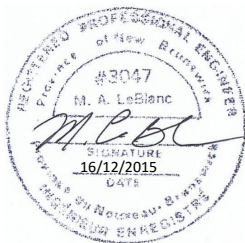


## 1 General

- .1 This Section covers items common to Sections of Electrical Divisions. This section supplements requirements of General Conditions.

## 2 Definitions

- .1 Definitions:
- .1 ULC - Underwriters Laboratories of Canada
  - .2 EMT - Electrical Metallic Tubing
  - .3 CSA - Canadian Standards Assoc.
  - .4 AWG - American Wire Gauge



## 3 Codes and Standards

- .1 Do complete installation in accordance with CSA C22.1 except where specified otherwise.
- .2 Abbreviations for electrical terms: to CSA Z85.
- .3 PWGSC documents ES/SPEC-1001, SW0102R6E and SW010R3E are to be considered as part of this specifications and their contents shall apply to this contract.

## 4 Addenda and Revisions

- .1 Refer to Division 1.
- .2 The Owner and Engineer reserve the right to make revisions to the drawings during the period of construction and these revisions shall take precedence over previously issued drawings. All revisions to work shall be executed by duly authorized change orders with the amount of addition or deduction to the contract amount approved by the Owner before the execution of any work entailed in the revisions.

## 5 Prior Approval

- .1 Refer to Division 1

## 6 Substitutions

- .1 Refer to Division 1.

## 7 Scope of Work

- .1 The Electrical Contractor shall furnish all labour, materials, tools, appliances and equipment to entirely

complete and provide for the operation of the electrical systems.

- .2 The overall intention is to provide for a complete integrated system, complete in all aspects, and all items reasonably inferable as called for by the plans and specifications, and by normally accepted good practice, notwithstanding that every item necessarily required may not be particularly mentioned. This Contractor shall fulfill his obligation and not take advantage of any unintentional errors or omissions should such exist, to the detriment of the Owner's interest. The work shall include but not be limited to:
  - .1 Power Distribution
  - .2 Branch Circuit Wiring
  - .3 Building Entrance Control System
  - .4 Card Access System
  - .5 Key Control System
  - .6 All Cutting, Patching and Painting

## 8 Electrical Drawings

- .1 The drawings which constitute an integral part of this contract shall serve as working drawings. They indicate the general layout of the complete electrical system; arrangements of feeders, circuits, outlets, switches, controls, panelboards, service equipment, communications, underground duct banks, overhead pole lines, power centers, etc..
- .2 Field verification of scale dimensions on plans is directed since actual locations, distances, and levels will be governed by the field conditions.
- .3 All discrepancies related to the electrical work shall be promptly brought to the attention of the Electrical Engineer for clarification.

## 9 Examination of Drawings and Existing Conditions

- .1 The Electrical Contractor shall become completely familiar with the drawings and specifications, as well as construction methods of other trades related to his work to avoid possible conflicts on the project. Should drastic changes be necessary to resolve such conflicts, this Contractor shall notify the Departmental Representative and secure written approval and agreement on necessary adjustments before the installation is started.
- .2 The Contractor shall determine all working conditions and rigidly comply. Conditions requiring special

consideration include but not be limited to:

- .1 Dust.
- .2 Noise.
- .3 Vibration.
- .4 Water.
- .5 Use of powder actuated tools.
- .6 Working hours.
- .7 Access to working locations.
- .8 Continuity of power.
- .9 Project schedule.
- .10 Physical protection of Owner's facility and equipment.

.4 No extras will be allowed due to failure to take site conditions into consideration.

.5 The exact roughing-in dimensions and connection points shall be determined from shop drawings and on-site measurements.

## 10 Discrepancies

.1 Bidders in preparing their tenders, finding any errors, omissions, or discrepancies in the plans, specifications or other documents, or having any doubt in the intent or meaning of any part thereof, shall immediately notify the Departmental Representative, who will send written instructions or clarification to all bidders. Where such discrepancies exist and it is evident that this Contractor could not have properly tendered without clarification and where such clarification was not requested, no extra to the contract will be considered in order to have the installation properly made. The Owner and Engineer will not be responsible for oral instruction.

## Product Data and Samples

- .1 Refer to Division 1.
- .2 Where applicable, include wiring, single line and schematic diagrams.
- .3 Include wiring drawings or diagrams showing interconnection with work of other Sections or Divisions.
- .4 The review of shop drawings is for the sole purpose of ascertaining conformance with the design concepts. This review shall not imply that the Engineer approves the detail design inherent in the shop drawings, responsibility for which shall remain with the Contractor submitting the shop drawings, and the review

shall not relieve the contractor of his responsibility for errors or omissions in the shop drawings or of his responsibility for meeting all requirements of the construction and contract documents. The Contractor is responsible for dimensions to be confirmed and correlated at the job site, for information that pertains solely to fabrication processes or to techniques of construction and installation, and for co-ordination of the work of all sub-trades.

