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## 1. **PART 1 – GENERAL**

### 1.1 General

- .1 The purpose of this section is to establish applicable guidelines, specifically for electrical work which are, unless otherwise indicated or modified explicitly on plans or specifications, made by the Electrical Subcontractor.
- .2 Whenever the expression “Electrical Subcontractor” is used in Division 26, it is understood that it means the person, the company, the corporate name or the corporation acting directly or through a duly authorized representative, responsible for work described in Division 26. The expression “Contractor” designates the General Contractor or the Project Manager.
- .3 The Contractor is responsible for implementation and coordination of all work mentioned and described in specifications and drawings. However, the Contractor must subcontract part of the work to qualified Subcontractors.
- .4 Responsibilities – Scope of work
  - .1 The work described on the following plans is an integral part of the Contractor responsibilities:

<u>CSA file no.</u>	<u>Project title</u>	<u>DWG. No.</u>
A12-5.2	New elevator – conference centre	E-01 and E-02

### 1.2 Abbreviations

- .1 Words, sentences and abbreviations with well-known technical meaning will have the same meaning in this document, including:
  - .1 c/w: complete with, including
  - .2 c/c: centre to centre
  - .3 min.: minimum
  - .4 max.: maximum
  - .5 m: metre
  - .6 mm: millimetre
  - .7 ' or ft: feet
  - .8 " or in: inch
  - .9 m<sup>2</sup>: square metre
  - .10 mm<sup>2</sup>: square millimetre
  - .11 ft<sup>2</sup>: square foot
  - .12 in<sup>2</sup>: square inch
  - .13 Ø : diameter
  - .14 NPS: nominal pipe size
  - .15 °F: degree Fahrenheit
  - .16 °C: degree Celsius
  - .17 rpm: revolution per minute
  - .18 db: decibel
  - .19 e.g.: for example
  - .20 hr: hour
  - .21 amp. or A: ampere
  - .22 HZ (Hz): hertz
  - .23 V: volt
  - .24 kW: kilowatt
  - .25 HP: horse-power
  - .26 kVA: kilovolt-ampere

- .27 f: connecting wire
- .28 ph: Phase
- .29 EMT: electrical metallic tubing, thin walled
- .30 PVC: polyvinyl chloride conduit
- .31 C: conduit
- .32 std: standard
- .33 H.C.: off contract
- .34 CSA/(ACNOR): Canadian Standard Association
- .35 ULC: Underwriter's Laboratories of Canada
- .36 CEC: Canadian Electrical Code

### 1.3 Duties and responsibilities of Electrical Subcontractor

- .1 Provide all materials, supervision, labour, handling, equipment, tools, machinery, scaffolding, hauling and transportation to build, execute and complete in a timely, substantial and satisfying manner all works required for the installation of all systems provided for in this section, as described on plans and specifications.
- .2 Pay all permits required by authorities and respect applicable codes and regulations (latest edition in force).
- .3 Present written proof that he and his Subcontractors have complied with work health and safety legislation requirements.

### 1.4 Site visit

- .1 Before submitting his bid, the Electrical Subcontractor must visit the site to see all existing conditions are evaluated correctly the scope of dismantling work, relocation work (if applicable) and the facilities to build. No claims for ignorance of local conditions will be considered by the Party with whom the contract is signed.

### 1.5 Reference Plans

- .1 In preparing his bid, the Electrical Subcontractor must consult all architectural, structural, electrical, plumbing, heating, ventilation and fire protection plans and verify all elements that could affect his work.
- .2 The Departmental Representative may issue additional drawings to clarify some details. These additional drawings have the same meaning and the same scope as if they were included in the plans and specifications.

### 1.6 Questions and interpretations

- .1 When there is appearance of contradiction between plans and specifications, regulations and/or codes, the Electrical Subcontractor must base his bid on the most restrictive requirements. The Departmental Representative reserves the right to interpret his plans and specifications.
- .2 If, upon reviewing contract documents (plans, specifications, etc.), the Electrical Subcontractor has questions about the meaning or the veracity of some points, he must immediately notify the Departmental Representative who could, if required, send written instructions to all bidders.

- .3 Plans and specifications are mutually explanatory and complementary. Any inaccuracy or contradiction that may be subject to interpretation must be notified to the Departmental Representative, to obtain the only possible interpretation. Any work that does not comply with plans and/or specifications and performed without such interpretation, must, if required, be redone without compensation, at the request and to Departmental Representative satisfaction.
- .4 No measurement taken on scale on drawings shall be used for the interpretation of dimensions for construction.

#### 1.7 Work not included in contract

- .1 No additional compensation will be paid to the Electrical Subcontractor for work not included in contract, unless the Electrical Subcontractor obtains a written authorization from the Party with whom the contract is signed.

