches: Provide limit switches to prevent over-travel, bumping and building damage. Safety edges shall not be used as limit switches.
  - .1 Limit Arm Type Limit Switches: Provide heavy-duty limit switches for anchored group doors to stop the travel of each group in the fully open and fully closed positions. The heavy-duty limit switches shall be positive acting snap action, lever arm type with actuating cams designed with sufficient over-travel to permit the group to come to a complete stop without over-traveling the limit switches. Mount on the leaves and the actuating cams mounted either on the top guides or on adjacent door leaves.
- .20 Warning Devices: provide one flashing amber light and one clearly audible signal on the powered door leaf of hangar door system. The warning devices shall automatically signal movement of the powered door leaf five (5) seconds before the door moves and shall flash and sound continuously while door is being operated. Warning devices shall consist of a rotating amber beacon light and a bell with a decibel level of not less than 100db at 3 metres or an equivalent decibel-rated horn, loud enough to be heard in the hangar and on the apron. Audible warning device shall have a sound different from that of the fire alarm system.
- .21 Emergency Operation: Hangar doors, shall be constructed and equipped so that they can be operated by on-site emergency power or manually by tractor pulls. Manual operation of hangar doors shall be designed to avoid damage to door leaves and electrical system.

- .22 Electrical Work: The door manufacturer shall provide the proper electrical equipment and controls built in accordance with the latest NEMA standards. Equipment, control circuits, and safety edge circuits shall conform to NFPA 70. Where located 450 mm or less above the floor, they shall be explosion-proof as defined in NFPA 70, Article 513. Manual or automatic control devices necessary for motor operation of the doors shall be provided, including push button stations, limit switches, combination fused disconnect switches and magnetic reversing starters, control circuit transformers, relays, timing devices, warning devices, and trolley ducts with collectors or trolleys.
- .23 Power and Grounding: Power shall be provided by junction boxes on both ends of the door leaves. Electrical for doors are 600 volts, three phase, six wire, 20 amperes, 60 hertz. Power shall be delivered to the rolling leaves by a trolley device carried along by each door leaf in the door canopy. The trolley duct electrical characteristics shall be 600 volts, three phase, four pole, 60 amperes, with the fourth pole (rail) being for grounding purposes. Continuity of electrical grounding from leaf to leaf shall be accomplished by using grounding pole (rail) in each trolley duct. Electrical work and equipment shall be grounded and bonded in conformance with UL 467.
- .24 Trolley Duct Electrification System:
  - .1 Provide runs of trolley duct, used as a feeder system to the hangar doors, as required for the door system, including warning and safety devices. Ducts shall have solid copper conductors in protective steel or polyvinyl chloride housing. Locate ducts as shown on door manufacturer's shop drawings. Provide adequate clearances in the top guide system for the travel.
  - .2 Each run shall consist of the required number of sections of straight track, a section of dropout track, feed boxes, end caps, couplings, hangers and all accessories to make the system complete and workable.
  - .3 Furnish one self-supporting collector for each individually motor-operated door, complete with spring-loaded brush contacts. Provide trolley pulling brackets and corrosion-protected chains attached from each side of the pulling bracket to each side of the support bracket for self-bracket for self-supporting collectors.
- .25 Safety Edge:
  - .1 Provide safety edges on each leading and trailing edge of leaf from 25 mm above the floor to the top of the door leaf. For leaves 305 mm thick or less, provide a single run of safety edge. For leaves over 305 mm thick, provide a double run of safety edges spaced to provide the maximum degree of safety in stopping the leaves. Safety edges installation shall not interfere with proper functioning of pick up brackets.
  - .2 Design: Provide safety edges to provide a minimum of 89 mm of over-travel after actuation until solid resistance is met and door motion comes to a complete stop. Safety edges shall be pneumatic type. A minimum of one air pressure switch shall be provided for each 6.1 metres of vertical edge. The electrical service to the pressure switch shall not be more than 110 volts.
  - .3 Actuation of a safety edge shall stop movement of the door leaf and lock out the motor control in the direction of travel until reset, but shall permit the door to be reversed away from the obstruction which tripped the safety edge. Safety edges shall be live only when doors are in motion. Safety edges shall be reset by moving doors away from the obstruction. The lower portion of the safety edges to a height of approximately 1.5 metres shall be independently removable for

convenience in servicing or repair. The remainder of the safety edge may be in one piece up to a maximum of 6.1 metres.