- .8 All shop drawings submitted shall be considered to have the above paragraph affixed to each one.

## 11 Operation and Maintenance Data

- .1 Provide operation and maintenance data for incorporation into operation and maintenance manual in accordance with General conditions.
- .2 Include in operation and maintenance data:
  - .1 Details of design elements, construction features, component function and maintenance requirements, to permit effective start-up, operation, maintenance, repair, modification, extension and expansion of any portion or feature of installation.
  - .2 Technical data, product data, supplemented by bulletins, component illustrations, exploded views, technical descriptions of items, and parts lists. Advertising or sales literature not acceptable.
  - .3 Wiring and schematic diagrams and performance curves.
  - .4 Names and addresses and phone numbers of local suppliers for items included in maintenance manual.
  - .5 Copy of reviewed shop drawings.
  - .6 Copy of Division 16 specifications.
  - .7 Names and addresses and phone numbers of Electrical Contractors.
  - .8 Warranties.
  - .9 Inspection certificates and verification reports.
- .4 Acceptance testing, training, and Manuals to conform to conform to PWGSC document SW010R3E.

## 12 Maintenance Materials

- .1 Provide maintenance materials in accordance with Division 1.

- |  |    |   |
|--|----|---|
| <u>13 Care, Operation<br/>and Start-up</u>     | .1 | Instruct operating personnel in the operation, care and maintenance of equipment.   |
|  | .2 | Arrange and pay for services of manufacturer's factory service engineer to supervise start-up of installation, check, adjust, balance and calibrate components.   |
|  | .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.   |
|  | .4 | Acceptance testing, training, and Manuals to conform to conform to PWGSC document SW010R3E.   |
| <br><u>14 Voltage Ratings</u>                  | .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. |
| <br><u>15 Permits, Fees<br/>and Inspection</u> | .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 associated fees.  |
|  | .3 | Drawings and specifications required by Electrical Inspection Department and Supply Authority will be provided at no cost.  |
|  | .4 | Notify Engineer of changes required by Electrical Inspection Department prior to making changes.  |
|  | .5 | Furnish Certificates of Acceptance from authorities having jurisdiction on completion of work.  |
| <br><u>16 Materials and</u>                    | .1 | Provide materials and equipment.  |

Equipment

- .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 Factory assemble control panels and component assemblies.

17 Finishes

- .1 Shop finish metal enclosure surfaces by application of rust resistant primer inside and outside, and at least two coats of finish enamel.
  - .1 Paint outdoor electrical equipment "equipment green" finish to EEMAC Y1-1.
  - .2 Paint indoor switchgear and distribution enclosures light grey to EEMAC 2Y-1.
- .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.

18 Equipment  
Identification

- .1 Identify electrical equipment with labels as follows:
- .2 Labels:
  - .1 Lamacoid 3 mm thick plastic engraving sheet, white face, black core.
- .3 Labels: Lamacoid 1/8" thick plastic engraving sheet.
  - .1 White face, black core for equipment nameplates.
  - .2 Red face, white core for warnings or as directed.
  - .3 Blue face, white core for essential panels.
  - .4 Black face, white core for non-essential panels.
- .4 Label sizes:
  - .1 Size 1, 10 x 50 mm, 1 line, 3 mm high letters
  - .2 Size 2, 12 x 70 mm, 1 line, 5 mm high letters
  - .3 Size 3, 12 x 70 mm, 2 lines, 3 mm high letters
  - .4 Size 4, 20 x 90 mm, 1 line, 8 mm high letters
  - .5 Size 5, 20 x 90 mm, 2 lines, 5 mm high letters
  - .6 Size 6, 25 x 100 mm, 1 line, 12 mm high letters
  - .7 Size 7, 25 x 100 mm, 2 lines, 6 mm high letters
- .5 Labels:
  - .1 Embossed plastic labels with 6 mm high letters

unless specified otherwise.

