

Part 1 General

1.1 REFERENCES

- .1 National Building Code, complete with Manitoba Amendments.
- .2 CAN/ULC-S132, Emergency Exit and Emergency Fire Exit Hardware.
- .3 American National Standards Institute (ANSI) / Builders Hardware Manufacturers Association (BHMA)
 - .1 ANSI/BHMA A156.1-2016, American National Standard for Butts and Hinges.
 - .2 ANSI/BHMA A156.2-2017, Bored and Preassembled Locks and Latches.
 - .3 ANSI/BHMA A156.3-2014, Exit Devices.
 - .4 ANSI/BHMA A156.4-2013, Door Controls - Closers.
 - .5 ANSI/BHMA A156.5-2014, Auxiliary Locks and Associated Products.
 - .6 ANSI/BHMA A156.6-2015, Architectural Door Trim.
 - .7 ANSI/BHMA A156.8-2015, Door Controls - Overhead Stops and Holders.
 - .8 ANSI/BHMA A156.10-2017, Power Operated Pedestrian Doors.
 - .9 ANSI/BHMA A156.12-2018, Interconnected Locks and Latches.
 - .10 ANSI/BHMA A156.13-2017, Mortise Locks and Latches Series 1000.
 - .11 ANSI/BHMA A156.15-2015, Release Devices - Closer Holder, Electromagnetic and Electromechanical.
 - .12 ANSI/BHMA A156.16-2018, Auxiliary Hardware.
 - .13 ANSI/BHMA A156.18-2016, Materials and Finishes.
 - .14 ANSI/BHMA A156.19-2013, Power Assist and Low Energy Power - Operated Doors.
 - .15 ANSI/BHMA A156.20-2017, Strap and Tee Hinges and Hasps.
- .4 Canadian Standards Association (CSA)
 - .1 CSA B651-18, Accessible Design for the Built Environment.
- .5 Canadian Steel Door and Frame Manufacturers' Association (CSDMA)
 - .1 CSDMA Recommended Dimensional Standards for Commercial Steel Doors and Frames - 2009.
- .6 National Fire Protection Association (NFPA)
 - .1 NFPA 80, Standard for Fire Doors and Other Opening Protectives.
 - .2 NFPA 252, Fire Tests of Door Assemblies.
- .7 Underwriter's Laboratories of Canada (ULC)
 - .1 CAN/ULC S104, Fire Tests of Door Assemblies.
- .8 Winnipeg Accessibility Design Standards (WADS) – latest edition.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for door hardware and include product characteristics, performance criteria, physical size, finish and limitations.
- .2 Shop drawings:

- .1 Indicating locations and mounting heights of each type of hardware, schedules, electrical characteristics, and connection requirements.
- .3 Hardware List:
 - .1 Submit contract hardware list.
 - .2 Indicate specified hardware, including make, model, material, function, size, finish and other pertinent information.
- .4 Manufacturer's Instructions: submit manufacturer's installation instructions.
- 1.3 CLOSEOUT SUBMITTALS**
 - .1 Operation and Maintenance Data: submit operation and maintenance data for door hardware for incorporation into manual.
- 1.4 MAINTENANCE MATERIALS SUBMITTALS**
 - .1 Extra Stock Materials:
 - .1 Supply maintenance materials as per below:
 - .1 Tools:
 - .1 Supply 2 set(s) of wrenches for door closers, locksets and fire exit hardware or any speciality tools required.
- 1.5 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 Certificates: product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.
- 1.6 DELIVERY, STORAGE AND HANDLING**
 - .1 Deliver, store and handle materials in accordance 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 Package items of hardware including fastenings, separately or in like groups of hardware, label each package as to item definition and location.
 - .4 Storage and Handling Requirements:
 - .1 Store materials off ground, indoors, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect door hardware from nicks, scratches, and blemishes.
 - .3 Protect prefinished surfaces with wrapping/ strippable coating.
 - .4 Replace defective or damaged materials with new.
- Part 2 Products**
 - 2.1 HARDWARE ITEMS**
 - .1 Use one manufacturer's products only for similar items.

2.2 DOOR HARDWARE

- .1 Butts and hinges: to ANSI/BHMA A156.1, heavy weight.
- .2 Exit devices: to ANSI/BHMA A156.3, Grade 1, to NFPA 80 and NFPA 1-1, push devices listed and ULC labelled.
- .3 Cylinders: to ANSI/ BHMA A156.5, solid brass, 6pin, to suit lock; finish to match.
- .4 Door Closers and Accessories:
 - .1 Door controls (closers): to ANSI/BHMA A156.4, Grade 1 and ANSI A117.1, aluminum case; rack and pinion operation; adjustable backcheck intensity.
 - .1 Arms: Heavy-duty forged steel, as scheduled.
- .5 Architectural door trim: to ANSI/BHMA A156.6, designated by letter J and numeral identifiers listed in Hardware Schedule.

2.3 MISCELLANEOUS HARDWARE

- .1 Indexed key control system: to ANSI/BHMA A156.5, designated by letter E and numeral identifiers, wall mounted system, colour enamel paint finish. Confirm location with Contract Administrator.

2.4 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 Where pull is scheduled on one side of door and push plate on other side, supply fastening devices, and install so pull can be secured through door from reverse side. Install push plate to cover fasteners.
- .5 Use fasteners compatible with material through which they pass.

2.5 KEYING

- .1 Doors, padlocks and cabinet locks to be keyed as directed by City of Winnipeg Assets and Project Management department. Confirm all keying requirements.
- .2 Prepare detailed keying schedule in conjunction with City of Winnipeg Assets and Project Management department and Contract Administrator.
- .3 Supply keys in duplicate for every lock in this Contract.
- .4 Supply 3 master keys for each master key or grand master key group.
- .5 Stamp keying code numbers on keys and cylinders.
- .6 Supply construction cores as required.
- .7 Hand over permanent cores and keys to City of Winnipeg Assets and Project Management department.

Part 3 Execution

3.1 INSTALLATION

- .1 Manufacturer's Instructions: comply with manufacturer's written recommendations, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.
- .2 Ensure blocking is installed as required for all door hardware, including wall stops.
- .3 Supply metal door and frame manufacturers with complete instructions and templates for preparation of their work to receive hardware.
- .4 Supply manufacturers' instructions for proper installation of each hardware component.
- .5 Install hardware to standard hardware location dimensions in accordance with CSDFMA Canadian Metric Guide for Steel Doors and Frames (Modular Construction).
- .6 Where door stop contacts door pulls, mount stop to strike bottom of pull.
- .7 Use only manufacturer's supplied fasteners.
 - .1 Use of "quick" type fasteners, unless specifically supplied by manufacturer, is unacceptable.
- .8 Remove construction cores at completion of construction as directed by City of Winnipeg Assets and Project Management department.
 - .1 Install permanent cores and ensure locks operate correctly.

3.2 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 ensure tight fit at contact points with frames.

3.3 CLEANING

- .1 Progress Cleaning:
 - .1 Clean hardware with damp rag and approved non-abrasive cleaner, and polish hardware in accordance with manufacturer's instructions.
 - .2 Remove protective material from hardware items where present.
 - .3 containers and bins from site and dispose of materials at appropriate facility.

3.4 DEMONSTRATION

- .1 Keying System Setup and Cabinet:
 - .1 Set up key control system with file key tags, duplicate key tags, numerical index, alphabetical index and key change index, label shields, control book and key receipt cards.
 - .2 Place file keys and duplicate keys in key cabinet on their respective hooks.
- .2 Maintenance Staff Briefing:
 - .1 Brief maintenance staff regarding:
 - .1 Proper care, cleaning, and general maintenance of projects complete hardware.
 - .2 Description, use, handling, and storage of keys.
 - .3 Use, application, and storage of wrenches for door closers, locksets and fire exit hardware.

- .3 Demonstrate operation, operating components, adjustment features, and lubrication requirements.

3.5 PROTECTION

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

3.6 HARDWARE SETS

Set: 1.0

1 Exit Device Trim	990NL	626	VD
1 BEST Cylinder	Re-Use Existing		BE

Notes: Remove existing thumbpiece pull and replace with storeroom type pull. All hardware from existing door to be re-used.

Above hardware is shown as a guide only. Confirm existing hardware on site prior to ordering hardware.

Set: 2.0

1 Exit Device Trim	810-STS	US26D	SA
1 BEST Cylinder	Re-Use Existing		BE

Notes: Remove existing thumbpiece pull and replace with dummy type pull. Re-Use existing cylinder. All hardware from existing door to be re-used.

Above hardware is shown as a guide only. Confirm existing hardware on site prior to ordering hardware.

Set: 3.0

2 Electric Latch Retraction Kit	Von Duprin QEL Kit to Suit		VD
1 Auto Operator	SW200i double operator c/w door mounted safety sensors **	689	BM
1 On/Off/Hold-Open Switch	By Section 08 71 13 **		BM
2 Door Loop	DL-2		AK
2 Relay	Camden CX-12 Plus		OT
1 Full Height Wireless Actuator	By Section 08 71 13 **		OT
2 Bollard with Full Height Wireless Actuator	By Section 08 71 13 **		OT
1 Bollard with Full Height Wired Actuator (Prep for Card Reader)	By Section 08 71 13 **		OT
1 Card Reader	By Security/Electrical		OT
1 Power Supply	PS902 .900-4RL-FA		VD
2 Electric Power Transfer	CEPT-10		SU

Notes: - Existing operator on single door to remain.

- Existing magnetic holders to be decommissioned.
- Remove existing door closers on the pair of doors.
- Existing electric strike on single door to remain. Confirm the existing electric strike is fail secure.
- Install CEPT-10 power transfers if possible. If not possible use door loops shown above.
- Add SW200i double operator to pair of doors. Add electric latch retraction kits to existing doors. Add door loops to existing doors.
- Existing exit device trims and cylinders to remain.
- Confirm operation of all existing hardware and replace any defective items as required. Power to electric latch retraction and auto operator to disconnect on fire alarm signal.
- Wireless actuator for use on pull side of single door. Bollard with wired actuator and card reader for use on pull side of the pair of doors. Both bollards with wireless actuators for use on push side of single door and push side of pair.
- Single door to have own actuators. Other actuators for pair.
- When doors are locked, swiping valid card will unlock all 3 doors. Pressing actuators will power open either the single door or the pair.

**Supplied and installed by Section 08 71 13.

Set: 4.0

2	4 Wire Electric Hinge	To Match Existing Hinges		OT
2	Electric Latch Retraction Kit	Von Duprin QEL Kit to Suit		VD
3	Exit Device Trim	990NL	626	VD
3	BEST Cylinder	Re-Use Existing		BE
1	Auto Operator	SW200i double operator c/w door mounted safety sensors **	689	BM
1	On/Off/Hold-Open Switch	By Section 08 71 13 **		BM
2	Door Loop	DL-2		AK
1	Relay	Camden CX-12 Plus		OT
1	Bollard with Full Height Wireless Actuator	By Section 08 71 13 **		OT
1	Bollard with Full Height Wired Actuator (Prep for Card Reader)	By Section 08 71 13 **		OT
1	Card Reader	By Security/Electrical		OT
1	Power Supply	PS902 .900-4RL-FA		VD

- Notes: - Replace existing thumbpieces with new levers.
- Existing magnetic holders to be decommissioned. Remove existing Sentronic closer/holders.
 - Install thru-wire hinges if possible. If not possible use door loops shown above. Confirm existing hinge size on site.
 - Add SW200i double operator to pair of doors. Add electric latch retraction kits to existing doors.
 - Confirm operation of all existing hardware and replace any defective items as required. Power to electric latch retraction and auto operator to disconnect on fire alarm signal.
 - Doors to be in hold open position during operating hours. Doors to unlock via card reader on walkway side off hours, allowing use of actuator. Pair of doors to open via actuator on library side off hours.

**Supplied and installed by Section 08 71 13.

Set: 5.0

2	4 Wire Electric Hinge	To Match Existing Hinges		OT
2	Fire Rated Surf Vert Rod	.QEL 9827.L-BE.F .996L-BE	.626	VD

1	Fire Rated Rim Exit	98.L-BE.F .996L-BE	.626	VD
1	Auto Operator	SW200i double operator c/w door mounted safety sensors **	689	BM
1	On/Off/Hold-Open Switch	By Section 08 71 13 **		BM
2	Door Loop	DL-2		AK
1	Relay	Camden CX-12 Plus		OT
1	Timer	Camden CX-1000/77 **		OT
2	Bollard with Full Height Wireless Actuator	By Section 08 71 13 **		OT
1	Power Supply	PS902 .900-4RL-FA		VD

Notes: Single door - replace exit device with new device shown. Sentronic closer to remain however power to it is to be disconnected in order to operate as a standard closer.

Pair doors - replace exit devices with new electric latch retraction devices. Remove Sentronic closers and add double Besam operator. Install electric hinges if possible, if not use door loop. Confirm hinge size on site.

Trims on all devices to be passage type - no locking.

- Pair of doors to be normally held open. If closed using actuator on either side of door will retract the exit device latches and power open the doors. Actuator on skywalk side to be installed on flat portion of ramp and to include an extended hold open when pressed.

- Power to electric latch retraction and auto operator to disconnect on fire alarm signal.

**Supplied and installed by Section 08 71 13.

Set: 6.0

1	On/Off/Hold-Open Switch	By Section 08 71 13 **		BM
1	Auto Operator	SW200i Single Operator c/w door mounted safety sensors**	689	BM
2	Bollard with Full Height Wireless Actuator	By Section 08 71 13 **		OT

Notes: Remove existing Sentronic closer from north leaf and replace with auto operator. Lower existing pulls - confirm height with architect.

**Supplied and installed by Section 08 71 13.

Set: 7.0

4	Hinge, Full Mortise, Hvy Wt	T4A3786 4-1/2" x 4-1/2"	US26D	MK
1	Push Bar & Pull	BF15847	US28	RO
1	Auto Operator	SW200i Single Operator c/w door mounted safety sensors**	689	BM
1	Floor Stop	441H	US26D	RO
2	Full Height Wireless Actuator	By Section 08 71 13 **		OT

Notes: Replace pair of doors with 40: wide single door. Door to be push/pull only - no locking.

**Supplied and installed by Section 08 71 13.

Set: 8.0

1 On/Off/Hold-Open Switch	By Section 08 71 13 **		BM
1 Auto Operator	SW200i Single Operator c/w door mounted safety sensors**	689	BM
2 Full Height Wired Actuator	By Section 08 71 13 **		OT

Notes: Remove existing Sentronic closer from north leaf and replace with auto operator.

**Supplied and installed by Section 08 71 13.

Set: 9.0

4 Hinge, Full Mortise, Hvy Wt	T4A3786 4-1/2" x 4-1/2"	US26D	MK
2 Hinge, Full Mortise, Hvy Wt	T4A3786 CC8 4-1/2" x 4-1/2"	US26D	MK
2 Fire Rated Surf Vert Rod	.QEL 9827.L-BE.F .996L-BE	.626	VD
1 Auto Operator	SW200i double operator c/w door mounted safety sensors **	689	BM
1 On/Off/Hold-Open Switch	By Division 08 71 13 **		BM
1 Gasketing	S88BL 20'		PE
1 Astragal	351C/CP		PE
1 Full Height Wireless Actuator	By Section 08 71 13 **		OT
1 Bollard with Full Height Wireless Actuator	By Section 08 71 13 **		OT
1 Power Supply	PS902 .900-4RL-FA		VD

Notes: Remove existing doors and replace with new doors. Doors to have vertical rod exit devices on each door. Doors normally held open by use of on/off/hold open switch. No locking on these doors. If doors are closed pressing actuator on either side of door will retract the exit device latches and power open both doors. Confirm hinge size and type on site. Bollard for use on pull side of door.