- .4 Provide a keyed bypass to the door controls to render the safety edges in a temporary "repair" mode. The door drive shall be restored from its "fail safe" mode by activation of the keyed bypass.

.26 Interlock Limit Switches:

- .1 Provide each personnel door with an electrical interlock switch to prevent motor operation of the hangar door group when the personnel door is open. Interlock control wiring between door leaves shall be done via a control wiring trolley busway. Provide an identified indicator light at door leaf control station indicating when the personnel door is in the open position.

### **Part 3 Execution**

#### **3.1 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.

#### **3.2 INSTALLATION**

- .1 Doors and accessories shall be erected in accordance with reviewed shop drawings and shall include the installation of top guides, bottom rails with structural supports, connection and setting door frames, installation of all seals, bumpers and hardware, installation of all necessary wiring, conduit fittings, junction boxes, limit switches, devices, illuminated exist signs, push buttons, control panels, warning lights, audible alarms, control trolley busway, power busway, disconnect switches and electrical cables, and metal panel systems.
- .2 The door manufacturer shall provide an authorized representative to supervise erection of doors. The representative shall be experienced in the erection of hangar doors of this type and shall be present during start-up of door operation and during checkout.
- .3 Bottom rails with structural supports and anchors shall be set in positions, leveled and aligned by the hangar door manufacturer.
- .4 Install all electrical equipment, outlets, conduit, and wiring within 610 mm of walls and a minimum on 1220 mm above finished floor.

#### **3.3 SHOP PAINTING**

- .1 Before shipment all steel members and hardware shall be painted with one (1) sprayed on coat of rust-inhibitive primer. All steel shall be thoroughly cleaned prior to painting to remove all oil, rust and other foreign material. Machined surfaces and neoprene weathering shall not be painted.

### **3.4 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.

### **3.5 TESTING**

- .1 Acceptance Test:
  - .1 Contractor shall perform complete operating tests for all door leaves. Perform no less than three complete opening and closing cycles, all safety controls, emergency manual operational system, and such other tests as specified in the Manufacturer's approved door test procedure plan. Notify the Departmental Representative a minimum of seven (7) days prior to the beginning of door tests.
  - .2 Any defects disclosed by the tests shall be corrected; final adjustments of the doors and operating equipment shall be turned over to the Departmental Representative in accordance with Section 01 33 00 – Closeout Submittals. Tests of previously defective items repaired or replaced by the Contractor shall be accomplished at no additional cost to the owner.

### **3.6 DEMONSTRATION**

- .1 After completion and acceptance of the door installation, the hangar door manufacturer shall provide the services of a competent factory service engineer for a period of 2 – four hour sessions, to instruct all shifts of the Departmental Representative and Owner's operating and maintenance personnel in the proper operation, lubrication, maintenance and servicing of the doors and operating systems.

### **3.7 CLEANING**

- .1 Perform cleaning after installation to remove construction and accumulated environmental dirt.
- .2 Clean aluminum, metal and other components with damp rag and approved non-abrasive cleaner in accordance with manufacturer's instructions.
- .3 Remove traces of primer, caulking; clean doors and frames.
- .4 Clean glass and glazing materials with approved non-abrasive cleaner.
- .5 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

**END OF SECTION**

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**Part 1            General**

**1.1                REFERENCES**

- .1     Aluminum Association (AA), Designation System for Aluminum Finishes (2000)
- .2     Canadian Standards Association (CSA) International
  - .1     CSA-A440-00/A440.1-00(R2005), A440-00, Windows / Special Publication A440.1-00, User Selection Guide to CSA Standard A440-00, Windows.
  - .2     CAN/CSA-G164-M92(R2003), Hot Dip Galvanizing of Irregularly Shaped Articles.

**1.2                SHOP DRAWINGS**

- .1     Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.
- .2     Indicate materials and details in full size scale for head, jamb and sill, profiles of components, interior and exterior trim, elevations of unit, anchorage details, location of isolation coating, description of related components and exposed finishes, fasteners, and caulking. Indicate location of manufacturer's nameplates.

**1.3                SAMPLES**

- .1     Submit samples in accordance with Section 01 33 00 - Submittal Procedures.
- .2     Submit two 150 x 150 samples of finish specified.

**1.4                TEST REPORTS**

- .1     Submit test reports from approved independent testing laboratories, certifying compliance with specifications, for:
  - .1     Windows classifications.
  - .2     Anodized finish, weathering characteristics.
  - .3     Air tightness.
  - .4     Water tightness.
  - .5     Wind load resistance.
  - .6     Condensation resistance.
  - .7     Forced entry resistance.

