

**AGENCE SPATIALE CANADIENNE  
CANADIAN SPACE AGENCY**



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**REPLACEMENT OF THE GENERATOR**

**ELECTRICAL  
TECHNICAL SPECIFICATIONS**

**For permit and tender**

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**Division 26 - Electrical**

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## **Division 26**

Electrical Specifications

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## PARTIE 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 contractor.
- .2 Whenever the expression “Electrical contractor” 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 Electrical Contractor.
- .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>
-	Replacement of the generator	E-501, E-502

### 1.2 DUTIES AND RESPONSIBILITIES OF ELECTRICAL CONTRACTOR

- .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.

### 1.3 SITE VISIT

- .1 Before submitting his bid, the Electrical contractor 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.

### 1.4 REFERENCE PLANS

- .1 In preparing his bid, the Electrical contractor 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.

## 1.5 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.

## 1.6 WORK NOT INCLUDED IN CONTRACT

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

## 1.7 EQUIVALENCES OR SUBSTITUTION OF MATERIALS

- .1 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 contractor 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 contractor 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.

## 1.8 COORDINATION

- .1 To avoid any conflict, the Contractor must coordinate the installation of his equipment before performing work.
- .2 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.

## 1.9 CORRESPONDENCE AND COMMUNICATIONS

- .1 The Contractor 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 The contractor must submit shop drawings, substitution requests, etc., 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.

#### 1.10 SITE MEETINGS

- .1 The contractor must attend site meetings to which he has been invited. Time and location of meetings will be defined by responsible authorities.

#### 1.11 WORK SCHEDULE

- .1 Once the master schedule for the project is defined, the Electrical contractor must comply with it during the project and ensure that work does not disrupt activities and the general conduct of the project.
- .2 If, for reasons beyond control, a contractor cannot respect the established schedule, he must notify the Departmental Representative so that appropriate corrective actions can be taken. The contractor 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.

#### 1.12 COST BREAKDOWN

- .1 Before applying for the first progress payment, the Electrical contractor 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.

#### 1.13 SHOP DRAWINGS

- .1 The Electrical contractor 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 contractor will receive no additional compensation for these drawings.
- .4 Drawings submitted must be prepared by the Electrical contractor (and manufacturers).
- .5 In submitting his plans and shop drawings or assembly drawings, the Electrical contractor 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 contractor 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 contractor 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 contractor 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 contractor, 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 contractor 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 contractor 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 pdf files.
- .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.

#### 1.14 POWER AND SERVICES DURING CONSTRUCTION

- .1 The Contractor shall provide, install and connect all required components for lighting, 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.

#### 1.15 SAFETY MEASURES DURING CONSTRUCTION WORK

- .1 The Electrical contractor 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 In case of conflict between the requirements of organizations mentioned above, the Electrical contractor must follow the most stringent requirements.

#### 1.16 ADDITIONAL PRECAUTIONARY MEASURES

- .1 When work is performed in an existing building, the Electrical contractor 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 contractor.
- .2 During construction work and to ensure the safety of staff, the Electrical contractor must protect exposed and energized equipment.
- .3 The Electrical contractor must enclose and mark energized parts using the inscription "circuit sous tension 120 volts" (or appropriate voltage), in French.
- .4 The Electrical contractor 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 contractor 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.
- .6 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.
- .7 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.

#### 1.17 CLEANING

- .1 During construction, the Electrical contractor shall:
  - .1 Not unduly accumulate materials or equipment that could clutter the site.
  - .2 On a daily basis, keep the premises, 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 contractor 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 contractor 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.

#### 1.18 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 contractor 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 contractor must store materials and equipment in accordance with instructions received from suppliers.
- .4 The Electrical contractor 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 contractor must move equipment or stored materials that hinder work of Departmental Representative.
- .6 The Electrical contractor must obtain from the Project Manager the authorization to store equipment in areas identified by him.

#### 1.19 LIFTING

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

#### 1.20 OPENINGS, SLEEVES AND PATCHING

- .1 Before opening a hole in a load-bearing member or a slab, 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 All openings must be performed by the contractor.