**Supplied and installed by Section 08 71 13.

Set: 10.0

1 Exit Device Trim	373L-BE	626	VD
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Notes: Remove existing thumbpiece and replace with lever. Trim shown above is for a guide only. Confirm requirements on site. Modify existing panic if possible, to suit lever trim. All hardware from existing door to be re-used.

Set: 11.0

4 Hinge, Full Mortise, Hvy Wt	T4A3786 4-1/2" x 4-1/2"	US26D	MK
1 Push Bar & Pull	BF15847	US28	RO
1 Floor Stop	441H	US26D	RO
1 Wireless Receiver	By Section 08 71 13 **		OT
2 Full Height Wireless Actuator	By Section 08 71 13 **		OT

Notes: Replace pair of doors with 40: wide single door. Door to be push/pull only - no locking. Re-use existing operator. Install new full height actuators.

**Supplied and installed by Section 08 71 13.

END OF SECTION

PART 1 - General

1.1 SUMMARY

- A. This section includes the following types of automatic door operators:
 - 1. Low energy and power assist door operators for swinging doors.
- B. Related Sections:
 - 1. Section 8 Section "Door Hardware" for hardware to the extent not specified in this Section.
 - 2. Division 26 and 28 Sections for electrical connections including conduit and wiring for automatic entrance door operators and access control devices.

1.2 REFERENCES

- A. References: Refer to the version year adopted by the Authority Having Jurisdiction.
 - 1. ANSI A117.1 - Accessible and Usable Buildings and Facilities.
 - 2. ICC/IBC - International Building Code.
 - 3. CUL – Approved for use in Canada.
 - 4. NFPA 70 - National Electrical Code.
 - 5. NFPA 80 - Fire Doors and Windows.
 - 6. NFPA 101 - Life Safety Code.
 - 7. NFPA 105 - Installation of Smoke Door Assemblies.
- B. American National Standards Institute (ANSI) / Builders Hardware Manufacturers Association (BHMA).
 - 1. ANSI/BHMA A156.10 American National Standard for Power Operated Pedestrian Doors.
 - 2. ANSI/BHMA A156.19 Standards for Power Assist and Low Energy Power Operated Doors.
- C. Underwriters Laboratories (UL).
 - 1. UL Listed R-9469 Fire Door Operator with Automatic Closer.
 - 2. UL10C – Positive Pressure Fire Tests of Door Assemblies.
 - 3. UL 325 Standard for Safety for Door, Drapery, Gate, Louver and Window Operators and Systems.
 - 4. UL991 Listed - Tests for Safety-Related Controls Employing Solid-State Device.
 - 5. UL244A – Solid – State Controls for Appliances.
 - 6. UL1998 – Software in Programmable Components.
 - 7. UL1310 – Class 2 Power Units.
- D. Canadian Standards Association (CSA).
 - 1. CAN/CSA-C22.2 NO 223-M91 – Power Supplies With Extra-Low-Voltage Class 2 Outputs.
 - 2. CAN/CSA-C22.2 NO 223-M92 – Operators and Systems of Doors, Gates, Draperies, and Louvers.
- E. American Association of Automatic Door Manufacturers (AAADM).
- F. American Society for Testing and Materials (ASTM).
 - 1. ASTM B221 Standard Specification for Aluminum and Aluminum Alloy Extruded Bars, Rods, Wire, Profiles and Tubes.
 - 2. ASTM B209 Standard Specification for Aluminum and Aluminum Alloy Sheet and Plate.

- G. American Architectural Manufacturers Association (AAMA).
 - 1. AAMA 611 Voluntary Specification for Anodized Architectural Aluminum.
- H. National Association of Architectural Metal Manufacturers (NAAMM).
 - 1. Metal Finishes Manual for Architectural Metal Products.
- I. International Code Council (ICC).
 - 1. IBC: International Building Code.

1.3 DEFINITIONS

- A. Activation Device: Device that, when actuated, sends an electrical signal to the door operator to activate the operation of the door.
 - 1. Knowing act: Consciously initiating the opening of a power operated door using acceptable methods including wall mounted switches such as push plates and controlled access devices such as keypads, card readers and key switches.
- B. Safety Device: A device that detects the presence of an object or person within a zone where contact could occur and provides a signal to stop the movement of the door.
- C. Double Egress Doors: A pair of doors that swing with the two doors moving in opposite directions and no mullion between them.

1.4 PERFORMANCE REQUIREMENTS

- A. Automatic door equipment accommodates medium to heavy pedestrian traffic.
- B. Opening Force Requirements: Doors shall open with a manual force, not to exceed 30lbf (133N) to set the door in motion and 15 lbf to fully open the door applied at 1" (25 mm) from the latch edge of the door. The force required to prevent a stopped door from opening or closing shall not exceed 15 lbf (67 N) measured 1" (25 mm) from the latch edge of the door at any point during opening or closing.
- C. Closing Time:
 - 1. Doors shall be field adjustable to close from 90 degrees to 10 degrees in 3 seconds or longer as applicable per ANSI/BHMA A156.19 standards.
 - 2. Doors shall be field adjusted to close from 10 degrees to fully closed in not less than 1.5 seconds.
- D. All operating requirements / parameters to meet or exceed Winnipeg Accessibility Design Guidelines (latest edition according to tender close date).

1.5 SUBMITTALS

- A. Product Data: Manufacturer's product data sheets including installation details, material descriptions, dimensions of individual components and profiles, fabrication, operational descriptions and finishes.
- B. Shop Drawings: Submit manufacturer's shop drawings, including elevations, sections and details, indicating dimensions, materials, operator, motion /presence sensor control device, anchors, hardware, finish, options and accessories.

1. Indicate required clearances, and location and size of each field connection.
 2. Indicate locations and elevations of entrances showing activation and safety devices.
 3. Wiring Diagrams: For power, signal, and activation / safety device wiring.
- C. Samples: Submit manufacturer's samples of aluminum finish.
- D. Manufacturers Field Reports: Submit manufacturer's field reports from AAADM certified technician of inspection and approval of doors for compliance with ANSI/BHMA after completion of installation.
- E. Operating and Maintenance Manuals: Provide manufacturers operating and maintenance manuals for each item comprising the work of this section. The manual to include the name, address, and contact information of the manufacturers providing the operators and their nearest service representatives. The final copies delivered after completion of the installation test to include spare parts list.
- F. Warranties and Maintenance: Special warranties and maintenance agreements specified in this Section.

1.6 QUALITY ASSURANCE

- A. Manufacturers Qualifications: Engage qualified manufacturers with a minimum 10 years of documented experience in manufacturing of doors and equipment of similar to that indicated for this Project and that have a proven record of successful in-service performance. Manufacturer to have a company certificate issued by AAADM.
- B. Installer Qualifications: Installers, trained by the primary product manufacturers, with a minimum 3 years documented experience installing and maintenance of units similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.
- C. Certified Inspector Qualifications: Certified by AAADM.
- D. Source Limitations for Automatic Door Operators: Obtain each type of door, frame, operator and sensor components specified in this Section from a single source, same manufacturer unless otherwise indicated.
- E. Certifications: Operators shall be certified by the manufacturer to meet performance design criteria in accordance with the following standards.
1. ANSI/BHMA A156.19 American National Standard for Power Assist and Low Energy Operated Doors.
 2. NFPA 101 - Life Safety Code.
 3. UL 325 - Standard for Door, Drapery, Gate, Louver, and Window Operators and Systems.
 4. UL Listed R-9469 Fire Door Operator with Automatic Closer.
- F. Emergency Exit Door Requirements: Comply with requirements of authorities having jurisdiction for automatic entrance doors serving as a required means of egress.

1.7 COORDINATION

- A. Coordinate door operators with doors, frames and related work to ensure proper size, thickness, hand, function and finish. Coordinate hardware for automatic entrances with hardware required for rest of the project.

- B. Electrical System Roughing-in: Coordinate layout and installation of power door operators with connections to power supplies and access control system as applicable.

1.8 WARRANTY

- A. General Warranty: Special warranties specified in this Article shall not deprive City of Winnipeg Assets and Project Management department of other rights City of Winnipeg Assets and Project Management department may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.
- B. Automatic Door Operators shall be free of defects in material and workmanship for a period of one (1) year from the date of substantial completion.
- C. During the warranty period a factory-trained technician shall perform service and affect repairs. An inspection shall be performed after each adjustment or repair.
- D. During the warranty period all warranty work, including but not limited to emergency service, shall be performed during normal business hours.
- E. Manufacturer shall have in place a dispatch procedure that shall be available 24 hours a Day, 7 Days a week for emergency call back service.

PART 2 - Products

2.1 MANUFACTURER

- A. Manufacturer: ASSA ABLOY Entrance Systems, 1900 Airport Road, Monroe, NC 28110. Toll Free (888) 608-9242. Local (204) 223-0437. Website www.assaabloyentrance.ca Contact: bryan.bell@assaabloy.com
- B. Substitutions: Refer to tender bidding procedures Clause B7 – Substitutes.

2.2 MATERIALS

- A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated, as indicated below:
 - 1. Extruded Aluminum, Alloy 6063-T5.

2.3 SWING DOOR OPERATORS

- A. Model: Besam ASSA ABLOY SW200i low energy automatic door operator (Basis of Design):
 - 1. Reference Standard: ANSI/BHMA A156.19.
 - 2. Configuration: Operator to control single swinging doors and pairs of swinging doors as indicated on the drawings and specified below:
 - a. Traffic Pattern: Two way.
 - b. Pairs of Doors: Simultaneous swing.
 - 3. Automatic Door Operator: Electro-mechanical, non-handed operator, powered by 24 volt, 1/4 hp motor. Operator shall be adjustable to compensate for different manual push forces as required.
 - a. Automatic operator shall be capable of operating and controlling up to a 700 pound (317.5 kg) door, 48 inches (1219 mm) in width.

- b. Surface Mounted Operator:
 - 1) Surface Mounted Housing: Continuous for full width of door.
 - 2) Connecting Hardware: Surface mounted operators to have a steel arm from the operator, mounted to the top face of the swing door.
 - 3) UL Listed R-9469 Fire Door Operator with Automatic Closer (surface mounted operator).
- c. Operator shall be field switchable between an ANSI/BHMA A156.19 and an ANSI/BHMA A156.10 compliant operator and vice versa. Addition of the required safety sensors, activation devices and guard rails may be required to comply with the applicable standard.
- d. Operator Temperature Range: Capable of operating within temperature ranges of -31° F to 160° F (-35° C to 71° C).
- e. Electrical Characteristics: Maximum power consumption is 300 watts (2.5 amps at 120 VAC), 50/60hz, built-in thermal overload protection.
- 4. Door Operation:
 - a. Opening Cycle The adjustable speed operator mechanically powers the drive shaft and the torque control maintains constant speed throughout the opening cycle regardless of stack pressures or wind speed. Operator shall allow manual door operation with operational forces as indicated to fully open the door applied at 1" (25 mm) from the latch edge of the door.
 - 1) Manual push force shall be adjustable from 5 lbf to 15 lbf maximum.
 - b. Hold Open: The operator shall stop and hold the door open at the selected door opening angle for an adjustable period of time (1.5 seconds to 30 seconds).
 - c. Closing Cycle: Spring close with speed controlled power assist.
 - 1) Upon loss of power, dynamic braking will control the door insuring controlled closing.
 - 2) Selectable Torque Control: Automatically adjusts torque without changing the closing speed of the operator.
 - a) When the torque control is activated, the closing speed shall remain constant regardless of stack pressures or wind speed.
 - b) Torque Cancellation: The torque control is deactivated whenever there is a signal received from door mounted sensors.
 - c) The torque control is disabled during manual use of the door.
 - d. Wind Force Dampening: The operator electromechanically counteracts wind forces, slowing down the door movement to safely open or close the door.
 - e. Stack Pressure Compensation: Operator shall counteract positive stack pressures, negative stack pressures, and sudden changes of stack pressures. The operator never allows the door to open or close faster than the speed control settings, regardless of pressures.
 - f. Obstruction Control: The operator will stop and reverse the door movement.
 - g. Electric Lock Management:
 - 1) Internal module for electrified locking integration.
 - 2) Electric Lock Output: Selectable 12 VDC, maximum 1200 mA / 24 VDC, maximum 600 mA.
 - 3) Lock monitoring prevents operator(s) from opening door(s) until release of electrified lock.
 - 4) Operator pulls door closed before opening, automatically unjamming electric latch hardware.
 - 5) Sequenced operation between operators for pairs of doors allowing lock release and astragal coordination.
 - h. Lock Retry Circuit: If attempt to fully close the door is unsuccessful, the operator will automatically reverse open 10 degrees and reclose in an attempt to successfully close the door.

- i. Selectable Alarm Reset: The operator can be field set so that after receiving an alarm signal, the operator will not accept any activation impulses and will operate only as a manual door closer until manually reset.
 - j. Electronic Controls: Solid state integrated circuit controls the operation and switching of the swing power operator. The electronic control provides low voltage power supply for all means of actuation. The controls include time delay (1 to 30 seconds) for normal cycle.
 - k. Control Switch: Automatic door operators shall be equipped with the following type of multi-position function switch:
 - 1) 3 position rocker switch mounted inside the door header (Off-Auto-Hold).
 - 2) Door operator must be capable of infinite hold-open without requiring additional activation signals.
5. Operator Interface:
- a. Safety Sensor Integration for overhead presence safety device and door mounted reactivation safety sensors.

2.4 ACTIVATION DEVICES

- A. General: Provide activation devices in accordance with ANSI/BHMA standards, for condition of exposure and for long-term, maintenance-free operation under normal traffic load for type of occupancy indicated. Coordinate activation and safety devices with door operation and door operator mechanisms.
- B. Knowing Act Activation Device:
 1. Push Plate: Hard wired and wireless, 36" Full Length WIKK I36-3 Ingress'R push plate switches complete with "Push to Open" text and a blue wheelchair accessibility symbol.
 2. WIKK Bollards as follows:
 - a. D202a/202b
 - 1) One (1) x B-6SQ-RT-CL-ING48SG
 - 2) Two (2) x B-6SQ-RT-CL-INGR
 - b. D203a/203b
 - 1) One (1) x B-6SQ-RT-CL-ING48SG
 - 2) One (1) x B-6SQ-RT-CL-INGR
 - c. D204a/204b
 - 1) Two (2) x B-6SQ-RT-CL-INGR
 - d. D205
 - 1) Two (2) x B-6SQ-RT-CL-INGR
 - e. D211
 - 1) One (1) x B-6SQ-RT-CL-INGR
- C. Manual Operation:
 1. Operator shall allow manual door operation with operational forces adjustable from 5 lbf to 15 lbf maximum.

2.5 SAFETY DEVICES

- A. Safety Devices:
 1. Door Mounted Presence Sensor (DMPS): Shall be the ASSA ABLOY door mounted infrared presence safety device (mounted at top of each door); adjustable to provide detection field sizes and functions required by ANSI/BHMA A156.10.
 - a. Unit to provide detection during the travel of the door.
 - b. Upon detection the sensor shall provide a signal to stop or reverse the door action.