**1.5                CLOSEOUT SUBMITTALS**

- .1     Provide operation and maintenance data for windows for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

**1.6                WASTE MANAGEMENT AND DISPOSAL**

- .1     Separate and recycle waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

## **1.7 MANUFACTURER'S WARRANTY**

- .1 Provide manufacturer's written warranty that frame will not warp, shrink, dent, twist, bow or rot under normal conditions and use for a period of 25 years and against aging and maintenance of window finish for a period of 10 years from date of acceptance of installation.
- .2 Sealed glazing units shall be warranted against failure of the air seal due to defects in material or workmanship for a period of 10 years from date of acceptance of installation

## **Part 2 Products**

### **2.1 MATERIALS**

- .1 Materials: to CSA-A440/A440.1 supplemented as follows:
- .2 All windows by same manufacturer.
- .3 Sash: aluminum, thermally broken.
- .4 Main frame: aluminum, thermally broken.
- .5 Glass: double glazed sealed units in accordance with Section 08 80 50 - Glazing.
- .6 Exterior sills and aluminum facings: brake formed aluminum sheet metal of type and size to suit job conditions; minimum 3 mm thick, complete with joint covers, jamb drip deflectors, chairs, anchors and anchoring devices.
- .7 Isolation coating: alkali resistant bituminous paint.

### **2.2 WINDOW TYPE AND CLASSIFICATION**

- .1 Type: Window specifications are based on Kawneer 5500 Isoweb.
  - .1 Fixed: with double, insulating glass.
- .2 Classification rating: to CSA-A440/A440.1.
  - .1 Air tightness: A3.
  - .2 Water tightness: B7.
  - .3 Wind load resistance: C5.
  - .4 Condensation resistance: Temperature Index of the frame shall be 70 and the glass shall be 80.
  - .5 Forced Entry: F1.

### **2.3 FABRICATION**

- .1 Fabricate in accordance with CSA-A440/A440.1 supplemented as follows:
- .2 Fabricate units square and true with maximum tolerance of plus or minus 1.5 mm for units with a diagonal measurement of 1800 mm or less and plus or minus 3 mm for units with a diagonal measurement over 1800 mm.

- .3 Face dimensions detailed are maximum permissible sizes.
- .4 Brace frames to maintain squareness and rigidity during shipment and installation.
- .5 Finish steel clips and reinforcement with 380 g/m<sup>2</sup> zinc coating to CAN/CSA-G164.

## **2.4 ALUMINUM FINISHES**

- .1 Finish exposed surfaces of aluminum components in accordance with Aluminum Association Designation System for Aluminum Finishes.
  - .1 Clear anodic finish: designation AA-M10C22A41, #14 Clear Anodized Aluminum.

## **2.5 ISOLATION COATING**

- .1 Isolate aluminum from following components, by means of isolation coating:
  - .1 Dissimilar metals except stainless steel, zinc, or white bronze of small area.

## **2.6 GLAZING**

- .1 Glaze windows in accordance with CSA-A440/A440.1.

## **2.7 AIR BARRIER AND VAPOUR RETARDER**

- .1 Equip window frames with factory installed air barrier material for sealing to building 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 from interior.

## **Part 3 Execution**

### **3.1 WINDOW INSTALLATION**

- .1 Install in accordance with CSA-A440/A440.1.
- .2 Attach to structure to permit sufficient adjustment to accommodate existing building conditions and other irregularities.
- .3 Install products specified square, plumb and level. Center window unit in opening and secure window unit as indicated in manufacturer's written instructions. Provide alignment attachments and shims to permanently fasten system to building structure.
- .4 Arrange components to prevent abrupt variation in colour.
- .5 All fasteners are to be concealed. Exposed heads will not be permitted.

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**3.2 CAULKING**

- .1 Seal joints between windows and window sills with sealant. Bed sill expansion joint cover plates and drip deflectors in bedding compound. Caulk between sill upstand and window-frame. Caulk butt joints in continuous sills.
- .2 Apply sealant in accordance with Section 07 92 00 - Joint Sealing. Conceal sealant within window units except where exposed use is permitted by Departmental Representative.

**3.3 CLEANING**

1. Clean interior and exterior surfaces free of labels, mortar, plaster, paint, joint sealers and other foreign mater to prevent damage to weatherstripping.
2. 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.
3. Remove excess sealant by moderate use of mineral spirits or other solvent acceptable to sealant manufacturer.