- .6 Wording on labels to be approved by Engineer prior to manufacture.
- .7 Allow for average of twenty-five (25) letters per label.
- .8 Identification to be English.
- .9 Labels for terminal cabinets and junction boxes to indicate system and/or voltage characteristics.
- .10 Terminal cabinets and pull boxes: indicate system and voltage.
- .11 Name plates for conduits to indicate conduit location and designation.
- .12 Label Key Cabinets with a size 6 label. Indicate Cabinet number

## 19 Wiring Identification

- .1 Identify wiring with permanent indelible identifying markings, either numbered or coloured plastic tapes, on both ends of phase conductors of feeders and branch circuit wiring.
- .2 Maintain phase sequence and colour coding throughout.
- .3 Colour code: to CSA C22.1.
- .4 Use colour coded wires in communication cables, matched throughout system.

## 20 Conduit and Cable Identification

- .1 Colour code conduits, boxes and metallic sheathed cables.
- .2 Code with plastic tape or paint at points where conduit or cable enters wall, ceiling, or floor, and at 15m intervals.
- .3 Colours: 25mm wide prime colour and 20mm wide auxiliary colour.
  - .1 Up to 250 V: yellow
  - .2 Other communication systems: green/blue
  - .3 Other Security Systems: green
- .4 Tag fishcords in empty conduits at each conduit opening with conduit designation. Use lamacoid plates with hole to permit attachment to fishcord.

<u>21 Wiring Terminations</u>	.1	Lugs, terminals, screws used for termination of wiring to be suitable for copper conductors.
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<u>22 Manufacturers and CSA Labels</u>	.1	Visible and legible after equipment is installed.
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<u>23 Warning Signs</u>	.1	As specified and to meet requirements of Electrical Inspection Department and Engineer.
	.2	Decal signs, minimum size 175mm x 175mm.

<u>24 Location of Outlets</u>	.1	Locate outlets in accordance with requirements of architectural division.
	.2	Do not install outlets back-to-back in wall; allow minimum 150mm horizontal clearance between boxes.
	.3	Change location of outlets at no extra cost or credit, providing distance does not exceed 3m and information is given before installation.
	.4	Locate light switches on latch side of doors. Locate disconnect devices in mechanical and elevator machine rooms on latch side of door.

<u>25 Conduit and Cable Installation</u>	.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 100mm.
	.2	Install cables, conduits and fittings to be embedded or plastered over, neatly and close to building structure so furring can be kept to minimum.



## 26 Field Quality Control

- .1 Conduct and pay for following tests:
  - .2 Systems: security, access control, Key Control.
- .2 Furnish manufacturer's certificate or letter confirming that entire installation as it pertains to each system has been installed to manufacturer's instructions.
- .3 Insulation resistance testing.
  - .1 Megger circuits, feeders and equipment up to 350 V with a 500 V instrument.
  - .2 Megger 350-600 V circuits, feeders and equipment with a 1000 V instrument.
  - .3 Check resistance to ground before energizing.
- .4 Carry out tests in presence of Departmental Representative unless advised otherwise.
- .5 Provide instruments, meters, equipment and personnel required to conduct tests during and at conclusion of project.
- .6 Submit test results for review.
- .7 Refer to PWGSC documents SW0102R6E for quality control requirements.
- .8 Acceptance testing, training, and Manuals to conform to conform to PWGSC document SW010R3E

## 27 Co-ordination of Protective Devices

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

## 28 Co-ordination with Others

- .1 Co-ordinate interruptions of electrical services and installation of equipment to minimize inconvenience to Owner.
- .2 Care must be taken to prevent interference with normal operations of the Owner.
- .3 Work by other contractors will be done concurrently with work in this contract. This contractor shall schedule and arrange his work and store his material in co-operation and so as to avoid interference with others.

- 29 Removal of Existing Equipment and Material
- .1 All equipment and wiring to be reused is indicated on the drawings or outlined in the appropriate section of the specification.
  - .2 All removed equipment is to remain the property of the Owner as shown and where directed on site by the Owner; otherwise the Electrical material removed shall become the property of the Electrical Contractor and shall be promptly removed from the site.
  - .3 Remove connections to equipment to be removed.
  - .4 Remove all electrical equipment as indicated including all conduit and wiring to and from equipment which to be removed.

- 30 Cleaning
- .1 Remove debris and waste material on a daily basis.
  - .2 At the completion of the project, remove all grease, dust, labels, fingerprints, etc. from equipment and leave in new condition.

- 31 Record Drawings
- .1 In accordance with Division 1.

- 32 Cutting
- .1 The Contractor shall be responsible for all cutting required to complete the work shown on the drawings and described herein.
  - .2 All holes through concrete or masonry shall be made by core drilling. Care must be taken to contain dust and debris.
  - .3 Seal all holes and openings using a non-shrink, fire proof compound.

- 33 Patching and Painting
- .1 The Contractor shall neatly patch all surfaces cut or damaged as a result of this contract.