#### 1.8 Equivalences or substitution of materials

- .1 Specialized product – no equivalence
  - .1 For certain products, it is desired that the specification be fully respected. Those products are identified in documents with the label “No equivalence”.
  - .2 In such cases, no equivalence is accepted.
- .2 Several manufacturers are identified or have the mention “Equivalent approved”
  - .1 When more than one manufacturer is identified in documents for a given material or product, the Electrical Subcontractor remains free to choose at any time one of the manufacturers specified if the product meets specifications.
  - .2 When, in documents, a specification is indicated for a manufacturer with the mention “or approved equivalent”, the Electrical Subcontractor remains free to choose at any time one of the manufacturers specified if the product meets specifications.
  - .3 Any product found not equivalent by the Departmental Representative will be rejected. His decision will be final.

#### 1.9 Codes and standards

- .1 Works must comply with the following requirements (most recent applicable editions):
  - .1 Standards of the Canadian General Standards Board (CGSB).
  - .2 Standards of the Canadian Standards Association (CSA).
  - .3 Quebec Construction Code.
  - .4 Quebec Electrical Code.
  - .5 Hydro-Québec standards.
- .2 Requirements specified on plans and specifications should never be lowered under the pretext that provincial and local regulations or standards and codes mentioned above are less strict. In all cases, the most stringent standards and codes shall prevail.
- .3 In “food” areas, CFIA standards must be complied with (e.g.: paint, sealant, installation).

#### 1.10 Coordination

- .1 To avoid any conflict, the Contractor and his Subcontractors must coordinate the installation of their respective equipment before performing work.
- .2 In addition, special attention must be given to the installation of equipment. The Contractor shall require from his Subcontractors that:
  - .1 The definitive location of luminaries (including mounting heights) is coordinated with other installations (conduits, cable racks, ventilation, plumbing, fire protection).
  - .2 The Electrical Subcontractor must notify the Departmental Representative about any major discrepancy regarding the installation of lighting fixtures.
  - .3 Shop drawings for ventilation ducts must be verified by each Subcontractor (electricity, plumbing, fire protection) and a copy must bear the signature of each foreman, meaning that coordination has been carried out and that all components can be integrated without problem.
    - .1 Absence of signature entails automatic refusal of drawings.
- .3 The Contractor is responsible for any problem that may result from lack of coordination and he will apply corrective actions as required, at his own expense.
- .4 Each Subcontractor must organize his work so as not to hinder other works performed in the building.

#### 1.11 Correspondence and communications

- .1 The Contractor, the Subcontractors and the Departmental Representative recognize as negotiations only verbal communications that they may have with each other. To be valid, any decision, amendment or change must be authorized in writing by the Departmental Representative or at least be recorded in the minutes of meeting where he is present.
- .2 Subcontractors must submit shop drawings, substitution requests, etc., to the Contractor according to the procedure established for this project. All these documents must state project names and equipment submitted, reference numbers used by the Departmental Representative on his plans, and reference to sections of Specifications for each piece of equipment.

#### 1.12 Site meetings

- .1 Subcontractors must attend site meetings to which they have been invited. Time and location of meetings will be defined by responsible authorities.

#### 1.13 Work schedule

- .1 Once the master schedule for the project is defined, the Electrical Subcontractor must comply with it during the project and ensure that work does not disrupt activities between various Subcontractors and the general conduct of the project.
- .2 If, for reasons beyond control, a Subcontractor cannot respect the established schedule, he must notify the Contractor so that appropriate corrective actions can be taken. Each Subcontractor must comply with these new guidelines.
- .3 When changes, delays or other circumstances modify the work schedule, the Contractor shall make necessary changes to the schedule and transmit the revised version to the Departmental Representative.

#### 1.14 Cost breakdown

- .1 Before applying for the first progress payment, the Electrical Subcontractor will present a detailed breakdown of costs depending on his discipline, the requirements of the responsible authorities, and the total amount of the contract. Once approved by Departmental Representative, this cost breakdown will serve as a basis for the calculation of progress payments.

#### 1.15 Inspection of plans and specifications

- .1 The Electrical Subcontractor must submit to competent authorities the necessary number of drawings and descriptive specifications so that they can study and approve them prior to start of work.
- .2 The Electrical Subcontractor shall notify the Departmental Representative about all received requests for changes by inspection services prior to those modifications. The Electrical Subcontractor must make changes as directed by the Departmental Representative.

#### 1.16 Shop drawings

- .1 The Electrical Subcontractor shall submit shop drawings of all electrical products and equipment for which such drawings are requested.
- .2 Shop drawings must be provided sufficiently in advance, prior to beginning of work, to not hamper the project.
- .3 The amount specified in the bid must include the cost and supply of all shop drawings and their revision if necessary, and the Electrical Subcontractor will receive no additional compensation for these drawings.
- .4 Drawings submitted must be prepared by the Subcontractors involved (and manufacturers) and submitted by the Contractor.
- .5 In submitting his plans and shop drawings or assembly drawings, the Electrical Subcontractor must notify in writing to the Departmental Representative any modifications with respect to plans and specifications of the Departmental Representative.
- .6 Verification of drawings by Departmental Representative does not in any way relieve the Electrical Subcontractor and/or the Supplier from their responsibility for the accuracy of these drawings, and their conformity with regard to plans and specifications and conditions on construction site.
- .7 Production of equipment must begin only after verification of drawings by the Departmental Representative and required authorities.
- .8 The Electrical Subcontractor must assume the risk associated with ordering materials or performing any work prior to the receipt of drawings verified by the required professional.
- .9 All installed equipment must be approved by the Canadian Standards Association (CSA) for intended usage and bear the CSA seal of approval.
  - .1 Where there is no other alternative but to provide equipment not approved by CSA, the Electrical Subcontractor must obtain specific approval from the inspection authority or CSA special inspection services and pay the fees.
  - .2 The “ULC” certification is required instead of the “CSA” certification for fire alarm systems.
- .10 Material subject to Departmental Representative approval may be rejected based on poor performance with respect to energy drawn or consumed.