2. Door Mounted Safety Sensor Devices: Safety sensor devices shall be door mounted as specified.
 - a. The door mounted safety sensor devices shall be mounted on the approach (push) side of the door (1 safety sensor per leaf), providing detection on one side of the door only.
 - b. Power transfer from the door mounted safety sensor to operator shall be through an exposed door cord.

2.6 ALUMINUM FINISHES

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Automatic Door Operator Enclosure:
 1. Anodized Finish:
 - a. AAMA 611, Clear, AA- M12C22A41, Class I, 0.018 mm.

2.7 QUALITY CONTROL

- A. Before placing doors into operation, AAADM certified technician shall inspect and approve doors for compliance with ANSI/BHMA A156.19. Certified technician shall be approved by manufacturer.

2.8 CLEANING AND PROTECTION

- A. Clean adjacent surfaces soiled by automatic door operator installation.
- B. Clean metal surfaces promptly after installation. Remove excess sealants, compounds, dirt and other substances. Repair damages and finish to match original finish.

2.9 DEMONSTRATION

- A. Engage a factory-authorized representative to train City of Winnipeg Assets and Project Management department's maintenance personnel to adjust, operate, and maintain safe operation of the door.

END OF SECTION

Part 1 General**1.1 GENERAL**

- .1 All drawings and all sections of the specifications shall apply to and form an integral part of this section.

1.2 CODES AND STANDARDS

- .1 Electrical installation shall be in accordance with current approved edition of the Canadian Electrical Code CSA C22.1.
- .2 Electrical installation shall be in accordance with current edition of the Canadian Electrical Code, Provincial and other codes, rules and regulations. It is not the intention of the drawings and specifications to reiterate the Code. It is expected that the Contractor will be responsible for, but not limited to access panels, ground fault receptacles, tamper-resistant receptacles, wire sizes and methods, conduit sizes, fire rating of cables, coordination of circuit protection components, fire alarm ancillary devices, exit and emergency lighting requirements, specialty ratings for cable for elevators etc. Notify the Contract Administrator of any detected code deficiencies prior to submission of tender. In the absence of such notifications, it will be assumed that the Contractor has accepted responsibility for a complete code-compliant installation, and no additional compensation will be provided for code-related items.
- .3 Supply materials and labour required to meet requirements of codes, rules and regulations, whether or not such work is indicated on the drawings or in specifications.
- .4 Where Division 26 specifies better quality of construction (or materials) than minimum code requirements, the more expensive of the two will be provided.
- .5 Electrical installation shall be in accordance with the requirements of the electrical supply authority and local inspections authority.
- .6 Emergency systems to be in accordance with CSA C282.
- .7 All underground systems will be installed in accordance with CSA C22.3 except where specified otherwise.

1.3 CARE, OPERATION AND START-UP

- .1 Instruct operating personnel in the operation, care and maintenance of systems, system equipment and components. Arrange care and instructional sessions to be provided at a time convenient to the City of Winnipeg.
 - .2 Arrange and pay for services of manufacturer's factory service engineer to supervise start-up of installation, check, adjust, balance and calibrate components and instruct operating personnel.
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- .3 Provide these services for such period, and for as many visits as necessary to put equipment in operation, and ensure that operating personnel are conversant with all aspects of its care and operation.

1.4 VOLTAGE RATINGS

- .1 Operating voltages: to CAN3-C235.
- .2 Motors, electric heating, control and distribution devices and equipment to operate satisfactorily at 60 Hz within normal operating limits established by above standard. Equipment to operate in extreme operating conditions established in above standard without damage to equipment.

1.5 PERMITS, FEES AND INSPECTION

- .1 Submit to Electrical Inspection Department and Supply Authority necessary number of drawings and specifications for examination and approval prior to commencement of work.
- .2 Pay all fees for permits and inspections as required for the electrical installation.
- .3 Notify Contract Administrator of changes required by Electrical Inspection Department prior to making changes.
- .4 Furnish Certificates of Acceptance from Electrical Inspection Department on completion of work to Contract Administrator. Include copies of certificate in maintenance manuals.

1.6 DEFINITIONS

- .1 The following are definitions of terms and expressions used in the Specification:
 - .1 **Contract Administrator** means Engineer, Architect, Designer.
 - .2 **Inspection Authority** means agent of any authority having jurisdiction over construction standards associated with any part of the electrical work on site.
 - .3 **Supply Authority** means electrical power utility company responsible for delivery of electrical power to project.
 - .4 **Electrical Code** means Canadian Electrical Code or Local Code in force at Project location.
 - .5 **Indicated** means as shown on contract drawings or noted in contract documents.
 - .6 **Type Tested** means that each piece of equipment produced by manufacturer is not fully tested. An original piece with similar arrangement has been fully tested and results of that test are available.
 - .7 **Provide** means to supply, install and leave in working order all materials and necessary wiring, supports, access panels, etc., as necessary for equipment.
 - .8 **Concealed** means hidden from normal sight in furred spaces, shafts, ceiling spaces, walls and partitions;
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- .9 **Exposed** means work normally visible, including work in equipment rooms, tunnels, and similar spaces;
- .10 **Finished** means when in description of any area or part of an area or a product which receives a finish such as paint, or in case of a product may be factory finished;
- .11 **Install** (and tenses of "install") – means secure in position, connect complete, test, adjust and verify;
- .12 **Supply** means to procure, arrange for delivery to site, distribute to floors, inspect, accept delivery and administer supply of manufacturer's products and/or systems, and includes manufacturer's supply of any special cables, standard on site testing, initial start-up, programming, basic commissioning, warranties and assistance to Contractor;
- .13 **Delete** or **Remove** (and tenses of "delete" or "remove") – means to disconnect, make safe, remove including any back box and exposed conduits, patch and repair/finish surfaces to match adjoining similar construction, include for associated re-programming of systems and/or change of documentation identifications to suit deletions, and properly dispose of deleted products off site unless otherwise instructed by Contract Administrator. All items to be deleted are to be disconnected and completely removed in its entirety, any branch circuit wiring, outlet, etc. for any system no longer required to remain in use is to be removed or if this is not possible rendered permanently inaccessible and completely disconnected from panel.
- .14 **BAS** means building automation system; "BMS" – means building management system, "FMS" – means facility management system; and "DDC" means direct digital controls; references to "BAS", "BMS", "FMS" and "DDC" generally mean same;
- .15 **Electrical Divisions** refers to Division 26 and other Divisions as specifically noted, and which work as defined in Specifications and /or on drawings is responsibility of Electrical Contractor, unless otherwise noted;

1.7 OPERATION AND MAINTENANCE DATA

- .1 Provide operation and maintenance data for incorporation into operation and maintenance manuals. Operation and maintenance manuals shall be submitted to City of Winnipeg in time to be used in the commissioning of the project.
 - .2 Include detail of design elements, construction features, components function and maintenance requirements, to permit effective start-up, operation, maintenance, repair, modification, extension and expansion of any portion or feature of installation.
 - .3 Include technical data, product data; supplement by bulletins, component illustration, exploded views, technical description of items, and parts lists. Advertising or sales literature will not be accepted.
 - .4 Include wiring, schematic diagrams and performance curves.
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- .5 Include driver data sheets, wiring device types, data sheets for each lamp type including emergency lighting system, final panel board directories, survey at motor data sheets.
- .6 Include name and addresses of local suppliers for items included in maintenance manuals.
- .7 Maintenance manuals shall be submitted to Contract Administrator for review. Manuals that are incomplete shall be returned to electrical subcontractor for completion. Completed manuals must be submitted, to the satisfaction of the Contract Administrator, before final payment may be considered to be due.

1.8 SHOP DRAWINGS, PRODUCT DATA AND SAMPLES

- .1 Submit shop drawings, product data and samples for review by Contract Administrator. Manufacture of equipment must not commence until shop drawings have been reviewed.
- .2 Indicate detail construction, dimension, capacities, weights and electrical performance characteristics of equipment or material.
- .3 Where applicable, include wiring, single line and schematic diagrams.
- .4 Include wiring drawings or diagrams showing interconnection with work of other sections.
- .5 Submit samples in accordance with General Conditions. Deliver samples to Contract Administrator's office. Pay all transportation costs to ship samples to Contract Administrator's office including return costs. Approved samples will be retained until after tender closing, then all samples will be returned except for the samples submitted by successful Contractor in tender documents. This sample will be used for comparison with the actual production run of successful manufacturer.
- .6 **Shop drawing submissions shall include a photocopy of all applicable specification sections showing a complete compliance/non-compliance listing.**
- .7 Each drawing submission to bare following signed stamp, and include name of project, equipment supplier and clause number equipment is specified under.

CONTRACTORS CERTIFICATION

This drawing has been reviewed by

(firm name)

All dimensions have been checked and found compatible with the contract drawings and all capacities, quantities, sizes and other data contained in the contract documents have been listed by the supplier on this drawing and have been checked by the undersigned and found correct.

Date

Per

- .8 Clearly show division of responsibility. No item, equipment or description of work shall be indicated to be supplied or work to be done 'By Others' or 'By Purchaser'. Any item, equipment or description of work shown on shop drawings shall form part of the contract, unless specifically noted to the contrary.
- .9 Provide field dimensions required by electrical supplier and sub-subcontractors. In cases where fabrication is required prior to field dimensions being available, check all related drawings and obtain clarification from Contract Administrator if necessary.
- .10 All main service, service entrance equipment, utility metering facility and location, panels, etc. shall bear the approval stamp of the electric utility prior to submission for Contract Administrator's review.
- .11 Division 26 shall check all shop drawings and make necessary changes, prior to submission to the Contract Administrator. They will be reviewed by the Contract Administrator and, if re-submission is required, Division 26 shall ensure that the supplier's drawings have been changed to comply before returning them to the Contract Administrator for another review. If the drawings still do not comply, and require additional review by the Contract Administrator, the Contract Administrator shall be reimbursed by Division 26 for the time required for such additional reviews.
- .12 Review of the shop drawings by the Contract Administrator shall not relieve the Contractor from responsibility for errors and omissions therein.
- .13 Shop drawings reflecting additional design or change in design shall be reviewed by the Contract Administrator and City of Winnipeg.
- .14 Provide shop drawings for all electrical components, including but not limited to wiring devices, lamps, starters, luminaires, etc.

1.9 EQUIVALENT MATERIALS AND EQUIPMENT

- .1 Bidder shall submit a tender based on the specified materials and equipment only.
 - .2 Bidders may submit a tender based on equivalent material and equipment, only if such items have been approved as equal by the Contract Administrator.
 - .3 **Request for equal submissions shall include a photocopy of all applicable specification sections showing a complete compliance/non-compliance listing in the left hand margin. Every clause of the applicable specification section must be individually marked indicating details of how compliance is met or, how the non-compliance items should be considered equal.**
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- .4 **All luminaire submittals will be required to be accompanied with a complete photometric site/and or floor plan for lighting level confirmation.**
- .5 Submittal list will be returned and may be picked up at the Contract Administrator's office when directed by the Contract Administrator. Where submissions are not returned by the Contract Administrator before tender or forty (40) working hours before close of tender, they are considered not approved.
- .6 The approval of equivalent products will be granted on the basis of general design only. Such approvals will not relieve the electrical trade from providing all necessary components and functions required in the specifications or on the drawings.
- .7 Clearly show division of responsibility. No item, equipment or description of work shall be indicated to be supplied or work to be done 'By Others' or 'By Purchaser'. Any item, equipment or description of work shown on shop drawings shall form part of the contract, unless specifically noted to the contrary.

1.10 RECEIPT SUBMITTAL

- .1 At the time of purchase of electrical components, (mainly but not limited to light fixtures), which are components that may require review by regulatory agencies such as Efficiency Manitoba Certification process, the Contractor shall provide the City of Winnipeg and Contract Administrator with copies of the corresponding receipts. The submittal of receipts is intended to verify quantities and specification of the components for submittal to the regulatory agencies.

1.11 LOT PRICING

- .1 Package lot pricing from manufacturers, suppliers, and/or wholesalers will not be acceptable.

1.12 FIELD QUALITY CONTROL

- .1 All electrical work to be carried out by qualified licensed electricians or apprentices as per conditions of the Provincial Act respecting manpower vocational training and qualifications. Employees registered in a provincial apprentices program shall be permitted, under the direct supervision of a qualified licensed electrician, to perform specific tasks - the activities permitted shall be determined based on the level of training attained and the demonstration of ability to perform specific duties.
- .2 The work of this Division to be carried out by a Contractor who holds a valid Master Electrical Contractor license as issued by the Province that the work is being constructed.
- .3 Conduct and pay for all tests required by the Code and AHJ.
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1.13 CO-ORDINATION WITH OTHER TRADES

- .1 Refer to architectural, structural and mechanical design drawings and specification for electrical work in connection with other divisions. The most stringent or restrictive requirement of specifications or drawings from any Division shall apply and be included in the tender price. This will be applicable even after the work was installed with the lesser requirement. Provide all required work to the full satisfaction of the Contract Administrator.
- .2 Co-ordinate electrical work with work of other trades to avoid conflict with pipes, air ducts and other equipment. Provide additional supports, wiring, etc. to all relocated equipment as required where relocation is necessary to avoid interferences.

1.14 EXAMINATION OF SITE

- .1 Prior to submitting a tender, examine site and local conditions, which may affect work. Claims for extra payment resulting from conditions, which may have been foreseen during examination of the site, will not be recognized.
- .2 Ensure that all equipment designated as “existing to remain” or “existing to be relocated” is suitable for its intended re-use, including panelboards and circuits. Report any discrepancies to the Contract Administrator before tender close.

1.15 RECORD DOCUMENTS

- .1 Allow for computer aided drafting (CAD) of original drawings to show as constructed information. Submit three (3) copies of the maintenance manuals to the City of Winnipeg, in 3-ring binders. Include a copy of all inspection and testing certificates, shop drawings, name/ address/phone # of each supplier, contractor and engineer, table of contents, and a copy of project "as-built" drawings in an envelope at the back of the binder and electronic files on a USB stick. Include all costs in contract. CAD files can be obtained from Contract Administrator.
 - .2 The Contractor shall keep a set of white prints on the job site at all times on which he shall record all additions or deviations from the contract documents including all changes covered by addenda, change orders, field changes, job conditions, etc. A set of drawings shall be utilized for each system and the contractor shall obtain prints as required. Drawings to include locations of all junction and pull boxes, routing of feeders and conduits, and changes to circuit numbers.
 - .3 All principle below grade or inaccessible conduits, systems, etc. shall be dimensioned at each change in direction. All conduit routes not shown by the Contract Administrator on original drawing shall be shown including circuit wiring, junction boxes, zoned conduit runs, etc.
 - .4 The Contractor shall provide one set of clean marked-up drawings for approval and a final set with changes as may be requested by the Contract Administrator.
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- .5 If corrections are required after the second Contract Administrator review, due to missing information, the Electrical Subcontractor shall be responsible for the Contract Administrator's time to indicate the required corrective measures and all courier and printing costs.
- .6 The Contractor is responsible for the total cost of mylars, and white prints taken from mylars, and electronic files.
- .7 Corrected, revised "Mylars", white prints, electronic files, etc. will be forwarded to the City of Winnipeg by the Contract Administrator. Final payment on the contract will not be made until correct mylars, and files are prepared and submitted to the City of Winnipeg.