**3.4 PROTECTION**

- .1 Protect window unit from damage. Protect ventilators and operating parts from dirt and damage caused by subsequent construction activities. Repair or replace damages units.
- .2 Protect finished Work from damage.

**END OF SECTION**



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**Part 1            General**

**1.1                REFERENCES**

- .1 Canadian Steel Door and Frame Manufacturers' Association (CSDFMA).
  - .1 CSDFMA Canadian Metric Guide for Steel Doors and Frames (Modular Construction): standard hardware location dimensions.
- .2 Canadian General Standards Board (CGSB).
  - .1 CAN/CGSB-69.18-M90/ANSI/BHMA A156.1-1981, Butts and Hinges.
  - .2 CAN/CGSB-69.20-M90/ANSI/BHMA A156.4-1986, Door Controls (Closers).
  - .3 CAN/CGSB-69.22-M90/ANSI/BHMA A156.6-1986, Architectural Door Trim.
  - .4 CAN/CGSB-69.29-93/ANSI/BHMA A156.13-1987, Mortise Locks and Latches.
  - .5 CAN/CGSB-69.32-M90/ANSI/BHMA A156.16-1981, Auxiliary Hardware.

**1.2                SUBMITTALS**

- .1 Product Data:
  - .1 Submit manufacturer's printed product literature, specifications and data sheet in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Hardware List:
  - .1 Submit contract hardware list in accordance with Section 01 33 00 - Submittal Procedures.
  - .2 Indicate specified hardware, including make, model, material, function, size, finish and other pertinent information.
- .3 Manufacturer's Instructions:
  - .1 Submit manufacturer's installation instructions.
- .4 Closeout Submittals
  - .1 Provide operation and maintenance data for door closers, locksets, door holders electrified hardware and fire exit hardware for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

**1.3                QUALITY ASSURANCE**

- .1 Regulatory Requirements:
  - .1 Hardware for doors in fire separations and exit doors certified by a Canadian Certification Organization accredited by Standards Council of Canada.
- .2 Test Reports: certified test reports showing compliance with specified performance characteristics and physical properties.
- .3 Certificates: product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

#### **1.4 DELIVERY, STORAGE, AND HANDLING**

- .1 Packing, Shipping, Handling and Unloading:
  - .1 Deliver, store, handle and protect materials in accordance with Section 01 61 00 - Common Product Requirements.
  - .2 Package each item of hardware including fastenings, separately or in like groups of hardware, label each package as to item definition and location.
- .2 Storage and Protection:
  - .1 Store finishing hardware in locked, clean and dry area.

#### **1.5 WASTE DISPOSAL AND MANAGEMENT**

- .1 Separate and recycle waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

#### **1.6 MAINTENANCE**

- .1 Extra Materials:
  - .1 Provide maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.
  - .2 Supply two sets of wrenches for door closers, locksets, and fire exit hardware.

### **Part 2 Products**

#### **2.1 HARDWARE ITEMS**

- .1 Use one manufacturer's products only for similar items.

#### **2.2 DOOR HARDWARE**

- .1 Locks and latches:
  - .1 Mortise locks and latches: to CAN/CGSB-69.29, series 1000 mortise lock, grade 1, designed for function as stated in Hardware Schedule.
  - .2 Lever handles: Corbin Russwin 'LWR' design.
  - .3 Escutcheons: Cast.
  - .4 Normal strikes: box type, lip projection not beyond jamb.
  - .5 Cylinders: Corbin Russwin 6 pin, random bitted, L4 cylinder for construction purposes; Keying by Owner.
  - .6 Finish: 626 satin chrome.
  - .7 Acceptable manufacturer: Corbin Russwin
  - .8 List of locksets:
    - .1 ANSI F15: Corbin Russwin Model ML2029-LWR-626.
- .2 Butts and hinges:
  - .1 Butts and hinges: to CAN/CGSB-69.18.
  - .2 Manufacturers: Stanley, Hager, Monthard, McKinney or approved alternate.