- .11 Shop drawings will be accepted for review only if they contain the following information:
  - .1 Project name and number.
  - .2 Names of Subcontractor, Supplier and Manufacturer.
  - .3 Identification of equipment (name, model, serial number).
  - .4 Relevant information for the project.
  - .5 Technical characteristics.
  - .6 Dimensions and size of equipment.
  - .7 Confirmation of integration on site (location in relation to adjacent structures).
  - .8 Wiring and control diagrams.
  - .9 Certifications (CSA, ULC, etc.);
  - .10 Illustrated details of manufacturing and installation.
- .12 The Electrical Subcontractor shall:
  - .1 Verify shop drawings, product specifications and samples before submittal to the Departmental Representative.
  - .2 Verify measures taken on site.
  - .3 Check catalogue numbers and related data.
  - .4 Seal the documentation submitted stating that it has been reviewed, that the dimensions have been taken on site and that everything is in conformity with contract documents.
- .13 The Electrical Subcontractor must match submitted documentation with requirements for work and contract documents. Drawings will not be approved piecewise. Verification will be done only when all associated drawings will have been submitted.
- .14 Documentation must be submitted on sheets with dimensions less than 836 mm x 1143 mm.
- .15 Unless otherwise indicated, all materials must be new and free from manufacturing defects.
- .16 Unless otherwise indicated, use products of a single manufacturer in the case of materials and equipment of same type.

#### 1.17 Paraseismic measures

- .1 Responsibility:
  - .1 The Electrical contractor is responsible for seismic measures related to his trade.
  - .2 The design of seismic devices and systems must be done by a company specialized in seismic protection and recognized in the province of Quebec.
  - .3 Fees for this specialist must be included in the bid price of the contractor.
  - .4 The electrical contractor must include in his bid the supply and installation of all seismic protective devices.
  - .5 The electrical contractor must coordinate the type of installation of his electrical equipment (recessed, surface, floor or wall mounted, etc.) with seismic measures specialist that he will retain within the project. To this effect, this specialized firm must recommend in writing to the contractor, the devices and measures to instate in order to have the installation of the electrical equipment comply with the applicable standards. A copy of the report must be remitted to the project Departmental Representative. The specialized seismic measures firm must submit all calculation criteria used in conjunction with paraseismic measures to be used. This document must also include all technical bulletins, diagrams and installation drawings of the paraseismic anchoring methods required by the electrical equipment installed inside this project.
  - .6 The electrical contractor must install all devices and implement all measures described in the report issued by seismic measures specialist. Once these measures and devices implemented, the electrical contractor must have his electrical installations verified by the seismic measures specialist who must certify that the electrical contractor conforms to the measures described in the specialist's report.

- .7 Where appropriate, the electrical contractor shall make required adjustments and take corrective actions according to the written report presented by the seismic protection specialist.
- .8 The seismic protection specialist has to provide a conformity certificate sealed and signed to the electrical contractor who has to give a copy to the Departmental Representative.
- .2 Codes and standards in effect:
  - .1 SMACNA 1138, "Seismic Restraint Manual Guidelines for Mechanical Systems";
  - .2 Addendum no.1 to Seismic Restraint Manual Guidelines for Mechanical Systems;
  - .3 ASTM E-488;
  - .4 Quebec building code, latest edition.
- .3 Installation:
  - .1 Seismic measures must be designed and selected to meet the requirements of the latest edition of the National Building Code of Canada and its supplement, and of the NPPA.
  - .2 Submit shop drawings for seismic measures and calculations.
  - .3 After installing all rigid and flexible restraints and ensuring their proper functioning for normal conditions, request an inspection by certified authorities, perform required repairs (if applicable) and prepare a report (accredited authorities).
  - .4 All seismic measures must be fully integrated and compatible with requirements for noise reduction and anti-vibration systems on electrical material and related systems.
  - .5 Equipment and materials must be firmly anchored to the building structure.
  - .6 Equipment laid on floor must be firmly anchored to the floor or retained by a bearing wall with metal straps. For equipment with high centre of gravity, provide rigid supports with struts anchored to floor, ceiling or bearing wall.
    - .1 For cabinets, use steel framing external to cabinet and anchor them to the floor or the ceiling.
  - .7 Suspended equipment must be retained with metallic belts and appropriate bracings.
  - .8 Supports of electrical conduits, bus bar, transformer and other suspended equipment must be braced with longitudinal and transversal bracing. These bracing can be of a rigid type or cable type. In a same bracing, use identical crossbars (do not use rigid brace with cable).
  - .9 Maximum spacing between seismic bracing shall be as follows for conduits:

Bracing	Electric conduit	Other piping
Transversal	6.1 m (20')	12.2 m (40')
Longitudinal	12.2 m (40')	24.4 m (80')

#### 1.18 Power and services during construction

- .1 The Contractor shall provide, install and connect all required components for connection, distribution and services on site.
- .2 Services (outlets) must be made using double outlets 15A, 125V Install as needed for the project. Provide 15A circuit for each outlet.