- .2 The patching shall be of matching material or as specified herein and carried out by tradesmen trained and skilled in the work to be done.
- .3 Painting of a patched area will be required. The painted area shall match as near as possible the existing paint.
- .4 All patching, painting and sealing shall be to the satisfaction of the Engineer Owner.
- .5 The Contractor shall neatly paint all surfaces left exposed or patched as a result of this contract.

#### 34 Deficiency Lists

- .1 The Contractor will be notified at various intervals of defective workmanship, installation deficiencies, etc. The Contractor shall not request revised or up-dated lists without first submitting a current detailed report on the status of each item on the previous deficiency list.
- .2 The Contractor shall notify the Engineer when the project is ready for a final inspection. If the resulting deficiency list exceeds twenty (20) items, the project will not be considered ready for the final inspection, and the list may not be supplied to the Contractor.

#### 35 Warranty

- .1 Guarantee material and workmanship to be free from defect for a period of one year, or longer where specified otherwise, after the issuing of the certificate of substantial completion.
- .2 Make good, at the Owner's convenience, all defects covered by this guarantee without additional cost to the Owner.

## PART 1 - GENERAL

- |  |    |   |
|--|----|---|
| <u>1.1 Shop Drawing and Product Data</u> | .1 | Submit product data in accordance with Division 1 |
|--|----|---|

## PART 2 - PRODUCTS

- |                           |    |   |
|---------------------------|----|---|
| <u>1.1 Building Wires</u> | .1 | Conductors: stranded for 10 AWG and larger. Minimum size: 12 AWG.   |
|                           | .2 | Copper conductors: size as indicated, with 600 V insulation of chemically cross-linked thermosetting polyethylene material rated RW90 . |
| <u>1.2 System Wiring</u>  | .1 | System conductors shall be in accordance with manufacturers requirements.   |

## PART 3 - EXECUTION

- |   |    |   |
|---|----|---|
| <u>3.1 Installation of Building Wires</u> | .1 | Install wiring as follows:  |
|   | .1 | In conduit systems in accordance with Section 260534.               |
| <u>3.2 Installation of System Wires</u>   | .1 | Install system wiring in conduit in accordance with section 260534. |
| <u>3.3 Installation</u>                   | .1 | Branch wiring shall be #12 up to 20m in length maximum.             |

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General

Any length greater than 20m and less than 36m shall be #10. Any length greater than 36m shall be sized to suit equipment load and voltage drop.

## PART 1 - GENERAL

- |   |    |   |
|---|----|---|
| <u>1.1 Shop Drawings<br/>and Product Data</u> | .1 | Submit shop drawings and product data for cabinets in accordance with Section 013300 - Shop Drawings, Product Data, Samples and Mock-ups. |
|---|----|---|

## PART 2 - PRODUCTS

- |  |    |  |
|--|----|--|
| <u>2.1 Junction and<br/>Pull Boxes</u> | .1 | Welded steel construction with screw-on flat covers for surface mounting.                  |
|  | .2 | Covers with 25 mm minimum extension all around, for flush-mounted pull and junction boxes. |

## PART 3 - EXECUTION

- |   |    |   |
|---|----|---|
| <u>3.1 Junction, Pull<br/>Boxes and Cabinets<br/>Installation</u> | .1 | Install pull boxes in inconspicuous but accessible locations.   |
|   | .2 | Mount cabinets with top not higher than 2 m above finished floor.   |
|   | .3 | Only main junction and pull boxes are indicated. Install pull boxes so as not to exceed 30 m of conduit run between pull boxes. |
| <u>3.2 Identification</u>   | .1 | Provide equipment identification in accordance with Section 260500.   |
|   | .2 | Install size 2 identification labels indicating system name voltage and phase.  |

## PART 1 - GENERAL

### 1.1 References

- .1 CSA C22.1 Canadian Electrical Code, Part 1.

## PART 2 - PRODUCTS

### 2.1 Outlet and Conduit Boxes General

- .1 Size boxes in accordance with CSA C22.1.
- .2 102 mm square or larger outlet boxes as required for special devices.
- .3 Gang boxes where wiring devices are grouped.
- .4 Blank cover plates for boxes without wiring devices.
- .5 Combination boxes with barriers where outlets for more than one system are grouped.

### 2.2 Sheet Steel Outlet Boxes

- .1 Electro-galvanized steel single and multi gang flush device boxes for flush installation, minimum size 76 x 50 x 38 mm or as indicated. 102 mm square outlet boxes when more than one conduit enters one side with extension and plaster rings as required.
- .2 102 mm square or octagonal outlet boxes for lighting fixture outlets.
- .3 102 mm square outlet boxes with extension and plaster rings for flush mounting devices in finished plaster walls.