- .3 List of hinges: FBB 168 114 x 114 NRP.
- .3 Door Closers and Accessories:
  - .1 Door controls (closers): to CAN/CGSB-69.20, Grade One, heavy duty, adjustable hydraulic back check, separate regulation of closing speed and latching speed, rack and pinion action. Size in accordance with CAN/CGSB-69.20, Table A1, finished to 626.
  - .2 Manufacturers: LCN, Sargent, Norton, Rixson or approved alternate.
  - .3 List of closers: LCN 4040 with delayed action function.
- .4 Architectural door trim: to CAN/CGSB-69.22, listed in Hardware Schedule, and as listed below.
  - .1 Door protection plates: kick plate type, 1.6 mm thick stainless steel, 300 mm high by 25 mm less than door width, finished to satin steel.
- .5 Auxiliary hardware: to CAN/CGSB-69.32, listed in Hardware Schedule and as listed below.
  - .1 Door check chain: heavy duty compression springs, heavy duty welded steel chain, vinyl cover, 650 mm long, 26D finish.
- .6 Thresholds: 125 mm wide x full width of door opening, stainless steel, mill finish, serrated surface, with thermal break of rigid PVC.
- .7 Weatherstripping:
  - .1 Head and jamb seal:
    - .1 Extruded aluminum frame and solid closed cell neoprene insert, clear anodized finish.
  - .2 Door bottom seal:
    - .1 Heavy duty, door seal of extruded aluminum frame and closed cell neoprene weather seal, surface mounted, closed ends, adjustable, clear anodized finish.

## **2.3 FASTENINGS**

- .1 Use only fasteners provided by manufacturer. Failure to comply may void warranties and applicable licensed labels.
- .2 Supply screws, bolts, expansion shields and other fastening devices required for satisfactory installation and operation of hardware.
- .3 Exposed fastening devices to match finish of hardware.
- .4 Use fasteners compatible with material through which they pass.

## **2.4 KEYING**

- .1 Door locks to be keyed by Owner.
- .2 Provide blank keys in duplicate for every lock in this Contract.
- .3 Provide construction cores.

- .4 Provide all permanent cores and keys to Departmental Representative.

### **Part 3 Execution**

#### **3.1 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 Furnish metal door and frame manufacturers with complete instructions and templates for preparation of their work to receive hardware.
- .3 Furnish manufacturers' instructions for proper installation of each hardware component.

#### **3.2 INSTALLATION**

- .1 Install hardware to standard hardware location dimensions in accordance with Canadian Metric Guide for Steel Doors and Frames (Modular Construction) prepared by Canadian Steel Door and Frame Manufacturers' Association.
- .2 Where door stop contacts door pulls, mount stop to strike bottom of pull.
- .3 Use only manufacturer's supplied fasteners. Failure to comply may void manufacturer's warranties and applicable licensed labels. Use of "quick" type fasteners, unless specifically supplied by manufacturer, is unacceptable.
- .4 Remove construction cores when directed by Departmental Representative.

#### **3.3 ADJUSTING**

- .1 Adjust door hardware, operators, closures and controls for optimum, smooth operating condition, safety and for weather tight closure.
- .2 Lubricate hardware, operating equipment and other moving parts.
- .3 Adjust door hardware to provide tight fit at contact points with frames.

#### **3.4 CLEANING**

- .1 Perform cleaning after installation to remove construction and accumulated environmental dirt.
- .2 Clean hardware with damp rag and approved non-abrasive cleaner, and polish hardware in accordance with manufacturer's instructions.
- .3 Remove protective material from hardware items where present.
- .4 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

**3.5**

**SCHEDULE**

- .1 Hardware group No. 1:
  - .1 1 lockset
  - .2 1½ pair hinges, NRP.
  - .3 1 closer.
  - .4 1 kick plate (interior side).
  - .5 1 check chain.
  - .6 1 threshold.
  - .7 1 set weatherstripping c/w door bottom seal.

**END OF SECTION**

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**Part 1            General**

**1.1            REFERENCES**

- .1    American National Standards Institute (ANSI).
  - .1    ANSI/ASTM E330-02(2010), Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.
- .2    American Society for Testing and Materials International, (ASTM).
  - .1    ASTM C542-05(2011), Specification for Lock-Strip Gaskets.
  - .2    ASTM D2240-05(2010), Test Method for Rubber Property - Durometer Hardness.
- .3    Canadian General Standards Board (CGSB).
  - .1    CAN/CGSB-12.3-M91, Flat, Clear Float Glass.
  - .2    CAN/CGSB-12.8-97, Insulating Glass Units.
- .4    Flat Glass Manufacturers Association (FGMA).
  - .1    FGMA Glazing Manual.
- .5    Laminators Safety Glass Association (LSGA).
  - .1    LSGA Laminated Glass Design Guide.

**1.2            SYSTEM DESCRIPTION**

- .1    Performance Requirements:
  - .1    Provide continuity of building enclosure vapour and air barrier using glass and glazing materials.
  - .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.