Part 2 Products

2.1 MATERIALS AND EQUIPMENT

- .1 Electrical equipment shall be new and of the type and quality specified.
- .2 Equipment and material to be CSA certified. Where there is no alternative to supplying equipment which is not CSA certified, obtain special approval from Electrical Inspection Department.
- .3 Provide labour, materials, transportation, equipment and facilities, etc. required for the complete electrical installation as indicated or can be reasonably implied from the drawings and specifications.
- .4 Provide factory assembled control panels and component assemblies.
- .5 **Provide minimum 1500mm (59") clearance and access/working space at all equipment access doors/panels, breakers, switches, transformers, controls, etc. that is rated 1200A or more or rated over 750V and minimum 1000mm (39.4") clearance in all other areas.**
- .6 Equipment shall not be located near pipe shafts or fluid piping.
- .7 Equipment, conduits and cables shall not restrict or interfere with necessary access space required to safely service mechanical equipment (ventilation fans, filters, etc.) which are existing and/or to be installed under this contract.

2.2 MAINTENANCE MATERIAL

- .1 Provide all maintenance materials as required.

2.3 FINISHES

- .1 Shop finish metal enclosure surfaces by application of rust resistant primer inside and outside, and at least two coats of finish enamel.
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- .1 Paint outdoor electrical equipment "Seafoam Green" finish to EEMAC Y1-1-1955 to match Manitoba Hydro Transformer, unless otherwise indicated.
- .2 Paint indoor switchgear and distribution enclosures light grey to EEMAC 2Y-1-1958.
- .2 Clean and touch up surfaces of shop-painted equipment scratched or marred during shipment or installation, to match original paint.
- .3 Clean and prime exposed non-galvanized hangers, racks and fastenings to prevent rusting.

2.4 WIRING TERMINATIONS

- .1 Lugs, terminals, screws used for termination of wiring to be suitable for either copper or aluminium conductors.

2.5 ELECTRIC MOTORS, EQUIPMENT AND CONTROLS

- .1 Supplier and installer responsibility is indicated in Motor, Control and Equipment Schedule on electrical drawings and related mechanical responsibility is indicated on Mechanical Equipment Schedule on mechanical drawings.
- .2 Control wiring and conduit is specified in Division 26 except for conduit, wiring and connections below 50 volts, related to control systems, are specified in Division 25.
- .3 All electrical connections, terminations, power requirements related to electrical work shown on architectural or mechanical drawings are to be included by this Division.

2.6 MANUFACTURERS AND CSA LABELS

- .1 Visible and legible, after equipment is installed.

2.7 WARNING SIGNS

- .1 Provide warning signs on equipment, as required, to meet the requirements of the Inspection Authorities and Contract Administrator.

2.8 FIRE STOPPING

- .1 Provide approved fire stopping systems and smoke seals for all electrical penetrations at all fire rated walls and floors to maintain the integrity of wall/floor fire rating being penetrated.

2.9 ACCESS DOORS

- .1 Supply access doors in inaccessible construction to give access to all concealed junction boxes, pull boxes, conductor joints and other similar electrical work, which may require maintenance or repair.
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- .2 Before commencing installation of electrical work, submit to the Contract Administrator for approval a list of required access doors showing the exact sizes and locations of such access doors. Locate access doors in walls and partitions to the Contract Administrators approval, and arrange electrical work to suit. Access doors shall be, wherever possible, of a standard size for all applications. Confirm exact dimensions with the Contract Administrator, prior to ordering.
- .3 Access doors will be installed by the Division responsible for the particular type of construction in which access doors are required. Supply the access doors to the Division installing same at the proper time to avoid construction delays.

Part 3 Execution

3.1 PROCEDURE SCHEDULE

- .1 All electrical work shall be coordinated with City of Winnipeg and sub-trades involved. Manner and areas of work shall be pre-arranged prior to proceeding.
- .2 Procedure schedule will be prepared by the Contractor in conjunction with the City of Winnipeg and Contract Administrator to ensure continuity of work can be maintained with minimal interruption to occupant routine within the existing facilities. Electrical sub-contractor to coordinate his/her proposed schedule with the GC in a manner satisfactory to all parties involved.

3.2 DELIVERY, STORAGE AND HANDLING

- .1 Deliver all materials to the site in an orderly fashion.
- .2 Store all materials in a clean and dry place, secure from vandalism or theft. All materials to be left in shipping containers until required for use.
- .3 Provide additional protection such as tarps, padding, wood skids, etc., where such is required to ensure protection of equipment and as directed by the Contract Administrator.

3.3 WORKMANSHIP

- .1 Install equipment, conduits and cables in a workmanlike manner to present a neat appearance to the satisfaction of the Contract Administrator. Install conduit and cable runs parallel and perpendicular to building lines, in chases, behind furring or above ceilings, where such concealment is possible. In areas where systems are to be exposed, install neatly and group in a tidy appearance.
 - .2 Install equipment and apparatus requiring maintenance, adjustment or eventual replacement, with adequate clearance and accessibility for same.
 - .3 Include in the work all requirements shown on the shop drawings or manufacturer's installation instructions.
 - .4 Replace work unsatisfactory to the Contract Administrator without extra cost.
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3.4 SUPERVISION

- .1 Supervise the work at all times through a responsible and competent supervisor.
- .2 Employ the same supervisor on the project from the start to the finish to ensure continuity of the work.
- .3 Employ experienced, qualified journeymen and apprentices.

3.5 CUTTING AND PATCHING

- .1 Pay the costs of all cutting and patching required for the installation of electrical work. Payment for cutting and patching shall be made through the GC.
- .2 Cutting and patching required for the installation of electrical work shall be done by the particular trade whose work is involved.
- .3 Obtain the approval of the Contract Administrator and/or City of Winnipeg before arranging for any cutting. Patching shall restore the affected area to the original condition; material used for patching shall be compatible with existing condition.
- .4 Cutting or patching shall be carried out by the tradesmen of the subcontractor who normally works with materials involved, with the cost being the responsibility of Division 26 Sub-Contractors.

3.6 CONDUIT, SLEEVES AND HOLES

- .1 Make necessary arrangement for cutting of chases, drilling of holes and other structural work required to install electrical conduits, cables, pull boxes and outlet boxes. **In existing facilities - Do Not core without City of Winnipeg's permission or without x-ray or scanning of floors.**
- .2 Install conduit and sleeves prior to pouring of concrete. Sleeves through concrete to be sized for free passage of conduit.
- .3 Flash and weatherproof any penetrations or holes through exterior walls and roof.
- .4 Install cables, conduits, and fittings to be embedded or plastered over, neatly and close to building structure so furring can be kept to a minimum.
- .5 All sleeves and access conduits shall protrude through the floor min. 25mm above finished floor surface.
- .6 Provide fire-stop all floor and wall penetrations.

3.7 LOCATION OF OUTLETS

- .1 Locate outlets as indicated.
 - .2 Do not install outlets back-to-back in wall; allow minimum 150 mm horizontal clearance between boxes.
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- .3 **Change location of outlets at no extra cost or credit, providing distance does not exceed 3000 mm (10'-0"), and information is provided before installation.**
- .4 Locate light switches on latch side of doors.
- .5 Drawings are schematic only, co-ordinate mounting height and location of all equipment with architectural, mechanical and structural drawings prior to installation.
- .6 Vertically align outlets of different systems when shown in close proximity to each other and occur at different mounting heights.

3.8 MOUNTING HEIGHTS

- .1 Mounting height of equipment is from finished floor to centreline of equipment unless specified or indicated otherwise.
- .2 If mounting height of equipment is not specified or indicated, verify before proceeding with installation.
- .3 Install electrical equipment at following heights unless indicated on electrical drawings, architectural elevations, or instructed otherwise:
 - .1 Local switches: 1200 mm.
 - .2 Wall receptacles:
 - .1 General: 450 mm.
 - .2 Above top of continuous baseboard heater: 200 mm.
 - .3 Above top of counters: 150 mm.
 - .4 Above top of counter splash backs: 100 mm.
 - .5 In mechanical rooms: 1200 mm.
 - .3 Panelboards: 2000 to top.
 - .4 Voice, data and cable TV outlets: 450 mm.
 - .5 Wall mounted telephone outlets: 1200 mm.
 - .6 Fire alarm manual pull stations: 1200 mm.
 - .7 Fire alarm strobe/speakers: 2300 mm.
 - .8 Wall mounted emergency lights: 2286mm

3.9 CO-ORDINATION OF PROTECTIVE DEVICES

- .1 Ensure circuit protective devices such as overcurrent trips, relays and fuses are installed to required values and settings.

3.10 PROTECTION

- .1 Protect exposed live equipment during construction for personnel safety.
 - .2 Shield and mark live parts "LIVE 120 VOLTS", or with appropriate voltage in English.
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- .3 Arrange for installation of temporary doors for rooms containing electrical distribution equipment. Keep these doors locked except when under direct supervision of electrician.

3.11 LOAD BALANCE

- .1 Measure phase current to panelboards with normal loads operating at time of acceptance. Adjust branch circuit connections as required to obtain best balance of current between phases and record changes.
- .2 Measure phase voltages at loads and adjust transformer taps to within 2% of rated voltage of equipment.
- .3 Submit, at completion of work, report listing phase and neutral currents on panelboards, dry-core transformers and motor control centres, operating under normal load. Record hour and date on which each load was measured, including voltage at time of test.

3.12 CONDUIT AND CABLE INSTALLATION

- .1 Install conduit and sleeves prior to pouring of concrete. Sleeves through concrete: schedule 40 steel pipe sized for free passage of conduit, and protruding 50 mm.
- .2 If plastic sleeves are used in fire rated walls or floors, remove before conduit installation.
- .3 Install cables, conduits and fittings to be embedded or plastered over, neatly and close to building structure so furring can be kept to minimum.

3.13 CLEANUP

- .1 The electrical trade and his/her sub-trades shall at all times during construction, keep the site free of all debris, boxes, packing, etc., resulting from work of this trade.
- .2 At the completion of the work, the electrical installation shall be left in a clean, finished condition to the satisfaction of the City of Winnipeg.

3.14 GUARANTEE/WARRANTY

- .1 Satisfactory operation of all work and equipment installed under this contract shall be guaranteed for a period of one (1) year from the date of final acceptance of this work except where otherwise noted.
 - .2 All unsatisfactory work and any equipment that does not perform satisfactorily within the guarantee period shall immediately be repaired or replaced at no cost to the City of Winnipeg, providing such failure is not due to improper usage by the City of Winnipeg. The warranty on any replacement equipment or components shall be one year from the date of their installation.
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- .3 Any equipment that has been placed in use for any reason prior to the beginning of the guarantee period, such as for heating during construction, shall be cleaned and provided with whatever maintenance and repair is required so that its condition is equal to that of new equipment, or it shall be replaced, at no cost to the City of Winnipeg.
- .4 Equipment that fails as a result of its use prior to the beginning of its one-year guarantee period shall be repaired or replaced at no cost to the City of Winnipeg, even after the normal one-year guarantee period has expired.
- .5 All details of warranty repairs shall be documented in letters to the City of Winnipeg, with a copy sent to the Contract Administrator.
- .6 No certificate given, payment made, or the use of the equipment by the City of Winnipeg, shall be construed as acceptance of defective work or of improper materials.
- .7 This guarantee shall not act as a waiver for products that are warranted by the manufacturer for longer than one year.

3.15 PRICING OF CHANGES AFTER TENDER

- .1 Within a week of contract award, the Electrical Contractor shall submit an itemized cost breakdown for labour, including an hourly rate for foreman (or journeyman) for all work to be performed on changes of the Contract (PCNS). Refer to General Conditions for further requirements under this section.
- .2 **The Contract Administrator reserves the right to review costing using acceptable pricing standards based on Means “normal” pricing guide. Refer to Section 26 05 01 “Supplementary Components and Revisions - Electrical”.**

3.16 MONITORING

- .1 Before substantial performance will be granted, contractor shall arrange for monitoring of the Intrusion and Fire Alarm systems. Provide print-out of all events at monitoring company denoting time and type of signal from each device for Intrusion and FA systems. The print-out shall list time and type of signal received. Contractor shall produce a list of tested devices to show time of time testing. The list shall be produced in the same format as the print-out for fast cross-reference. A letter from monitoring company stating conformance to ULC requirements is required. This letter shall be provided and the connection incorporated in the Fire Alarm system verification as described elsewhere in this specification.

3.17 FINAL ELECTRICAL ACCEPTANCE

- .1 As the Contract Administrators are required to give professional assurance that all electrical systems have been installed, tested, commissioned and verified in accordance with the current edition of the Manitoba Building Code and the Canadian Electrical Code, the following items are required from the Contractor prior to
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substantial performance acceptance and issuance of "Assurance of Field Review and Compliance."

- .1 "Certificate of Final Electrical Inspection" certificate signed by the Electrical Inspector for the project (a declaration form signed by the Electrical Contractor is not acceptable);
- .2 Certificate of Fire Alarm System Verification; (Certificate shall include checklist for each and every item of the Fire Alarm System), Inspection, Testing and Maintenance Technician sheets; this implies that system is fully operational.
- .3 Verification Certificate of Exit and Emergency Light Inspection and Testing Systems; this implies that system is fully operational.
- .4 Confirmation of F.A. System monitoring of Alarm, Trouble and Supervisory Signals. Contractor shall obtain this confirmation from the City of Winnipeg's monitoring company in the form of a print-out letter. The letters shall show the time each event signal occurred and has been reset during the verification.
- .5 Obtain and Complete a **Efficiency Manitoba Rebate Form** and submit to the Project Manager with all required backup.
- .6 Submit all testing reports and certifications.

3.18 EVALUATION OF "PROGRESS CLAIMS"

- .1 Contractor shall submit to the Contract Administrator for review and approval a detailed breakdown of material and labor.
- .2 The Progress Claim form(s) shall be submitted to the Contract Administrator prior to the initiation of the Contractor's first claim for payment for review and acceptance. Failure to submit the Progress Claim form(s), and to subsequently submit all Progress Claims based on the same format, will delay the processing of the Contractor's Progress Claim.

END OF SECTION

Part 1 General

1.1 RELATED WORK

- .1 Refer to all sections of the specification for related work.