#### 1.19 Safety measures during construction work

- .1 The Electrical Subcontractor must observe and enforce safety measures required for construction work by the latest applicable edition of the Quebec Construction Code, provincial agencies, the Commission de la Santé et de la Sécurité au Travail and municipal organisms and by-laws.
- .2 The Electrical Subcontractor must comply with requirements of the Fire Commissioner of Canada standard FC 301, “Standards for construction operations”, most recent edition, published by the Fire Commissioner of Canada and any other applicable standard.
- .3 In case of conflict between the requirements of organizations mentioned above, the Electrical Subcontractor must follow the most stringent requirements.

#### 1.20 Additional precautionary measures

- .1 When work is performed in an existing building or adjacent to an existing building, the Electrical Subcontractor must take necessary measures so that normal enjoyment of building by users is in no way disrupted during work. These measures may concern noise as well as any other disturbance produced by the work. Any additional expenses incurred towards this goal will be at the expense of the Electrical Subcontractor.
- .2 During construction work and to ensure the safety of staff, the Electrical Subcontractor must protect exposed and energized equipment.
- .3 The Electrical Subcontractor must enclose and mark energized parts using the inscription “circuit sous tension 120 volts” (or appropriate voltage), in French.
- .4 The Electrical Subcontractor must provide for the installation of temporary doors to close rooms containing electrical distribution material and keep those doors locked, except when under direct supervision by an electrician.
- .5 The Electrical Subcontractor must provide warning signs with minimum dimensions of 177 mm x 250 mm in accordance with requirements and/or as required by the Departmental Representative and the responsible inspection body.

#### 1.21 Cleaning

- .1 During construction, the Electrical Subcontractor shall:
  - .1 Not unduly accumulate materials or equipment that could clutter the site.
  - .2 On a daily basis, keep the premises, including rooftops, free of debris and waste.
  - .3 Keep all construction site and public property free of debris and waste.
  - .4 Install on site containers to receive debris and waste.
  - .5 Remove debris and waste from construction site.
  - .6 At the end of each work day, the Electrical Subcontractors shall block the open end of all pipes and conduits to prevent entry by any waste.
  - .7 Evacuate from site waste material and debris at regular interval or dispose of as directed by the Departmental Representative. Do not burn waste materials on site unless approved by the Departmental Representative and/or the Architect and/or the Project Manager.
- .2 During final cleaning, the Electrical Subcontractor shall:
  - .1 When the work is nearly completed, remove excess materials, tools, and machinery and construction equipment that are no longer required for performance of the work remaining to be done.
  - .2 Remove discarded materials and debris and leave facility clean and ready to be occupied by the Departmental Representative.
  - .3 When the work is completely finished, remove excess materials, tools, and machinery and construction equipment. Remove waste and debris.

- .4 Take necessary arrangements with competent authorities for the disposal of waste materials and waste, and obtain from them the required permits.
- .5 Perform a general clean-up to remove dust, stains or marks on electrical equipment.
- .6 Inspect finish of electrical equipment, repair damaged material and retouch paint as required.

#### 1.22 Delivery and storage

- .1 Materials and equipment must be delivered and stored on site in such a way that manufacturer's seal and label are kept intact.
- .2 The Electrical Subcontractor must ensure that materials and equipment are not damaged, soiled or altered during delivery, handling and storage. Rejected materials and equipment must be transported out of site immediately.
- .3 The Electrical Subcontractor must store materials and equipment in accordance with instructions received from suppliers.
- .4 The Electrical Subcontractor must resurface to Departmental Representative satisfaction damages caused by surfaces finished at factory. Use a primer and an enamel paint matching original finish. Do not paint nameplates.
- .5 The Electrical Subcontractor must move equipment or stored materials that hinder work of Departmental Representative or another Electrical Subcontractor.
- .6 The Electrical Subcontractor must obtain from the Project Manager the authorization to store equipment in areas identified by him.

#### 1.23 Lifting

- .1 The Electrical Subcontractor must perform lifting of materials and equipment he provides, plan the lifting tasks and pay for rental cost of required equipment.

#### 1.24 Scaffolding

- .1 The Electrical Subcontractor must design and build scaffoldings according to CSA S269.2-M standard (latest edition).