**1.3            SUBMITTALS**

- .1    Product Data:
  - .1    Submit manufacturer's printed product literature, specifications and data sheet in accordance with Section 01 33 00 - Submittal Procedures.
  - .2    Submit two copies of WHMIS MSDS - Material Safety Data Sheets in accordance with Section 01 33 00 - Submittal Procedures. Indicate VOC's.
- .2    Shop Drawings:
  - .1    Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.
- .3    Samples:
  - .1    Submit samples in accordance with Section 01 33 00 - Submittal Procedures.

.4 Manufacturer's Instructions:

- .1 Submit manufacturer's installation instructions in accordance with Section 01 33 00 - Submittal Procedures.

.5 Closeout Submittals:

- .1 Provide maintenance data including cleaning instructions for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

**1.4 QUALITY ASSURANCE**

.1 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 testing for glass.

.2 Certificates: product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

.3 Mock-ups:

- .1 Construct mock-ups in accordance with Section 01 45 00 - Quality Control.
- .2 Construct mock-up to including glass, glazing, and perimeter air barrier and vapour retarder seal.
- .3 Mock-up will be used:
  - .1 To judge workmanship, substrate preparation, operation of equipment and material application.
- .4 Locate where directed.
- .5 Allow 24 hours for inspection of mock-up before proceeding with work.
- .6 When accepted, mock-up will demonstrate minimum standard of quality required for this work. Approved mock-up may remain as part of finished work.

**1.5 SITE CONDITIONS**

.1 Environmental 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.

**1.6 WASTE MANAGEMENT AND DISPOSAL**

.1 Separate and recycle waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

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**Part 2            Products**

**2.1                MATERIALS: FLAT GLASS**

- .1        Float glass: to CAN/CGSB-12.3.

**2.2                MATERIALS: SEALED INSULATING GLASS**

- .1        Insulating glass units: to CAN/CGSB-12.8, double unit, 25 mm overall thickness.
  - .1        Glass: to CAN/CGSB-12.3.
  - .2        Glass thickness: 6 mm each light.
  - .3        Exterior Lite:
    - .1        Heat strengthened.
    - .2        Colour: clear.
  - .4        Inter-cavity space thickness: 12.7 mm with low conductivity spacers.
  - .5        Interior Lites:
    - .1        Colour: clear.
  - .6        Glass coating: Low E coating, surface number 2.
    - .1        Manufacturers:
      - .1        AGC "Comfort TI-AC-40."
      - .2        PPG "Solarban 60."
      - .3        Approved alternate.
  - .7        Inert gas fill: argon.
  - .8        Spacer: warm edge "Superspacer."

**2.3                ACCESSORIES**

- .1        Sealant: in accordance with 07 92 00 - Joint Sealants.
- .2        Setting blocks: Neoprene, 80-90 Shore A durometer hardness to ASTM D2240, to suit glazing method, glass light weight and area.
- .3        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.
- .4        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.
- .5        Glazing splines: as recommended by aluminum window manufacturer.
- .6        Glazing clips: manufacturer's standard type.
- .7        Lock-strip gaskets: to ASTM C542.



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**Part 3            Execution**

**3.1                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.

**3.2                EXAMINATION**

- .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.

**3.3                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.

**3.4                INSTALLATION: INTERIOR - DRY METHOD (TAPE AND TAPE)**

- .1        Perform work in accordance with FGMA Glazing Manual, IGMAC and Laminators Safety Glass Association - Standards Manual for glazing installation methods.
- .2        Cut glazing tape to length and set against permanent stops, projecting 1.6 mm above sight line.
- .3        Place setting blocks at 1/4 points, with edge block maximum 150 mm from corners.
- .4        Rest glazing on setting blocks and push against tape for full contact at perimeter of light or unit.
- .5        Place glazing tape on free perimeter of glazing in same manner described.
- .6        Install removable stop without displacement of tape. Exert pressure on tape for full continuous contact.
- .7        Knife trim protruding tape.

**3.5                CLEANING**

- .1        Perform cleaning after installation to remove construction and accumulated environmental dirt.
- .2        Remove traces of primer, caulking.
- .3        Remove glazing materials from finish surfaces.
- .4        Remove labels after work is complete.

- .5 Clean glass using approved non-abrasive cleaner in accordance with manufacturer's instructions.
- .6 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

### **3.6 PROTECTION OF FINISHED WORK**

- .1 After installation, mark light with an "X" by using removable plastic tape or paste.

### **3.7 SCHEDULE**

- .1 Refer to drawings.

**END OF SECTION**