1.2 COORDINATION

- .1 Contractor shall allow for off-hours work as required and approved by the City of Winnipeg.
 - .2 Where existing services or systems, such as electrical power, telephone system, data systems, equipment alarm system, fire alarm system, etc. are required to be disrupted and/or shut-down, coordinate the shut-downs with the City of Winnipeg and carry out the work at a time and in a manner acceptable to them. Carefully schedule all disruptions and/or shutdowns and ensure the duration of same is kept to the absolute minimum. Submit for approval, a written concise schedule of each disruption at least 120 hours in advance of performing work and obtain written consent prior to implementing. Allow for after-hours work.
 - .3 Should any temporary connections be required to maintain services or systems during work in the existing building, supply and install all necessary material and equipment and provide all labour at no extra cost. Should any existing equipment or system be damaged, make full repairs without extra cost, and to the satisfaction of the City of Winnipeg and Contract Administrator.
 - .4 Comply with instructions regarding working hours necessary to maintain the building in operation.
 - .5 Coordinate complete installation of relocated utility services, if required, with utilities to ensure minimum interruption of service. Coordinate the disconnection and re-connection of the existing electrical circuits in order to keep power interruptions to a minimum.
 - .6 The drawings indicate major items of equipment to be deleted or relocated but may not indicate every item of equipment or conduit to be deleted or relocated. Contractor shall be responsible for determining which existing equipment is to be deleted or relocated by examining all site conditions and all construction documents.
 - .7 No drilling in concrete floors shall take place unless the floor has been scanned (or x-rayed) to confirm exactly what is in the floor. The Contractor shall notify the City of Winnipeg before drilling. The Contractor assumes complete responsibility for any and all damages or work stoppages occurring from unforeseen problems. The City of Winnipeg does not want any facility disruptions.
-

1.3 EXISTING DEVICES IN NEW CONSTRUCTION

- .1 Disconnect and remove existing electrical equipment made obsolete due to renovations. Remove associated wiring and conduits back to source panel.
 - .2 Where existing devices (receptacles, switches, etc.) are presently mounted on a wall which will be covered with a new finish, provide an extension ring, coverplate, etc., as required, to mount device to new wall finish.
 - .3 All existing electrical equipment to remain, which is located in or on portions of existing walls being demolished, shall be relocated to nearest wall. This equipment shall include cabinets, panels, switches, receptacles, etc.
 - .4 Where existing conduits, which are in use, pass vertically through a wall being demolished, relocate those conduits and conceal in a new wall or surface mount in a service area. Extend conduit, wiring, etc. as required.
 - .5 Where new ceilings are to be installed, relocate all existing ceiling mounted devices down to new ceiling. This equipment shall include but not be limited to smoke detectors, heat detectors, speakers, luminaires, etc. Extend existing conduit and wiring as required.
 - .6 All existing junction boxes in walls and ceiling spaces required to maintain existing circuits shall remain accessible.
 - .7 Include all costs to x-ray existing floors to be drilled or sleeved to ensure no existing services are severed or damaged. Damages could be very serious. Any damages resulting from failure to x-ray (or scan) is the Contractor's responsibility.
 - .8 Redundant existing circuit breakers will not be connected to any wiring and are to be labelled as spares.
 - .9 Field-check all existing fire alarm work on site including existing terminal boxes on each floor before submitting tender. Include all required work and re-work as may be required for a completely finished working system. No compensation will be given to the Contractors for work that should have been foreseen before submitting tenders.
 - .10 Some new outlets may require shallow boxes to fit into existing walls with shielding. Contractor shall confirm site conditions prior to submitting bid.
 - .11 All existing fire alarm devices that are being relocated or disconnected during areas of renovation should have all open loops closed to eliminate trouble signals in fire alarm panel during construction period. Allow for reprogramming of fire alarm panel to allow for all offline devices during construction period.
-

1.4 REMEDIAL WORK

- .1 It is the Electrical Contractor's responsibility to ensure that any coring of holes through decks or floor slabs, will not penetrate existing conduits, cables or mechanical equipment in walls, ceilings or floor slabs. The Contractor, at his cost, is responsible to take all actions required and as may be deemed necessary by the City of Winnipeg to correct any damage. No coring shall be undertaken unless permission is given by the building City of Winnipeg.

1.5 DAMAGE

- .1 Where existing structure, grade or pavement has to be removed, altered or otherwise defaced to facilitate electrical installation, Contractor shall arrange for breaking of openings or grooves in any building structure or breaking of pavement and/or digging of trenches.
- .2 Any equipment, structure, pavement or grade damaged by the execution of this Contract shall be repaired to its original condition. Any cost incurred for such work shall be allowed for in tender sum.
- .3 Irreparably damaged equipment shall be replaced at no cost to the City of Winnipeg.
- .4 If the finish of new equipment is damaged, the Contractor shall, at the discretion of the Contract Administrator, either replace or restore the equipment to its original condition by re-spraying, refinishing, etc., at no cost to the City of Winnipeg.
- .5 Openings and cutouts shall not be burned into panels. Oversize openings shall not be patched up with loose plates or oversize washers. Oversized openings will be considered damage to the equipment and are to be treated as specified above.
- .6 The Contractor shall use extreme care when working near existing services and any services disturbed shall be replaced by the contractor at no cost to the City of Winnipeg to the satisfaction of the Contract Administrator.
- .7 Contractor shall determine the location of the existing underground services from the authorities having jurisdiction and/or City of Winnipeg and/or Contract Administrator before excavation of existing grade and sub-grade, or new construction begins.

Part 2 Products

2.1 MATERIALS

- .1 Provide all materials required for the complete interface and reconnection installation.
-

ELECTRICAL WORK IN EXISTING BUILDINGS

City of Winnipeg Skywalk Accessibility Upgrades

Winnipeg, Manitoba
f-BLOK Project No. 2132

Section 26 05 05

Page 4 of 4
January 2022

- .2 New wiring required to interconnect new devices to existing systems shall be provided to suit the manufacturer's requirements and instructions.
- .3 Add new grounding materials as required to make existing grounding systems good in renovated areas only. Confirm existing on site.
- .4 Add modules, switches, etc., in existing control panels, as required, to extend existing systems to the new or renovated areas only. Confirm existing on site.
- .5 Where an existing panelboard requires to be relocated, provide as many junction and/or pull boxes in accessible ceiling space as necessary to properly extend all conductors. Provide permanent compression connections or, appropriate terminal blocks. Provide permanent identification on all related junction and pull boxes.
- .6 New system devices, speakers, starters, panelboards, breakers, etc. that are required to be tied into existing systems, quality of new materials to match or exceed existing. Confirm existing on site.
- .7 Add modules, switches, etc. in existing control panels, as required, to extend existing systems to new or renovated areas.
- .8 It is the intent of these specifications to **not** re-use any existing wiring.

Part 3 Execution

3.1 INSTALLATION

- .1 Install boxes, conduit and wiring through existing areas as required for the new installation.
- .2 Patch and repair walls and ceilings in existing building that have been damaged or cut open due to the new electrical installation.
- .3 Patch and make good existing walls which are to remain where existing electrical devices have been removed.
- .4 Where new cables or conduits have been installed through existing fire rated walls, seal opening around cables and conduit to maintain fire rating.
- .5 Test and confirm all existing grounding systems are effective and in good condition. Include work and materials required to change wiring and make good existing.
- .6 Electrical Contractor shall confirm the exact position and mounting height of each outlet prior to commencement of work. Special efforts are required to coordinate outlets, conduit routes, etc. with architectural, mechanical and other related work.

END OF SECTION

Part 1 General

1.1 RELATED WORK

- .1 Refer to all Sections of the specification for related work.

1.2 REFERENCES

- .1 CSA C22.2 No. 0.3 Test Methods for Electrical Wires and Cables.
- .2 CAN/CSA-C22.2 No. 131.

1.3 PRODUCT DATA

- .1 Submit product data in accordance with Section 26 05 00 Common Work Results - Electrical.

1.4 FIRE RATING

- .1 Fire ratings shown are minimum required. Provide cable of fire rating as required by authority having jurisdiction.
- .2 Fire rate entire cable support system. This shall include but not be limited to cable racks, support rods, anchors, etc.

Part 2 Products

2.1 CABLE IDENTIFICATION

- .1 Cables to be identified with wire markers.
- .2 Machine printed self laminating label type.
- .3 Thermal transfer type with printable area and translucent vinyl film.

2.2 BUILDING WIRES

- .1 Conductors in conduit:
 - .1 Type: RW90, RWU90
 - .2 Conductors for panel and branch circuits:
 - .1 Solid copper #10 AWG and smaller
 - .2 Stranded copper #8 AWG and larger.
 - .3 Sized as required (minimum #12 AWG).
 - .3 Insulation:
 - .1 Cross link polyethylene (XLPE), 90°C.

- .4 Configuration:
 - .1 Single conductor.
- .5 Voltage Rating: 600V.
- .6 Certification:
 - .1 CSA C22.22 No. 38 or latest revision.

2.3 ARMoured CABLE

- .1 Type: AC90 (BX).
- .2 Conductors:
 - .1 Solid copper #10 AWG and smaller.
 - .2 Stranded copper #8 AWG and larger.
 - .3 Sized as required (minimum #12 AWG).
- .3 Insulation:
 - .1 Cross link polyethylene (XLPE), 90°C.
- .4 Configuration:
 - .1 Multi-conductor, as required, complete with a separate bare CU ground wire.
- .5 Voltage Rating: 600V.
- .6 Armour: Bare inter-locked aluminum.
- .7 Certification:
 - .1 CSA C22.22 No. 51 or latest revision.

2.4 ARMoured CABLE (TECK)

- .1 Type: TECK 90
 - .2 Conductors for panel and branch circuits:
 - .1 Solid copper #10 AWG and smaller.
 - .2 Stranded copper #8 AWG and larger.
 - .3 Sized as required (minimum #12 AWG).
 - .3 Insulation:
 - .1 Cross link polyethylene (XLPE), 90°C.
 - .4 Configuration:
 - .1 Single or multi-conductor, as required.
 - .5 Colour Code:
 - .1 Black, red, blue and white in 4/C cable. Cables of more than 4/C to be number coded.
-

- .6 Voltage Rating: 600V.
- .7 Inner Jacket:
 - .1 Black polyvinyl chloride (PVC).
 - .2 Low flame spread (LFS).
 - .3 Low gas emission (LGE).
- .8 Armour:
 - .1 Inter-locked aluminum.
- .9 Outer Jacket:
 - .1 Black polyvinyl chloride (PVC), -40°C.
 - .2 Low flame spread (LFS).
 - .3 Low gas emission (LGE).
- .10 Fire Rating: FT4, AG14.
- .11 Certification:
 - .1 CSA C22.22 No. 131 or latest revision.

2.5 ALUMINUM SHEATHED CABLE

- .1 Type: RA-90 (Corflex)
 - .2 Conductors:
 - .1 Solid copper #10 AWG and smaller.
 - .2 Stranded copper #8 AWG and larger.
 - .3 Sized as required (minimum #12 AWG).
 - .3 Insulation:
 - .1 Cross link polyethylene (XLPE), 90°C. (194°F).
 - .4 Configuration:
 - .1 Single or multi-conductor as required.
 - .5 Voltage Rating: 600V.
 - .6 Aluminum Sheath:
 - .1 Liquid and vapour tight solid corrugation.
 - .7 Outer Jacket:
 - .1 Polyvinyl chloride (PVC), -40°C (-40°F).
 - .2 Low flame spread (LFS).
 - .3 Low gas emission (LGE).
 - .8 Fire Rating: FT4, AG14.
-

- .9 Certification:
 - .1 CSA C22.22 No. 123 or latest revision.

2.6 ELECTRONIC CABLES

- .1 Conductors:
 - .1 #18 AWG - STC solid copper.
- .2 Insulation:
 - .1 Polyvinyl chloride (PVC).
- .3 Configuration:
 - .1 Twisted pairs (number as required).
- .4 Shielding:
 - .1 Copper braid.
- .5 Voltage Rating: 300V.
- .6 Certification:
 - .1 CSA.

2.7 EXTRA LOW VOLTAGE CONTROL CABLES

- .1 Type: LVT.
- .2 Conductors:
 - .1 Solid copper #18 AWG.
- .3 Insulation:
 - .1 Thermoplastic, colour coded.
- .4 Configuration:
 - .1 Single, two conductors – parallel.
 - .2 Three or more conductors – twisted.
- .5 Voltage Rating: 30V.
- .6 Outer Jacket:
 - .1 Thermoplastic.
- .7 Certification:
 - .1 CSA C22.22 No. 35.

2.8 INSTRUMENTATION CABLES

- .1 Type: Instrumentation cable.
 - .2 Conductors:
-

WIRES AND CABLES (0-1000 V)

City of Winnipeg Skywalk Accessibility Upgrades

Winnipeg, Manitoba
f-BLOK Project No. 2132

Section 26 05 21

Page 5 of 10
January 2022

- .1 7-wire, concentric lay, Class B tinned copper, #18 or #14 AWG as required.
 - .3 Voltage Rating: 300V or 600V as required.
 - .4 Insulation:
 - .1 Fire retardant - cross link polyethylene (XLPE), 90°C.
 - .5 Configuration:
 - .1 Single or multi pairs or triads, as required.
 - .6 Shielding:
 - .1 Aluminum/mylar shield with drain wire for each pair triad.
 - .2 Overall aluminum/mylar shield with drain wire.
 - .7 Drain Wires:
 - .1 7-wire, concentric lay, Class B tinned copper.
 - .2 Individual shields to be one size smaller than conductor size.
 - .3 Overall shields to be the same as conductor size.
 - .8 Colour Codes:
 - .1 300V Pairs:
 - .1 black, white and number code.
 - .2 300V Triads:
 - .1 black, white and number code.
 - .3 600V Pairs:
 - .1 black, red and number code.
 - .4 600V Triads:
 - .1 black, red, yellow and number code.
 - .9 Armour:
 - .1 Inter-locked aluminum.
 - .10 Outer Jacket:
 - .1 Grey polyvinyl chloride (PVC).
 - .2 Low flame spread (LFS).
 - .3 Low gas emission (LGE).
 - .11 Fire Rating: FT4.
 - .12 Certification:
 - .1 CSA C21.1 or latest revision.
 - .2 CSA C22.2 No. 174 or latest revision.
-

2.9 CONNECTORS

- .1 Pressure type connectors, fixture type splicing connectors, cable clamps and lugs, as required.
- .2 Refer to Section 26 05 20 Wire and Box Connectors and 26 05 22 Connectors and Terminations.

Part 3 Execution

3.1 CABLE INSTALLATION & WORKMANSHIP

- .1 Install cables for feeders or branch circuits in raceways, cable trays, wireways or trenches as required.
- .2 Prevent over-heating by induction in accordance with rule 12-3022(6) and 12-3022(7) and Appendix B Canadian Electric Code, Part 1 where single conductor cables connect to boxes and cabinets.
- .3 Install sleeves where cables pass through poured concrete or masonry.
- .4 Provide mechanical protection for cables where cables are turned up above the floor through sleeves or slots. Provide channels, angle sills or rigid conduit sleeves which protrude at least 150 mm above the finished floor.
- .5 Where cables are grouped and not run in tray, support on channels.
- .6 Run cables parallel to the lines of the building.
- .7 Bends to be concentric.
- .8 Seal cables which penetrate air barrier and vapour barrier and boxes.

3.2 PHASE BALANCING

- .1 Connect single phase equipment to minimize imbalance on feeders. Adjust branch circuiting for optimum balancing.
- .2 Record all changes on "as-built" drawings.
- .3 Phase rotation to match existing

3.3 MINIMUM CABLE SIZE

- .1 Minimum wire size to be #12 gauge throughout except where indicated otherwise.
 - .2 Be responsible for providing the minimum wire size to meet the code where the wire size shown on the drawing is inadequate to serve the load.
 - .3 Minimum size of panelboard and motor feeders is to be in accordance with CEC.
-

3.4 VOLTAGE DROP

- .1 Size wiring for branch circuits to achieve a maximum 3% voltage drop.
- .2 Base on distance from overcurrent device to furthest wiring device/load.
- .3 Provide cable size for entire length of circuit.
- .4 Submit voltage drop calculations when requested.

3.5 NEUTRAL CONDUCTORS

- .1 Reduced neutrals not permitted.
- .2 Provide separate neutrals for all dimmers, laser printers or as otherwise indicated.
- .3 Provide 200% Neutral connections where shown on single line drawings and on K-rated and harmonic mitigating transformers.