#### 1.25 Openings, sleeves and patching

- .1 Before opening a hole in a load-bearing member or a slab, the Electrical Subcontractor or the Contractor must obtain permission from the Structural Departmental Representative (or the Project Departmental Representative). If necessary and if requested by the Departmental Representative, the Contractor shall perform an X-ray analysis.
- .2 Openings to be made in prefabricated architectural and structural elements must be made at the factory, at the expense of the Contractor. The Contractor must notify in writing each required Subcontractor and give them sufficient time to indicate on plans, with a support letter, all necessary openings. Failing to indicate these openings on written documents within the required time, each concerned Subcontractor must pay the cost for those openings. However, if the contractor neglects or fails to notify his Subcontractors, he must assume all the costs of drilling.
- .3 All openings less than 100 mm must be performed by the Electrical Subcontractor, while those of 100 mm and above are the responsibility of the Contractor. The Electrical Subcontractor is responsible to indicate to the Contractor the location and diameter of openings to be performed.
- .4 When an opening must be blocked, sealing and finishing materials (paint, aggregates, etc.) must be of the same kind and same colour than those surrounding the opening. The Contractor is responsible for patching, finishing and paint work.

- .5 When conduits run through architectural or structural elements, the Electrical Subcontractor must install sleeves. These sleeves will be made of schedule 40 steel. An overrun of 50 mm is required when the surface is a slab and of 25 mm for a wall. The installation of sleeves is the responsibility of the Contractor.
- .6 Voids must be sealed as directed by the Quebec Construction Code, including a fire-retardant treatment when the surface is a firewall. Sealing must be done by the Contractor.
- .7 When bus bars run through a firewall, a slab or any other firewall separation, the Electrical Subcontractor shall provide a firewall barrier for bus bars.

#### 1.26 Acoustical treatment

- .1 The Contractor is responsible for acoustic sealing around conduits and other technical equipment running through walls.
- .2 The Contractor is responsible for ensuring that the electrical equipment causes no sound or vibration which may disrupt normal activities of the building. If deficiencies are noticed, the Contractor must take, at his own expense, required corrective actions so that the facility is acceptable. The Contractor must obtain Departmental Representative approval.

#### 1.27 Furring

- .1 The Contractor shall perform all required furring to dissimulate and/or embed equipment.
- .2 The Contractor is also responsible for associated finishing and painting work.

#### 1.28 Access doors and panels

- .1 The Electrical Subcontractor shall provide access doors in ceilings, partitions, etc., to allow access and maintenance of material, fittings, equipment such as junction and pull boxes. Access doors must be installed by the Contractor in accordance with requirements of section on wall, ceiling or floor construction, or in accordance with existing conditions in case of modifications to an existing building.
- .2 Unless otherwise indicated, access doors must be surface-mounted and have dimensions of 600 mm x 600 mm in the case of an entry hole and 300 mm x 300 mm in the case of a hand hole. They must open to 180°, have rounded corners, be fitted with concealed hinges, screwdriver locks and anchor fittings. The steel must have been coated with a layer of primer and doors must come from a recognized manufacturer which publishes technical documentation.
- .3 In the case of tile, marble or terrazo surfaces, access doors must be in stainless steel.
- .4 Access doors opening on fireproof partitions must show the seal ULC two (2) hours (Underwriters Laboratory Canada).
- .5 The exact location of access doors should be determined on site with the Contractor, other Subcontractors and the Architect to minimize the number and integrate them into the work.
- .6 Unless otherwise indicated, boxes must meet the following guidelines:

	AMEEC 1	AMEEC 3R	AMEEC 4X
Exterior			
Dry area	X		
“Wet” area			

### 1.29 Rated voltages

- .1 Operating voltages must comply with CAN-3-C235 standard (latest revision).
- .2 All motors, electrical heating equipment and control and distribution devices should operate satisfactorily at a frequency of 60 Hz and within normal limits established by the standards mentioned above. The equipment must be capable of operating in extreme conditions defined in this standard without being damaged.

### 1.30 Motors and controls

- .1 Electric motors
  - .1 Unless otherwise indicated, motors will operate with on following voltages with a service factor of 1.15:
    - .1 1/2 HP (0.4 kW) and less : 115 V/1 Ø/60 Hz
    - .2 3/4 HP (0.55 kW) and more : 575 V/3 Ø/60 Hz
- .2 Regulation devices
  - .1 The term “regulation device” designates any control device controlling an operation in order to satisfy an operating sequence. These devices can be thermostats, aquastats, humidistats, pressure and/or flow switch, push buttons, selectors, etc.
  - .2 These devices will be provided, installed, wired and connected by the manufacturer/installer of automatic control systems. When some of the devices are integrated into starters (push buttons and selectors), they will be provided, installed, wired and connected by the Electrical Contractor.
- .3 Control devices
  - .1 The term “control devices” designates any control device reacting to an input received from the regulation devices. These devices include: damper motors, motorized valves, relays and contactors.
  - .2 These devices will be provided, installed, wired and connected by the manufacturer/installer of automatic control systems. The type and number of such devices will depend on the needs of the operating sequence.
- .4 Starters
  - .1 Unless otherwise indicated, all starters will be provided, installed, wired and connected (power only) by the Electrical Subcontractor.
- .5 Power wiring
  - .1 Power wiring is required from the feeding point to motor terminals.
  - .2 The wiring will be performed by the Electrical Subcontractor.
  - .3 In the case of integrated assemblies (package units) such as boilers, ventilators, etc., the work of the Electrical Subcontractor shall consist in supplying, installing and connecting a disconnect switch near the equipment to be energized and to perform connection between the disconnect switch and the integrated assembly, according to manufacturer’s instructions.
- .6 Control wiring
  - .1 Control wiring begins at the electrical connection of starters and includes electrical connection of all regulation and control devices.
  - .2 This wiring will be provided and installed by the manufacturer/installer of automatic regulation systems.