### 2.3 Masonry Boxes

- .1 Electro-galvanized steel masonry single and multi gang boxes for devices flush mounted in exposed block walls.

- |                                  |    |   |
|----------------------------------|----|---|
| <u>2.4 Concrete Boxes</u>        | .1 | Electro-galvanized sheet steel concrete type boxes for flush mount in concrete with matching extension and plaster rings as required. |
|                                  |    |   |
| <u>2.5 Fittings-<br/>General</u> | .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 1- 1/4" 32 mm and pull boxes for larger conduits.   |
|                                  | .4 | Double locknuts and insulated bushings on sheet metal boxes.  |

### PART 3 - EXECUTION

- |                         |    |   |
|-------------------------|----|---|
| <u>3.1 Installation</u> | .1 | Support boxes independently of connecting conduits.   |
|                         | .2 | Fill boxes with paper, sponges or foam or similar approved material to prevent entry of debris during construction. Remove upon completion of work. |
|                         | .3 | For flush installations mount outlets flush with finished wall using plaster rings to permit wall finish to come within 6 mm of opening.            |
|                         | .4 | Provide correct size of openings in boxes for conduit, mineral insulated and armored cable connections. Reducing washers are not allowed.           |



## PART 1 - GENERAL

- |                                |    |   |
|--------------------------------|----|---|
| <u>1.1 Location of Conduit</u> | .1 | Drawings do not indicate all conduit runs. Those indicated are in diagrammatic form only. |
|--------------------------------|----|---|

## PART 2 - PRODUCTS

- |                     |    |  |
|---------------------|----|--|
| <u>2.1 Conduits</u> | .1 | Rigid galvanized steel threaded conduit. |
|---------------------|----|--|

- |                               |    |   |
|-------------------------------|----|---|
| <u>2.2 Conduit Fastenings</u> | .1 | One hole steel straps to secure surface conduits 50 mm and smaller. Two hole steel straps for conduits larger than 50 mm. |
|                               | .2 | Beam clamps to secure conduits to exposed steel work.   |
|                               | .3 | Channel type supports for two or more conduits.   |
|                               | .4 | Six mm dia threaded rods to support suspended channels.   |

- |                             |    |   |
|-----------------------------|----|---|
| <u>2.3 Conduit Fittings</u> | .1 | Fittings: manufactured for use with conduit specified.<br>Coating: same as conduit. |
|-----------------------------|----|---|

- |                      |    |                |
|----------------------|----|----------------|
| <u>2.4 Fish Cord</u> | .1 | Polypropylene. |
|----------------------|----|----------------|

## PART 3 - EXECUTION

### 3.1 Installation

- .1 Install conduits to conserve headroom in exposed locations and cause minimum interference in spaces through which they pass.
- .2 Conceal conduits except in mechanical and electrical service rooms.
- .3 Use Rigid Steel conduit.
- .4 Install fish cord in empty conduits.
- .5 Where conduits become blocked, remove and replace blocked section. Do not use liquids to clean out conduits.
- .6 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 channels.
- .5 Do not pass conduits through structural members except as indicated.
- .6 Do not locate conduits less than 75 mm parallel to steam or hot water lines with minimum of 25 mm at crossovers.

- |                 |    |   |
|-----------------|----|---|
| 3.3 Concealed   | .1 | Do not install horizontal runs in masonry walls.          |
| <u>Conduits</u> | .2 | Do not install conduits in terrazzo or concrete toppings. |

## PART 1 - GENERAL

- |                         |    |  |
|-------------------------|----|--|
| <u>1.1 Product Data</u> | .1 | Submit product data in accordance with Division 1. |
|-------------------------|----|--|

## PART 2 - PRODUCTS

- |                     |    |  |
|---------------------|----|--|
| <u>2.1 Breakers</u> | .1 | Bolt-on molded case circuit breaker: quick- make, quick-break type, for manual and automatic operation with temperature compensation for 40°C ambient. |
| <u>General</u>      | .2 | Common-trip breakers: with single handle for multi-pole applications.  |

- |                          |    |  |
|--------------------------|----|--|
| <u>2.2 Thermal</u>       | .1 | Molded 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. |
| <u>Magnetic Breakers</u> |    |  |

- |                          |    |                                    |
|--------------------------|----|------------------------------------|
| <u>2.3 Manufacturers</u> | .1 | Acceptable Manufacturers:          |
|                          | .1 | Match Existing panel manufacturer. |

PART 3 - EXECUTION

3.1 Installation .1 Install circuit breakers as indicated.