3.6 BONDING CONDUCTORS

- .1 Provide a green insulated bonding conductor equal in size to current carrying conductors within all raceways.

3.7 FIRE SEPARATIONS

- .1 Submit drawings showing proposed method of sealing fire separations.

3.8 INSTALLATION OF BUILDING WIRES

- .1 Install wiring in conduit system in accordance with Section 26 05 34 Conduits, Conduit Fastenings and Conduit Fittings.
- .2 Ensure conduits are dry and free of debris before pulling cables.
- .3 Provide colour coding and identification as per this Section.
- .4 Wires in outlet, junction and switch boxes, not having a connection within the box shall not be spliced, but shall continue unbroken through the box.

3.9 INSTALLATION OF ARMOURED CABLES (BX)

- .1 Group cables wherever possible.
 - .2 Terminate cables in accordance with Section 26 05 21 - Wire and Box Connectors.
 - .3 Type AC90 armoured cable (Bx) with screw type connectors shall be used for connections from conduit systems to luminaires in accessible ceilings only.
 - .4 Type Bx cable shall not be used for any other application.
-

- .5 Maximum length of AC90 armoured cable for connections to luminaires mounted in stud partitions shall be 1.5 metres. Cable drops for luminaires in accessible ceilings shall be of sufficient length to allow the luminaire to be relocated to any location within a 3m radius.
- .6 Cable shall be clamped before entering the lighting fixture and shall be clipped before entering the conduit system junction box.

3.10 INSTALLATION OF ARMOURED CABLES (TECK)

- .1 Group cables wherever possible on channels, spaced one (1) cable diameter apart.
- .2 Do not splice cables.
- .3 Terminate cables in accordance with Section 26 05 21 - Wire and Box Connectors. Terminate cables using non-magnetic connectors. Cable armour shall be grounded via an aluminum plate at the supply end and isolated via an insulating plate at the load end of the cable.
- .4 Cable bending radius shall be at least twelve (12) times the overall cable diameter and bend shall not damage or distort the outer sheath.
- .5 Do not install PVC jacketed cables in circulating air plenums.

3.11 INSTALLATION OF ALUMINUM SHEATHED CABLES

- .1 Group cables wherever possible.
- .2 Terminate cables in accordance with Section 26 05 21 - Wire and Box Connectors.
- .3 Do not use aluminum sheathed cable in cast concrete or masonry construction.

3.12 INSTALLATION OF EXTRA LOW VOLTAGE CONTROL CABLES

- .1 Install extra low voltage control cables in conduit.
- .2 Ground control cable shield.

3.13 INSTALLATION OF INSTRUMENTATION CABLES

- .1 Install instrumentation cables in conduit.
- .2 Ground cable shield.

3.14 INSTALLATION IN EQUIPMENT

- .1 Group and lace-in neatly, wire and cable installed in switchboards, panel boards, cabinets, wireways and other such enclosures.
-

3.15 TERMINATIONS

- .1 Terminate wires and cables with appropriate connectors in an approved manner.

3.16 MOTOR CONNECTIONS

- .1 Flexible connections to motors shall not exceed 2m unless authorized in writing by Contract Administrator.

3.17 IDENTIFICATION

- .1 Provide cable identification on all cables.
- .2 Wire in conduit #2 AWG and smaller shall have solid coloured insulation, colour coded as listed below.
- .3 Wire in conduit #1/0 AWG and larger and single conductor cables shall be identified at each outlet box and termination with a 150mm band of coloured vinyl tape of the appropriate colour. Neutral and ground conductors shall be identified. Paint or other means of colouring the insulation shall not be used.
- .4 Colour code wire in conduit and single conductor cables as follows unless otherwise shown on the drawings:

Three Phase Systems:	Single Phase Systems:
Phase A - red	Phase A - red
Phase B - black	Phase B - black
Phase C - blue	Neutral - white
Neutral - white	Ground - green
Ground - green	

- .5 Maintain phase sequence and colour coding throughout project.
- .6 Use colour-coded wires in communication cables, matched throughout the system.
- .7 Identify control conductors in motor control equipment, contactors, fire alarm panels, etc. with mylar/cloth wire markers.
- .8 Identification text to include panel name, wire number and wire type (A, B, C, N or G). Identification to be independent of circuit numbers to allow phase balancing.
- .9 Provide identification on cables at:
 - .1 Inside distributions/panelboards.
 - .2 Inside device boxes or at terminations.
 - .3 Wide junction boxes where joints are made.
- .10 Distribution feeders to be identified as follows:



WIRES AND CABLES (0-1000 V)

City of Winnipeg Skywalk Accessibility Upgrades

Winnipeg, Manitoba
f-BLOK Project No. 2132

Section 26 05 21

Page 10 of 10
January 2022

- .1 Color code of feeder phase shall appear on every cable in two locations at any distribution; once inside the distribution enclosure near the cable termination and once outside the distribution enclosure, in a visible location near the enclosure.

- .11 Color code all feeders at all terminations, at all points where taps are made, and at all panelboards, switchboards, motor control centres, etc., by means of colored insulation or markers. Use markers of a type not subject to aging or deterioration through heating, drying or easy erasure. Color code in accordance with Rule 4-032 of the CEC. Phasing to be ABC, left, centre, right respectively.

- .12 Demonstrate to the Contract Administrator that each wire has been clearly identified with wire markers where requested.

END OF SECTION

Part 1 General

1.1 RELATED WORK

- .1 Refer to all Sections of the specification for related work.

1.2 SECTION INCLUDES

- .1 Provision of low voltage and extra low voltage grounding/bonding system for the facility.
- .2 Includes but is not limited to grounding/bonding for:
 - .1 Electrical service.
 - .2 Transformer neutral.
 - .3 Water/gas/sewer pipe grounding.
 - .4 Equipment.

1.3 REFERENCES

- .1 Canadian Standards Association:
 - .1 CAN/CSA C22.2 No. 41 Grounding and Bonding Equipment.

Part 2 Products

2.1 MANUFACTURERS

- .1 Acceptable manufacturers:
 - .1 FCI Burnay Limited.
 - .2 Erico Eritech.

2.2 EQUIPMENT

- .1 Ground equipment: to CAN/CSA C22.2 No. 41
 - .2 Clamps for grounding of conductor: size as required to electrically bond to underground water piping.
 - .3 Grounding conductor system, circuit and equipment, grounding to be bare standard copper, sized in accordance with the Canadian Electrical Code.
-

- .4 Compression fittings to ground conductors to existing electrical system grounding.
- .5 Insulated grounding conductors: green, insulated.

2.3 ACCESSORIES

- .1 Non-corroding, necessary for complete grounding system, type, size, material as required, including:
 - .1 Grounding and bonding bushings
 - .2 Protective type clamps
 - .3 Bolted type conductor connectors
 - .4 Thermit welded type conductor connectors
 - .5 Bonding jumpers, straps
 - .6 Pressure wire connectors
- .2 Copper alloy castings with silicon bronze bolts, nuts and washers for connecting pipe, tube, cable, flat bar and special bus shapes.
- .3 Wire connectors and terminations: to Section 26 05 22 – Connectors and Terminations.

Part 3 Execution

3.1 INSTALLATION GENERAL

- .1 Ensure that all components make good contact at connections to form a continuous metallic ground through the system. Torque bolts in accordance with manufacturer's recommendations.
 - .2 Ensure that contact surfaces are free of grease, oil, paint, primer and similar surface coverings. Clean all conductor contact surfaces thoroughly before installation by scratch brushing until bright and shiny.
 - .3 Install complete permanent, continuous system and circuit grounding systems including electrodes, conductors, connectors and accessories to conform to requirements of local authority having jurisdiction over installation. Where EMT is used, run ground wire in conduit.
 - .4 Install connectors in accordance with manufacturer's instructions.
 - .5 For welding type connections, follow manufacturer's instructions.
 - .6 Protect exposed grounding conductors from mechanical injury.
 - .7 Use mechanical connectors for grounding connections to equipment provided with lugs.
 - .8 Soldered joints not permitted.
-

GROUNDING - SECONDARY

- .9 Install bonding wire for flexible conduit, connected at both ends to grounding bushing, solderless lug, clamp or cup washer and screw. Neatly cleat bonding wire to exterior of flexible conduit.
- .10 Install flexible ground straps for bus duct enclosure joints, where such bonding is not inherently provided with equipment.
- .11 Make grounding connections in radial configuration only, with connections terminating at single grounding point. Avoid loop connections.
- .12 Bond single conductor, metallic armoured cables to cabinet at supply end, and provide non-metallic entry plate at load end as necessary and run separate ground conductor.

3.2 SYSTEM AND CIRCUIT GROUNDING

- .1 Install system and circuit grounding connections to neutral of low voltage system(s).
- .2 In addition to grounding achieved through conduit grounds and cable ground wires, provide a #1/0 ground conductor from each derived ground (ie: transformers, drive isolation transformer, ATS) back to the main electrical room ground bus. Route to be identical to route used for main feeder.

3.3 EQUIPMENT GROUNDING

- .1 Install grounding connections to typical equipment included in, but not necessarily limited to following list. Service equipment, transformers, switchboard, duct systems, frames of motors, starters, control panels, building steel work, generators, distribution panels, outdoor lighting.

3.4 FIELD QUALITY CONTROL

- .1 Perform tests in accordance with Section 26 05 00 - Common Work Results – Electrical and Section 26 08 01 – Electrical Testing Requirements.
- .2 Perform ground continuity and resistance tests using method appropriate to site conditions and to approval of Contract Administrator and local authority having jurisdiction over installation. Record readings and place copy in maintenance manual.
- .3 Perform tests before energizing electrical system.
- .4 Disconnect ground fault indicator during tests.

3.5 GROUND RESISTANCE TESTING

- .1 Provide ground resistance testing as required by the Contract Administrator.

END OF SECTION

Part 1 General

1.1 RELATED WORK

- .1 Refer to all Sections of the specification for related work.

Part 2 Products

2.1 SUPPORT CHANNELS

- .1 U shape, galvanized steel, size 41mm x 41 mm, 2.5mm thick, surface mounted, suspended or set in poured concrete walls and ceilings as required.
- .2 Acceptable manufacturers: Burndy, Electrovert, Unistrut, Pilgrim, Pursley.
- .3 Support equipment to be of type and size required to withstand the fire rating where used (rack hangers, rods, anchors).

Part 3 Execution

3.1 INSTALLATION

- .1 Secure equipment to solid masonry, tile and plaster surfaces with lead anchors or nylon shields.
 - .2 Secure equipment to poured concrete with cast in or expandable inserts.
 - .3 Secure equipment to hollow masonry walls or suspended ceilings with toggle bolts.
 - .4 Secure surface mounted equipment with twist clip fasteners to inverted T bar ceilings. Ensure that T bars are adequately supported to carry weight of equipment specified before installation. Provide additional support where required.
 - .5 Support equipment, conduit or cables using clips, spring loaded bolts, cable clamps designed as accessories to basic channel members.
 - .6 Fasten exposed conduit or cables to building construction or support system using straps.
 - .1 One-hole steel straps to secure surface conduits and cables 32mm and smaller.
 - .2 Two-hole steel straps for conduits and cables larger than 32mm.
 - .3 Beam clamps to secure conduit to exposed steel work.
-

HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

- .7 Suspended support systems.
 - .1 Support individual cable or conduit runs with 6mm diameter threaded rods and spring clips.
 - .2 Support two or more cables or conduits on channels supported by 10mm diameter threaded rod hangers where direct fastening to building construction is impractical.
- .8 For surface mounting of two or more conduits use U-channels at 1500mm on centre spacing.
- .9 Provide metal brackets, frames, hangers, clamps and related types of support structures where indicated or as required to support conduit and cable runs.
- .10 Ensure adequate support for raceways and cables dropped vertically to equipment where there is no wall support.
- .11 Do not use wire lashing or perforated strap to support or secure raceways or cables.
- .12 Do not use supports or equipment installed for other trades for conduit or cable support except with permission of other trade and approval of Contract Administrator.
- .13 Install fastenings and supports as required for each type of equipment cables and conduits, and in accordance with manufacturer's installation recommendations.
- .14 Provide a separate fire rated system of supports where required (e.g. mineral insulated cables).
- .15 Install continuous vertical channel supports for conduits in utility service rooms and mechanical room.
- .16 Where conduit and cable runs are installed on support systems, they shall run so as to be as inconspicuous as possible. Coordinate support system with equipment of other trades to ensure proper installation of equipment. Run support system paths perpendicular or parallel to building lines.

END OF SECTION

Part 1 General

1.1 RELATED WORK

- .1 Refer to all Sections of the specification for related work.

1.2 REFERENCES

- .1 CAN/CSA C22.2 No. 40 Cutout, Junction and Pull Boxes.
- .2 CAN/CSA C22.2 No. 75 Splitters.

1.3 SHOP DRAWINGS AND PRODUCT DATA

- .1 Submit shop drawings and product data for splitters and cabinets in accordance with Section 26 05 00 Common Work Results - Electrical.

Part 2 Products

2.1 SPLITTERS, JUNCTION BOXES, PULL BOXES AND CABINETS - GENERAL

- .1 ANSI 61 grey polyester powder coat finish inside and out over phosphatized steel.
- .2 Gasketed and waterproof for wet and damp locations.
- .3 Locate splitters, junction and pull boxes as needed for each system.

2.2 SPLITTERS

- .1 Sheet metal enclosure, welded corners and formed hinged cover suitable for locking in closed position.
- .2 Main and branch lugs to match required size and number of incoming and outgoing conductors.
- .3 At least three spare terminals on each set of lugs in splitters less than 400A, two spare terminals in all other splitters.

2.3 JUNCTION AND PULL BOXES

- .1 Code gauge sheet steel, welded construction.
 - .2 Screw-on hinged flat covers.
 - .3 For flush mounting, covers to overlap box by 25mm minimum all round with flush head cover retaining screws.
-

2.4 CABINETS

- .1 Cabinets: code gauge sheet steel, welded construction, suitable for field painting with handle lock and catch.
- .2 Locks: to match panelboards, complete with two keys.
- .3 Backboards: 21mm GIS fir painted plywood, one piece per cabinet, covering entire cabinet interior.
 - .1 Type E: with hinged door and return flange overlapping sides, for surface mounting, size as indicated or to suit.
 - .2 Type T: surface, or flush with trim, and hinged door.

Part 3 Execution

3.1 SPLITTER INSTALLATION

- .1 Install splitters and mount plumb, true and square to the building lines.
- .2 Extend splitters full length of equipment arrangement except where indicated otherwise.

3.2 JUNCTION, PULL BOXES AND CABINETS INSTALLATION

- .1 Supply all pull boxes and junction boxes shown on the drawings and as required for the installation.
 - .2 Install in inconspicuous but accessible locations, above removable ceiling or in electrical rooms, utility rooms, or storage areas. Advise Contract Administrator of locations prior to installation.
 - .3 Size in accordance with Rule 12-3036, Canadian Electrical Code, as a minimum. Sizes shown on the drawings may be adjusted to suit available space. Review with Contract Administrator where necessary.
 - .4 Mount cabinets with top not greater than 2000mm above finished floor, coordinated with masonry, panelboards, fire hose cabinets and similar items. Securely fasten backboards to cabinet interiors.
 - .5 Install terminal block as Type T cabinets.
 - .6 Where junction and pull boxes are not indicated, install pull boxes so as not to exceed 30m of conduit run between pull boxes.
 - .7 Install junction and pull boxes clear of all mechanical duct work and piping.
-

SPLITTERS, JUNCTION, PULL BOXES AND CABINETS

City of Winnipeg Skywalk Accessibility Upgrades

Winnipeg, Manitoba
f-BLOK Project No. 2132

Section 26 05 31

Page 3 of 3
January 2022

3.3 IDENTIFICATION

- .1 Provide equipment identification in accordance with Section 26 05 53 - Identification for Electrical Systems.
- .2 Install size 2 identification labels indicating system name and system voltage (where voltage is applicable).