.7 Overload relay

- .1 The choice of overload relays will be performed by the Electrical Subcontractor and submitted to the Departmental Representative for approval. However, each Mechanical Subcontractor shall provide to the Electrical Contractor a list of specifications for motors in their trade. Specifications included on this list will reflect the requirements of the section “Required certificate with acceptance request”.

1.31 Equipment installation

- .1 Locations of outlets for electrical apparatus, equipment and fittings are indicated approximately on drawings. The exact location will be determined on site and approved, if required, by the Departmental Representative and/or the Architect.
  - .1 The location of outlets can be modified without additional charge or credit, provided that this displacement does not exceed 3 metres and a notice of change is given prior to installation.
- .2 Size and appearance of electrical equipment shown on drawings are approximate. Overall dimensions of electrical equipment must be approved by the Departmental Representative. Technical specifications and overall dimensions of equipment must be included in operating and maintenance manuals upon completion of work.
- .3 The Electrical Subcontractor must install electrical outlets, apparatus, equipment and fittings as to minimize overall dimensions and to maximize peripheral clearance.
- .4 The Electrical Subcontractor should refer to the manufacturer’s recommendations to perform installation in accordance with requirements and notify in writing the Departmental Representative if discrepancies are noted between manufacturer’s recommendations and requirements of contract documents. Final connections must be carried as directed by Departmental Representative.

1.32 Diagrams

- .1 Operation sequence for control of main electrical and electromechanical systems is illustrated on control diagrams shown on drawings. Detailed diagrams for wiring and connection, according to technical instructions by suppliers of system components, must be submitted to the Departmental Representative for approval. These diagrams must be included in operating and maintenance manuals supplied upon completion of work.

1.33 Identification

- .1 General
  - .1 All identifications must be made in French and English in accordance the Project Manager's directives. Before doing the work, the Electrical Subcontractor must ask the Departmental Representative to verify and approve the list of identifications.
- .2 Equipment identification
  - .1 The Electrical Subcontractor must identify with nameplates (glued and screwed lamicoid plates) all electric panels, motor control centres, starters, contactors, disconnecting switch, transformer and any other equipment to be identified in part 3 of the corresponding section.
  - .2 Prior to inscription, three (3) copies of the list of identifications must be submitted to Departmental Representative for verification.

- .3 Plate dimensions must correspond to dimensions given in the table below:

Format 1	9.53 mm x 50 mm	1 line	Letters of 3 mm high
Format 2	12 mm x 68 mm	1 line	Letters of 4.76 mm high
Format 3	12 mm x 68 mm	2 lines	Letters of 3 mm high
Format 4	18 mm x 87 mm	1 line	Letters of 7.94 mm high
Format 5	18 mm x 87 mm	2 lines	Letters of 4.76 mm high
Format 6	25 mm x 100 mm	1 line	Letters of 12 mm high
Format 7	25 mm x 100 mm	2 lines	Letters of 6 mm high

- .4 Identification plates for equipment connected on the emergency and plates for the fire alarm must be of red colour.

.3 Identification of cables and conduits

- .1 Cables and conduits must be identified with colour markers (plastic ribbons) at intervals of 15 m and wherever they enter in or emerge from a wall, a ceiling or a floor.
- .2 The base colour band shall be 25 mm wide and the complementary colour band must be 19 mm wide.
- .3 Colour for markers must be according to the table below:

	<b>Base colour</b>	<b>Complementary colour</b>
Up to 250 volts	yellow	
Up to 600 volts	yellow	green
Up to 15 kV	yellow	blue
Up to 25 kV	yellow	red
Telephone	green	
Other communication network, general call, etc.	green	blue
Fire alarm	red	
Emergency communication	red	blue
Other auxiliary and security networks	red	yellow

An additional marker must be installed in front of the other ones when the load is connected to the "normal/emergency" or "UPS" networks.

- "normal / emergency" network : orange
- "UPS" network : purple

.4 Conductor identification

- .1 All feeder, branch and control circuit conductors must be numbered at each end and within boxes, using Thomas & Betts indicators.

.5 Colour code

- .1 Colour code used for conductors must be in accordance with C.22.10 CSA standard (latest edition). This code must be respected for the entire installation.
- .2 Use a colour code for communication cables wires and match colours for the entire network.

.6 Junction and pull boxes

- .1 The Electrical Subcontractor shall identify with self-adhesive "P-Touch" tape, or equivalent, circuits and their origin on each junction and pull box exceeding 150 x 150 mm. Use of "Dymo" type tape is not acceptable.
- .2 Junction and pull boxes associated with the fire alarm system must be painted in red.

- .7 Outlets and lighting switches
  - .1 The Electrical Subcontractor must identify each outlet using self-adhesive “P-Touch” tape, or equivalent.
  - .2 Circuit numbers and panel identification must appear on tapes.
- .8 Nameplates
  - .1 Manufacturer nameplates and CSA labels must be clearly visible and legible after installation of equipment.
- .9 Existing panels
  - .1 Redo identification of circuits for all existing panels that have been modified (new sheets and lamicoid plates).

#### 1.34 Tests and start-up

- .1 Tests – General
  - .1 The Electrical Subcontractor shall provide all materials and labour required to perform tests, including costs incurred by the independent laboratory and manufacturers.
  - .2 The Electrical Subcontractor must ensure that tests are not destructive for equipment and, if necessary, disconnect or isolate certain components.
  - .3 The Electrical Subcontractor must notify the Departmental Representative 48 hours before testing day. The Departmental Representative will confirm his presence to the Electrical Subcontractor if the Departmental Representative wants to assist to tests.
  - .4 In the event that tests indicate deficiencies regarding expected results, the Electrical Subcontractor must, at his own expense, perform required verifications and take the necessary corrective actions, including replacing defective or inadequate components. A new series of tests shall be performed and results transmitted to the Departmental Representative before start-up of equipment and systems.
  - .5 The Electrical Subcontractor must submit to the Departmental Representative all reports indicating equipment tested, type of testing, methodology and results. All reports must be typed, dated, signed and submitted in three (3) copies.
  - .6 Some tests must be performed by a recognized independent laboratory (L), the Electrical Subcontractor (E) or the manufacturer (M). Some of those tests are as follows:

	Tests to be done	Tests done by
Medium voltage equipment and cable test		
Low voltage equipment test	X	E
Coordination study		
Grounding test		
Dielectric test (low voltage)		
Generator test		
UPS test		
Fire alarm system test	X	M
Lighting control system test		
Camera test		
Intrusion alarm test		
Arc flash tests		

- .2 Low voltage equipment test
  - .1 Check all circuits and ensure they are free of short-circuit and ground fault.
  - .2 Check all connections and make sure they are done properly.
  - .3 Check the polarity of outlets and correct as required.
- .3 Start-up
  - .1 The Electrical Subcontractor must perform or have performed, before start-up of equipment and systems, tests described above as well as those described in specifications or asked for on plans and ensure that the results comply with requirements and have been verified by the Departmental Representative.
  - .2 The start-up of all electromechanical systems must take place at least two (2) weeks prior to the date of building delivery (or building section if applicable).

#### 1.35 Spare parts and special tools

- .1 When required in Specifications, provide spare parts in original packaging, clearly indicating the content.
- .2 The Electrical Subcontractor must provide a toolkit containing all special tools required for maintenance of equipment in accordance with manufacturer's recommendations.

#### 1.36 Equipment Operation and Maintenance Manual

- .1 Upon completion of work, the Electrical Subcontractor must submit to the Departmental Representative copies of the Operation and Maintenance Manual containing all operating and maintenance data for equipment according to quantities mentioned in contract documents. This manual must be written in French and/or the language spoken by the Project Manager as indicated by him. Unless otherwise indicated, it must be prepared in accordance with the following:
  - .1 Write data on loose leafs of 366 mm x 280 mm sheets in a three-ring hard cover vinyl binder.
  - .2 Write on title page "Manuel d'exploitation et d'entretien", name of installation, date and table of contents.
  - .3 Divide the content in appropriate sections, according to subdivisions of the specifications. Identify each section with a labeled tab, covered with celluloid attached to the rigid paper division sheet.
- .2 Include on operating and maintenance sheets the following information in addition to required data:
  - .1 Details of components, construction specifications, function and maintenance requirements for various components in order to facilitate start-up, operation, maintenance, repair, modification, extension and expansion of any part, network or feature of the installation.
  - .2 Technical data and product specifications must be accompanied by supplementary information such as newsletters, illustrations and exploded view of parts, technical descriptions and list of parts.
  - .3 Full description of equipment and parts. Give information about nameplates such as brand, dimensions, capacity and serial number.
  - .4 Name, address, telephone number and fax number of Subcontractors and Suppliers.
  - .5 Complete set of shop drawings (bound separately) with corrections and changes made during manufacturing and installation.
  - .6 Specific purpose of warranty (project, work), effective date and duration.
  - .7 Final reports for requested tests.
- .3 Type neatly lists and remarks. Ensure clarity of drawings, diagrams and/or manufacturers' publications. Advertisement leaflets or brochures are not accepted.