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Refer to all Sections of the specification for related work.

1.2 REFERENCES

- .1 CAN/CSA C22.2 No. 18.1 Metallic Outlet Boxes.
- .2 UL 514C Non-Metallic Outlet Boxes, Flush Device Boxes and Covers.
- .3 Latest issue of CSA C22.1 Canadian Electrical Code, Part 1.

Part 2 Products

2.1 OUTLET AND CONDUIT BOXES - GENERAL

- .1 Minimum size of boxes to be in accordance with Canadian Electrical Code, Section 12.
- .2 Boxes to be hot dip galvanized to ASTM a924(M), designation zinc coating Z180 (G60).
- .3 102mm square or larger outlet boxes as required for special devices.
- .4 Provide multi-gang boxes where wiring devices are grouped.
- .5 Provide blank cover plates for boxes without wiring devices.
- .6 Provide barriers where outlets for more than one system are grouped.
- .7 All electrical equipment to be sprinkler-proof.

2.2 SHEET STEEL OUTLET BOXES

- .1 Hot dipped galvanized steel device boxes for flush installation, minimum size 102mm (4") square with extension and plaster rings as required.
 - .2 Hot dipped galvanized steel utility boxes for outlets connected to surface-mounted EMT conduit.
 - .3 102mm (4") square or octagonal outlet boxes for lighting fixture outlets.
 - .4 102mm (4") square outlet boxes with extension and plaster rings for flush mounting devices in finished plaster or tile walls.
-

OUTLET BOXES, CONDUIT BOXES AND FITTINGS

2.3 MASONRY BOXES

- .1 Hot dipped galvanized steel masonry single and multi-gang boxes, 89mm (3½") deep, for devices flush mounted in block walls.
- .2 Provide 64mm (2½") deep boxes only when wall thickness does not allow 89mm (3½") box to be used.

2.4 CONCRETE BOXES

- .1 Hot dip galvanized sheet steel concrete type boxes for flush mount in concrete with matching extension and plaster rings as required.

2.5 CONDUIT BOXES

- .1 Cast ferrous boxes, 64mm (2½") deep, with factory-threaded hubs and mounting feet for surface mounting of wiring devices and for use in electrical or mechanical rooms and service spaces/corridors.
 - .1 Provide 43mm (1 11/16") deep boxes only when installation does not allow 64mm (2½") boxes to be used.
 - .2 Not approved for telecommunications use.

2.6 SECTIONAL BOXES

- .1 Sectional boxes shall not be utilized.

2.7 FITTINGS - GENERAL

- .1 Bushing and connectors with nylon insulated throats.
- .2 Knock-out fillers to prevent entry of debris.
- .3 Conduit outlet bodies for conduit up to 32 mm and pull boxes for larger conduits.
- .4 Double locknuts and insulated bushings on sheet metal boxes.

Part 3 Execution

3.1 INSTALLATION

- .1 Install all outlets flush, plumb and square with building lines.
 - .2 Surface mount above suspended ceilings and in mechanical and electrical rooms.
 - .3 Adjust position of outlets in finished masonry walls to suit course lines. Coordinate cutting of masonry wall to achieve net openings for all boxes.
 - .4 Where a two gang box is required for single gang device, provide special plate with device opening in one gang and blank second gang.
-

OUTLET BOXES, CONDUIT BOXES AND FITTINGS

- .5 Do not distort boxes during installation. If boxes are distorted, replace with new boxes.
- .6 Use plaster rings to correct depth. Use 32mm on concrete block.
- .7 Installation to be in accordance with Rules 12-3000 to 12-3036, Canadian Electrical Code, "Installation of Boxes, Cabinets, Outlets and Terminal Fittings". Minimum box size to be in accordance with Rule 12-3036 and Table 23, Canadian Electrical Code, "Number of Conductors in Boxes". Use more than one outlet box where the number of joints exceeds the requirements for the boxes specified.
- .8 Support boxes independently of connecting conduits.
- .9 Fill boxes with paper, sponges or foam or similar approved material to prevent entry of debris during construction. Remove upon completion of work.
- .10 For flush installations mount outlets flush with finished wall using plaster rings to permit wall finish to come within 6 mm of opening.
- .11 Provide correct size of openings in boxes for conduit and cable connections. Reducing washers are not allowed.
- .12 Align outlets that are installed in the same general location so that they are centered.
- .13 Boxes installed in walls with air barriers require vapour boxes in accordance with Section 07 27 10. Apply acoustical sealant around conduits and cables which penetrate vapour boxes. Maximum VOC Content: 250 g/L for acoustic sealant.

END OF SECTION

Part 1 General

1.1 RELATED WORK

- .1 Refer to all Sections of the specification for related work.

1.2 REFERENCES

- .1 Canadian Standards Association (CSA)
 - .1 CAN/CSA C22.2 No. 18, Outlet Boxes, Conduit Boxes, and Fittings and Associated Hardware.
 - .2 CAN/CSA C22.2 No. 45, Rigid Metal Conduit.
 - .3 CAN/CSA C22.2 No. 56, Flexible Metal Conduit and Liquid-Tight Flexible Metal Conduit.
 - .4 CAN/CSA C22.2 No. 83, Electrical Metallic Tubing.
 - .5 CAN/CSA C22.2 No. 211.2, Rigid PVC (Unplasticized) Conduit.

1.3 PRODUCT DATA

- .1 Submit product data for non-metallic raceways in accordance with Section 26 05 00 Common Work Results - Electrical.

1.4 LOCATION OF CONDUIT

- .1 Drawings do not indicate all conduit runs. Those indicated are in diagrammatic form only.
- .2 **Electrical contractor shall produce layout sketches of conduit runs through mechanical and electrical service areas to avoid any conflict with other construction elements and to determine the most efficient route to run conduit. Submit sketches prior to roughing-in of conduits.**

1.5 FIRE RATING

- .1 Fire rating of combustible conduits shown are minimum required. Provide conduit of fire rating as required by authority having jurisdiction.

Part 2 Products

2.1 CONDUIT FASTENINGS

- .1 One hole steel straps to secure surface conduits 32mm and smaller. Two hole steel straps for conduits larger than 32mm.
 - .2 Beam clamps to secure conduits to exposed steel work.
 - .3 U-channel type supports for two or more conduits at no more than 2m o.c. spaced as per code and manufacturer's recommendations, whichever is closer.
-

CONDUITS, CONDUIT FASTENINGS AND CONDUIT FITTINGS

- .4 Threaded rods, 6mm diameter, to support suspended channels.
- .5 Perforated metal and field fabricated hangers and supports not acceptable.

2.2 CONDUIT FITTINGS

- .1 Fittings: manufactured for use with conduit specified. Coating: same as conduit.
- .2 Factory "ells" where 90° bends are required for 27mm and larger conduits.
- .3 Steel set screw connectors and couplings are not permitted.
- .4 Rain-tight connector fittings and couplings complete with O-rings for use on all enclosures and conduit installations, etc.

2.3 EXPANSION FITTINGS FOR RIGID METAL AND PVC CONDUIT

- .1 Weatherproof expansion fittings suitable for 200mm linear expansion.
- .2 Watertight expansion fittings suitable for linear expansion and 19mm deflection in all directions.
- .3 Weatherproof expansion fittings for linear expansion at entry to exterior enclosures/panels.
- .4 With internal bonding assembly for metallic conduits.

2.4 FISH CORD

- .1 Polypropylene, minimum 200 kg strength, UV resistant.

2.5 CONDUIT - GENERAL

- .1 Minimum conduit size shall be $\frac{3}{4}$ " (21mm) unless otherwise indicated.

2.6 ELECTRICAL METALLIC TUBING (EMT)

- .1 Conduit: electrical metallic tubing with wall thickness less than rigid conduit, hot dipped galvanized with corrosion resistant and friction reducing coating on inside, to CAN/CSA C22.2 No. 83.
 - .2 Connectors and fittings to be rain-tight type.
-

2.7 FIRE ALARM EMT

- .1 Provide red EMT conduits for fire Alarm system for all areas as manufactured by Columbia-MBF TRUE COLOR™ EMT (Electrical Metal Tubing).
- .2 Hot galvanized with a vibrant top coat for easy identification and durability
- .3 Excellent mechanical protection for conductors
- .4 Ductility for faster and easier bending
- .5 E-Z Pull™ interior finish provides a smooth interior surface for fast, less labor-intensive wire-pulling
- .6 EMF shielding characteristics
- .7 Certified to CSA C22.2 No. 83.1 and manufactured in accordance with ANSI C80.3
- .8 Label EMT as per specification Section 26 05 53.
- .9 Provide sample of labelling to Contract Administrator for final approval prior to installation.

2.8 RIGID METAL CONDUIT

- .1 Conduit: rigid galvanized steel, heavy wall, with threaded joints and connections to CAN/CSA C22.2 No. 45.
- .2 Connectors: liquid and dust tight with insulated throat.
- .3 Rigid conduit fittings: outlet boxes, junction boxes, LB's and other fittings cast metal with factory applied epoxy paint.
- .4 Expansion joints: rigid conduit type with external bonding jumper.
- .5 Ground bushing: threaded type with insulated throat.

2.9 RIGID PVC CONDUIT

- .1 Conduit: rigid non-metallic conduit of unplasticized polyvinyl chloride to CAN/CSA C22.2 No. 211.1.
 - .2 Fittings: threaded male or female solvent weld connectors and solvent weld couplings, as supplied and recommended by conduit manufacturer.
 - .3 Fire rating: FT4.
 - .4 Expansion joints: as supplied and recommended by conduit manufacturer, complete with two O-rings.
-

2.10 FLEXIBLE CONDUIT

- .1 Conduit: flexible metal conduit, spirally wound, interlocked zinc coated steel strip which may be easily bent without use of tools to CAN/CSA C22.2 No. 56.
- .2 Connectors: steel slip-proof, complete with insulated throat.

2.11 LIQUID TIGHT FLEXIBLE CONDUIT

- .1 Conduit: construction same as flexible conduit, with liquid-tight PVC outer jacket to CAN/CSA C22.2 No. 56.
- .2 Connector: type providing seal to conduit jacket and positive ground to interior of conduit, with high pull-out resistance and insulated throat, straight or angles.

Part 3 Execution

3.1 CONDUIT INSTALLATION

- .1 Provide a separate raceway for each electrical system.
 - .2 Install conduits to conserve headroom in exposed locations and cause minimum interference in spaces through which they pass.
 - .3 Conceal conduits except in mechanical and electrical service rooms and in unfinished areas.
 - .4 Do not surface mount conduits in other areas unless specifically indicated.
 - .5 Wiring homeruns to panel boards and main branch circuit wiring runs in ceiling space to be run using TECK or in conduit. Wiring drops from conduit systems to light fixtures shall not run horizontally more than 1.8m from conduit system junction boxes in ceiling space.
 - .6 **Type AC90 armoured cable (Bx) with screw type connectors shall be used for connections from conduit systems to luminaires in accessible ceilings and stud partitions or to magnetic door holders. Maximum length of AC90 armoured cable for connections to luminaires mounted in stud partitions shall be 1.5m. Type BX cable shall not be used for any other application.**
 - .7 Armour of TECK cable shall be grounded via an aluminum plate at the supply end and isolated via an insulating plate at the load end of the cable.
 - .8 Use electrical metallic tubing (EMT) above 2.4m and in areas where it will not be subjected to physical damage.
 - .9 Rigid galvanized steel conduit shall be used where exposed to damage, in wet or hazardous locations or under floor slabs and where shown on the drawings.
-

CONDUITS, CONDUIT FASTENINGS AND CONDUIT FITTINGS

City of Winnipeg Skywalk Accessibility Upgrades

Winnipeg, Manitoba
f-BLOK Project No. 2132

Section 26 05 34

Page 5 of 7
January 2022

- .10 Use Rigid PVC Conduit in poured concrete, in duct banks, in areas subject to intermittent or continuous moisture (i.e. coolers, etc.). These areas may not necessarily be shown on the drawings.
 - .11 Use flexible metal conduit in dry locations for connection to motors movable partitions not served by a solid (wiremold type) raceway, fluorescent fixtures recessed in T-bar ceilings, suspended fixtures, transformers and equipment subject to movement or vibration, A Motor connections and connections to transformers in damp locations to be liquid-tight.
 - .12 All flush mounted branch circuit panelboards shall have two 27mm spare conduits stubbed out and extended into accessible ceiling space so that future circuits can be installed without damaging walls or finishes surrounding the panel.
 - .13 The length of any conduit run shall not exceed 30m and no conduit run shall have more than four 90° bends before a pull box is required. Pull boxes to be installed in accessible ceiling space. Conduits shall be supported within 300mm of entering any junction box, pull box, cabinet or panel board.
 - .14 Conduit to be sized as per Canadian Electrical Code. Note that the sizes of branch circuit conductors scheduled and/or specified on the drawings are minimum sizes and must be increased as required to suit length of run and voltage drop in accordance with Canadian Electrical Code. Where conductor sizes are increased to suit voltage drop requirements, increase the conduit size to suit at no extra cost.
 - .15 Seal around all conduit penetrations through floors to ensure penetrations are watertight.
 - .16 Use explosion proof flexible connection for connection to explosion proof motors.
 - .17 Install conduit sealing fittings in hazardous areas. Fill with compound.
 - .18 Bend conduit cold. Replace conduit if kinked or flattened more than 1/10th of its original diameter. Radius of bend shall be not less than 600mm.
 - .19 Mechanically bend steel conduit over 21mm diameter.
 - .20 Install fish cord in empty conduits.
 - .21 Install expansion joints where conduits cross building expansion joints or for outdoor installations.
 - .22 Ream conduit ends to remove all burrs.
 - .23 Seal to air barriers conduits which penetrate barrier.
 - .24 Remove and replace blocked conduit sections. Do not use liquids to clean out conduits.
 - .25 Dry conduits out before installing wire.
-

3.2 SURFACE CONDUITS

- .1 Run parallel or perpendicular to building lines.
- .2 Locate conduits behind infrared or gas fired heaters with 1.5 m clearance.
- .3 Run conduits in flanged portion of structural steel.
- .4 Group conduits wherever possible on suspended or surface channels.
- .5 Do not pass conduits through structural members except as indicated.
- .6 Do not locate conduits within 300mm of flues. steam or hot water lines.
- .7 When a conduit can be run surface, it shall be primed and painted with two coats to match the wall.

3.3 CONCEALED CONDUITS

- .1 Run parallel or perpendicular to building lines.
- .2 Do not install horizontal runs in masonry walls.
- .3 Do not install conduits in terrazzo or concrete toppings unless otherwise indicated.

3.4 GROUNDING

- .1 Where current carrying conductors are installed in raceway, provide ground wire of equal size.
- .2 Where non-current carrying/telecommunication conductors are installed minimum ground wire size #6 AWG.
- .3 Ensure raceways are large enough to accommodate additional (ground) wire.