### 1.37 As-built plans

- .1 The Electrical Subcontractor must provide two sets of drawings for the production of “as-built” plans.
- .2 A copy of these plans must be maintained on site and any change to the work will be traced in red on plans as changes are made.
- .3 The Electrical Subcontractor must update drawings and faithfully note any deviations from the requirements of the contract documents, changes imposed by the nature of the site and/or changes made by various stakeholders, and changes made on site to dimensions or construction details.
- .4 Upon completion of work and prior to temporary acceptance of work by the Departmental Representative, the concerned Subcontractor must carefully transcribe corrections on the second set of drawings and hand over the two complete sets to the Contractor for verification and submittal to Departmental Representative.

### 1.38 Certificate of substantial completion

- .1 In addition to the requirements of this section, the “Certificate of completion” for all mechanical and electrical trades cannot be issued before acceptance, by concerned professionals, of all balancing reports required in the contract documents.
- .2 Upon receipt of a written request for acceptance by the Contractor that the work of his Subcontractor has been completed and that approval is required, the Departmental Representative will conduct an initial general inspection of the work and write a report indicating defects requiring corrective actions. This verification of work will be titled “General inspection #1”.
- .3 After written confirmation from the Contractor that work of his Subcontractor have been completed in accordance with contract documents and the general inspection report #1 issued previously by the Departmental Representative, the Departmental Representative will perform a second inspection, this time with the Architect if the Architect deems it necessary. This second inspection will be titled “General inspection #2”.
- .4 At this stage, if mechanical and electrical work are deemed compliant with plans and specifications to the satisfaction of the Departmental Representative and the Architect, the Contractor will prepare a list of mechanical and electrical work requiring corrective actions, taking into account comments contained in the report “General inspection #2” and will agree in writing to complete the corrective actions within five (5) days, and he will request acceptance by the Architect, with copy to the Departmental Representative.
- .5 The Departmental Representative will then use the “Certificate of substantial completion of mechanical and electrical work” in accordance with the spirit of the text below.
  - .1 Following an inspection that we made on the above mentioned date, we are hereby certifying that there has been substantial completion of work in our trades dated ... so that the Departmental Representative can use these systems for the purpose for which they are intended.
    - .1 A list of mechanical and electrical works to correct or to complete, as prepared by the Contractor and verified by the Departmental Representative, is attached hereto, and the Contractor agrees to complete this correction or completion work within five (5) days. This list was signed by the Contractor.
    - .2 It may not be exhaustive and the failure to mention particular work into it does not relieve the Contractor of his responsibility to complete all work in accordance with contract documents. In particular, everything that is mentioned in other reports or instructions given to the Contractor must be completed.
    - .3 Attached to this document:
      - .1 List of work to complete....
      - .2 Letter of transmission of documents, warranties and manufacturers’ instructions.

- .6 If, to issue such a certificate of temporary acceptance, the Departmental Representative must perform more than three (3) general inspections due to the negligence of the Contractor and his Subcontractor(s) to correct any defects listed on the report “General inspection #3”, the Contractor must be prepared to pay all inspection costs subsequent to this third inspection, if it proves insufficient to enable the Departmental Representative to issue his certificate of substantial completion.
- .7 Therefore, general inspections #4, #5, etc., required for the issuance of the “Certificate of substantial completion” will be charged (on an hourly basis) to the Departmental Representative by the Departmental Representative and/or the Architect. In accordance with this contractual document, the Departmental Representative will deduct the amount of this invoice from the amount indicated in the contract.
- .8 The above procedure is not intended to penalize unduly Mechanical and Electrical Subcontractors, but rather to seek their full cooperation to complete their work and avoid that their negligence cause unnecessary cost to the Departmental Representative.
- .9 The Departmental Representative will, at his discretion, inspect the site and he will make known to the Contractor the deficiencies he observes.

#### 1.39 Required certificate with acceptance request

- .1 No acceptance request for work made by a Subcontractor to the Contractor may be considered, unless it is accompanied by delivery of all certificates pertaining to this Subcontractor.
- .2 These documents and certificates are the following:
  - .1 For each electrical motor of each Subcontractor, current intensity in amperes with no load and with normal load, capacity of the heating element installed in the starter and value of maximum current, indicated in amperes on the motor plate.
  - .2 Warranty of work.
  - .3 Warranty of manufacturer for equipment provided through this contract.
  - .4 Operation and Maintenance Manuals.
  - .5 All certificates and documents required by the authorities.
  - .6 Certificates of equipment start-up.
  - .7 As-built plans.
  - .8 Copy of detailed report for tests done by a recognized independent laboratory.
  - .9 Other documents requested in other sections of the specifications.

#### 1.40 Warranty

- .1 The warranty period shall begin when the Departmental Representative will issue the Certificate of substantial or provisional completion.
- .2 If law, specifications or a section of the provincial Code Civil provides for a warranty period longer than one year, it should be applied.
- .3 Subcontractors must guarantee their work and installed equipment for a minimum period of one (1) year from the date of issuance of the Certificate of substantial completion. This warranty includes replacement and/or repair without charge (materials and labour) of any element found defective during this period, and all service calls required to maintain systems in good working order.