3.5 INSTALLATION OF EMT CONDUIT

- .1 Use EMT strictly in accordance with Rules 12-1400 to 12-1414 inclusive of CEC.

3.6 INSTALLATION OF FIRE ALARM EMT

- .1 Installation to be as for EMT.
- .2 Touch-up all nicks and scratches with red color matching paint.

3.7 INSTALLATION OF RIGID METAL CONDUIT

- .1 Touch up damage to epoxy finish on rigid conduit fittings with touch-up paint supplied by manufacturer. Paint exposed threads on rigid conduit with epoxy paint.
-

3.8 INSTALLATION OF RIGID PVC CONDUIT

- .1 Use strictly in accordance with Rules 12-1100 inclusive of CEC.
- .2 When not encased in concrete:
 - .1 Provide expansion joints and follow manufacturer's recommendations and code requirements with respect to expansion/contraction, particularly where temperature variations are anticipated.
 - .2 Install conduits loosely with straps and clamps to allow movement.

3.9 INSTALLATION OF LIQUID TIGHT FLEXIBLE CONDUIT

- .1 Provide a separate ground conductor within flexible conduit, bonded to motor frames and system ground.
- .2 Install conduit to prevent liquids draining to connectors.

3.10 CONDUIT AND CABLE IDENTIFICATION

- .1 Refer to Section 26 05 53 "Identification For Electrical Systems" for scope of work.

3.11 WORKMANSHIP

- .1 Install all conduit and wiring concealed, except where specifically noted otherwise. Install conduit in furred spaces or recessed in block or masonry walls. Do not recess conduits in columns or concrete walls, except as noted, without permission. Where conduit is necessary to be run exposed, run parallel to building lines.
- .2 Where metal conduit is placed in concrete, screw up joints tight and paint joints with sealant paint. Before concrete is poured, tightly pack outlet boxes with paper and cap open ends of conduit to prevent concrete intrusion. At junction between exposed conduit and concrete, paint conduit before concrete is poured.
- .3 Take extreme care and ream the ends of all conduits to ensure a smooth interior finish that will not damage the insulation of the wires. Ensure electrical continuity in all conduit systems.

END OF SECTION

Part 1 General

1.1 GENERAL

- .1 Suitably identify with nameplates all pieces of electrical equipment such as lighting, power and distribution panels, power conditioner unit, panelboards, motor control centre, telephone panels, transformers, disconnect switches, contactors, motor starters, control devices, pull boxes, exit lights, splitters, system panels, receptacle coverplates and all equipment connected direct to the power supply.
- .2 Revise and update all existing electrical identification plates (lamacoids) and panel directories affected by room number changes made in this project. This shall include all electrical distribution components which are fed from or which feed equipment located in areas where room number changes have been made.

1.2 NAMEPLATES AND PANEL DIRECTORIES

- .1 Laminated phenolic nameplates with engraved white letters on:
 - .1 Black for normal power.
- .2 Unless specifically indicated otherwise lettering size to be as follows:
 - .1 Lamacoid nameplates: 3mm (1/8") thick plastic engraving sheet, black or red faced, white core, mechanically attached with shelf-tapping screws or split rivets, unless otherwise specified. Sizes as follows:

NAMEPLATE SIZES

Size 1	10 x 50 mm	1 line	3 mm high letters
Size 2	12 x 70 mm	1 line	5 mm high letters
Size 3	12 x 70 mm	2 lines	3 mm high letters
Size 4	20 x 90 mm	1 line	8 mm high letters
Size 5	20 x 90 mm	2 lines	5 mm high letters
Size 6	25 x 100 mm	1 line	12 mm high letters
Size 7	25 x 100 mm	2 lines	6 mm high letters

- .2 Label receptacle and other outlet box coverplates: 5 mm minimum height (.76 mm inscription width).
- .3 Motor control centre identification lamacoid (top one), large sub-distribution panel identification lamacoid (top one), all main distribution identification lamacoids: 100 mm minimum height (1.52 mm inscription width).
- .4 Breakers:
 - .1 Sub-distribution panels: 7 mm minimum height. May be reduced to 5 mm if there are space restrictions.
 - .2 Panelboards: 5 mm minimum height. May be reduced to 3 mm if there are space restrictions.

IDENTIFICATION FOR ELECTRICAL SYSTEMS

City of Winnipeg Skywalk Accessibility Upgrades

Winnipeg, Manitoba
f-BLOK Project No. 2132

Section 26 05 53

Page 2 of 6
January 2022

- .5 Others: 7 mm minimum height (1.02 mm inscription width) when less than 2500 mm (100") above floor; 10 mm minimum height (1.52 mm inscription width) when more than 2500 mm (100") above floor.
- .3 Prior to nameplate fabrication, submit to the Contract Administrator/City of Winnipeg for approval a copy of all panel directories with a list stating exact wording and fabrication details for all nameplates.
 - .1 Submit one complete package, including details for all equipment and devices connected to or part of the electrical distribution.
 - .2 Submission to be received by Contract Administrator a minimum of 7 weeks prior to schedule completion of the work.
- .4 Submit panel directories in electronic format to accommodate future revisions.
 - .1 Submit copies of all 'as-built' panel directories for all new and existing panelboards worked on.
 - .2 Do not destroy old directories. For existing panels, insert old directory behind the new one where possible, otherwise turn them over to City of Winnipeg's representative on site.
- .5 Use City of Winnipeg's building and location codes to provide permanent equipment identification. Architectural room numbers on drawings are not acceptable. Confirm permanent building and location codes with Contract Administrator and City of Winnipeg prior to making name plates and directories.
- .6 In each maintenance/operating manual, include a copy of all panel directories and nameplate listings which were reviewed by Contract Administrator, including any changes or corrections prior to lamacoid fabrication. Nameplate listing schedule shall have exact description of what appears on installed lamacoid, for all lamacoids (excluding receptacle lamacoids) installed by Division 26.
- .7 Co-ordinate names of equipment and systems with mechanical to ensure consistency.
- .8 All nameplates and panel directories to be installed and 100% complete prior to commissioning.

1.3 PANELBOARD AND DISTRIBUTION CENTRE IDENTIFICATION

- .1 All existing panelboards or distribution centres affected by this project shall have their directories neatly updated. A copy of updated directories shall be included in each maintenance/operating manual.
- .2 Panel and circuit identification (examples provided):
 - .1 Panel directory identification:
 - .1 Near the top of the directory, provide the following information:
PANEL: A (panel identification code no.) 120/208V/3PH/4W
(panel voltage, # of phases and wires) FED FROM SD-2A IN B-005 (origin of feeder).

IDENTIFICATION FOR ELECTRICAL SYSTEMS

- .2 If panel is connected to emergency power, indicate: EMERG.
POWER: EA.
- .2 Receptacle colour and circuiting:
 - .1 Refer to wiring devices section for color
- .3 Sample panel directory:

Panel: A

120/208V/3PH/4W

Fed from SD-2A in B-01

Circuit	Three Phase	Circuit
Receptacles, Rm 100	1A	22A Receptacles, Rm 101
Receptacles, Rm 100	2B	23B Receptacles, Rm 101
Receptacles, Rm 102	3C	24C Crane
Receptacles, Rm 103	4A	25A 10 Ton Crane
Receptacles, Rm 103	5B	26B 10 Ton Crane
Receptacles, Rm 104	6C	27C 10 Ton Crane
Receptacles, Rm 104	7A	28A Receptacles, Rm 105
Receptacles, Rm 104	8B	29B Receptacles, Rm 106
Receptacles, Corr.	9C	30C B/B Heater BB-1
Receptacles, Corr.	10A	31A B/B Heater BB-1
Receptacles, Print Rm	11B	32B UnitHeater UH-1
Receptacles, Reception	12C	33C UnitHeater UH-1
Lights, Rm 100	13A	34A UnitHeater UH-2
Lights, Rm 101	14B	35B UnitHeater UH-2
Lights, Rm 101	16A	37A Spare
Lights, 102/103	17B	38B Spare
Lights, Rm 104	18C	39C Spare
Fan, F-1	19A	40A Space
Fan, F-2	20B	41B Space
Fan, F-3	21C	42C Space

The contractor is to supply a sample of the proposed panel designations to the City of Winnipeg for approval, prior to all labeling.

1.4 OTHER EQUIPMENT IDENTIFIED BY NAMEPLATE

- .1 Splitters and pullboxes: Indicate their function and characteristics (equipment description and location where fed from and what it feeds).
- .2 Panel Breakers:
 - .1 Sub-distribution panels: All breakers to have lamacoid identification with 7 mm high letters. Examples are:
 - .1 For mechanical equipment:
CONDENSING UNIT CU-1 (equipment description)
ON Roof (equipment location)

IDENTIFICATION FOR ELECTRICAL SYSTEMS

- .2 For electrical distribution equipment:
 - FEEDS TR-1 (equipment description)
 - IN Room 100 (equipment location)

.2 Panelboards: Provide lamacoid identification with 5 mm high lettering for breakers which control sub-fed panels. If there is insufficient space available adjacent to breakers, lamacoids to be mechanically fastened to the interior of panel door, either above or below the directory. If lamacoids are fastened adjacent to individual breakers, circuit numbers may be omitted from lamacoids.

EXAMPLE: CCT. #14, 15, 16

PANEL: A IN Rm 100

1.5 CONDUIT AND CABLE IDENTIFICATION

- .1 Colour code of feeder phase (Refer to Section 26 05 34 "Conduits" for colour coding.) shall appear on every cable in two locations at any distribution; once inside distribution enclosure near cable termination and once outside distribution enclosure, in visible location near enclosure.
- .2 Junction boxes with power wiring, all circuits inside the box shall be identified on the inside of the cover plate with permanent marker.
- .3 Provide Thomas and Betts stick-on conduit markers for the following systems. Markers to be:
 - .1 Style B 28.6 mm x 114.3 mm for 25 mm conduit and larger.
 - .2 Style C 12.7 mm x 57.2 mm for conduit under 25 mm.
- .4 Space markers 10 metres on centres maximum for exposed conduits and conduits in accessible ceiling spaces and, in addition, attach markers before and after all barriers, where conduits pass through closets, cupboards, stairwells, etc., and adjacent to all panels, cabinets, pullboxes and access fittings. Markers to be laminated mylar with orange background and black letters. Identify systems as follows:

NORMAL POWER	VOICE/DATA
EMERGENCY POWER	UPS POWER
DATA PROCESSING	AMPLE ORGANICS DATA
PROCESSING	
INTERCOM	FIRE ALARM
TELEVISION	CCVS
MONITORING SYSTEM	INTRUSION ALARM
ACCESS CONTROL	CONTROL WIRING
A.T.S. CONTROLS	DC EMERG. LIGHTING
GROUND CONDUCTOR	

Others: Check with Contract Administrator. All conduit systems shall be

IDENTIFICATION FOR ELECTRICAL SYSTEMS

City of Winnipeg Skywalk Accessibility Upgrades

Winnipeg, Manitoba
f-BLOK Project No. 2132

Section 26 05 53

Page 5 of 6
January 2022

identified.

- .5 All stick-on conduit markers must be installed during installation of related conduit systems, not after installation of complete conduit systems.
- .6 Do not apply stick-on conduit markers onto exposed wiremold raceways.
- .7 Terminal, Wire and Cable Identification:
 - .1 Identification:
 - .1 Use permanent markers to identify all cables, terminals and corresponding wires at all termination points and junctions stating the identification code of the circuit alarm module in the fire alarm panel.
 - .2 Coding system shall be consistent throughout the entire alarm system, corresponding exactly to the designations used at the main panel. As-built drawings and directories shall list colour coding by circuit.
 - .3 Colour scheme for cable and wiring shall be consistent throughout the entire alarm system installation. Refer to Section 26 05 53.
 - .2 Directory: Provide a typewritten directory in a clear plastic pouch inside all tub and master terminal cabinet covers describing the following:
 - .1 Enclosure nameplate code number and location code.
 - .2 The following for each terminal point in each enclosure:
 - .1 Terminal code number and/or colour.
 - .2 Areas served (state locations).
 - .3 Zone number.
 - .4 Function (i.e. equipment name and location, etc.).
 - .3 Cable codes and corresponding wire colour codes and/or code numbers. State cable function. Insert a copy of each tub or cabinet directory into each maintenance/operating manual.
- .8 Changes to existing: Whenever changes are made to existing wiring, panels, annunciators, etc., re-label as required and update corresponding directories and drawings, to reflect as-built conditions.
- .9 All identification and labeling shall be approved by the City of Winnipeg prior to installation.
- .10 All system identification (nameplates, directories, cable, wire, etc.) to be installed and 100% complete prior to system verification.

Part 2 Products

- .1 Not used.
-

IDENTIFICATION FOR ELECTRICAL SYSTEMS

City of Winnipeg Skywalk Accessibility Upgrades
Winnipeg, Manitoba
f-BLOK Project No. 2132

Section 26 05 53
Page 6 of 6
January 2022

Part 3 Execution

.1 Not used.

END OF SECTION

Part 1 General

1.1 RELATED WORK

- .1 Refer to all sections of the specification for related work.

1.2 SHOP DRAWINGS AND PRODUCT DATA

- .1 Submit shop drawings and product data in accordance with Section 26 05 00 - Common Work Results - Electrical
- .2 Include with requests for equal, time-current characteristic curves for breakers with ampacity of 800A and over or with interrupting capacity of 22,000 A symmetrical (RMS) and over at system voltage.

Part 2 Products

2.1 BREAKERS – GENERAL

- .1 Common-trip breakers: with single handle for multi-pole applications.
- .2 Bolt-on moulded case circuit breakers, quick-make, quick-break type, for manual and automatic operation with temperature compensation for 40°C (104°F) ambient.
- .3 Magnetic instantaneous trip elements in circuit breakers to operate only when value of current reaches setting. Trip settings on breakers with adjustable trips to range from 3-10 times current rating.
- .4 All circuit breakers mounted in switchboards and CDP's to be c/w with electronic trip (L.S.I.) as a minimum.
- .5 All breakers for heat trace cable circuits to be 30mA GFCI type breaker.
- .6 To be of same manufacturer as switchboards, CDP's and panelboards.

2.2 THERMAL MAGNETIC BREAKERS

- .1 Moulded case circuit breaker to operate automatically by means of thermal and magnetic tripping devices to provide inverse time current tripping and instantaneous tripping for short circuit protection.

2.3 OPTIONAL FEATURES

- .1 Include, as required:
 - .1 on-off locking devices
 - .2 under-voltage release
 - .3 handle mechanism
-

MOULDED CASE CIRCUIT BREAKERS

City of Winnipeg Skywalk Accessibility Upgrades
Winnipeg, Manitoba
f-BLOK Project No. 2132

Section 26 28 21
Page 2 of 2
January 2022

- .4 shunt trip
- .5 Red Breaker for fire alarm, in addition provide Elock-FA, E series circuit breaker lock as manufactured by "Space Age Electronics"

2.4 MANUFACTURERS

- .1 Acceptable manufacturers: GE, Eaton (Cutler Hammer) or Schneider (Square D).

Part 3 Execution

3.1 INSTALLATION

- .1 Install circuit breakers according to manufacturer's recommendations.
- .2 Install on-off locking devices for breakers feeding fire alarm panel, security panels, etc.
- .3 Install red fire alarm breaker.

END OF SECTION