- .3 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.
- .4 When conduits run through architectural or structural elements, the contractor 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.
- .5 Voids must be sealed as directed by the Quebec Construction Code, including a fire-retardant treatment when the surface is a firewall.

#### 1.21 SCAFFOLDING

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

#### 1.22 EQUIPMENT INSTALLATION

- .1 Locations of equipment and fittings are indicated approximately on drawings. The exact location will be determined on site and approved, if required, by the Departmental Representative.
- .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 contractor must install electrical, equipment and fittings as to minimize overall dimensions and to maximize peripheral clearance.
- .4 The Electrical contractor 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.

#### 1.23 EQUIPMENT OPERATION AND MAINTENANCE MANUAL

- .1 Upon completion of work, the Electrical contractor 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 pdf files.
  - .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 e-mail of contractor 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 Ensure clarity of drawings, diagrams and/or manufacturers' publications. Advertisement leaflets or brochures are not accepted.
- .4 Submit to department representative one pdf copy and one hard copy.

#### 1.24 AS-BUILT PLANS

- .1 The Electrical contractor must provide "as-built" plans.
- .2 The electrical contractor must note any change to the work as changes are made.
- .3 The Electrical contractor must 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, contractor must carefully transcribe corrections on autocad drawings. The name of the electrical contractor and the date must be indicated on those drawings, submit one pdf copy to department representative approval.

#### 1.25 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 Contractor must guarantee his 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.

## 1.26 SPECIAL CONDITIONS

### .1 Temporary generator set

- .1 The contractor must include in his tender the rental costs for an 800 kW/1 000 kVA mobile generator set in accordance with the following requirements:
  - As soon as the contract is awarded, the mobile generator must be in place and connected throughout the duration of the works, disconnect it at the end works and return it to the rental company. The generator set must be connected to the outside cabinet provided to this end;
  - Include a full tank of fuel and supervise the fuel level while the generator set is in use. Advise the ministerial representative before the fuel tank reaches a low fuel level;
  - Supply, install and connect all required accessory component for the proper operation of the generator set;
  - Verify the proper operation of the transfer system.

End of section

## PARTIE 1 - GENERAL

### 1.1 SECTION INCLUDES

- .1 Materials and installation for wire and box connectors.

### 1.2 REFERENCES

- .1 Canadian Standards Association (CSA International)
  - .1 CAN/CSA-C22.2 No.18, Outlet Boxes, Conduit Boxes, Fittings and Associated Hardware.
  - .2 CSA C22.2 No.65, Wire Connectors.
- .2 Electrical and Electronic Manufacturers' Association of Canada (EEMAC)
  - .1 EEMAC 1Y-2, Bushing Stud Connectors and Aluminum Adapters (1200 Ampere Maximum Rating).
- .3 National Electrical Manufacturers Association (NEMA)

## PARTIE 2 - PRODUCTS

### 2.1 MATERIALS

- .1 Pressure type wire connectors to: CSA C22.2 No.65, with current carrying parts of copper sized to fit copper conductors as required.
- .2 Bushing stud connectors: to EEMAC 1Y-2 NEMA to consist of:
  - .1 Connector body and stud clamp for copper conductors.
  - .2 Clamp for copper conductors.
  - .3 Stud clamp bolts.
  - .4 Bolts for copper conductors.
  - .5 Sized for conductors as indicated.
- .3 Clamps or connectors for armoured cable, aluminum sheathed cable, mineral insulated cable, flexible conduit, as required to: CAN/CSA-C22.2 No.18.

## PARTIE 3 - EXECUTION

### 3.1 INSTALLATION

- .1 Remove insulation carefully from ends of conductors and:
  - .1 Install mechanical pressure type connectors and tighten screws [with appropriate compression tool recommended by manufacturer]. Installation shall meet secureness tests in accordance with CSA C22.2 No.65.
  - .2 Install bushing stud connectors in accordance with EEMAC 1Y-2 NEMA.

End of section

## PARTIE 1 - GENERAL

### 1.1 RELATED SECTIONS

- .1 Section 260520E - Wire and Box Connectors - 0 - 1000 V.

### 1.2 REFERENCES

- .1 CSA C22.2 No .0.3, Test Methods for Electrical Wires and Cables.

### 1.3 SHOP DRAWINGS AND PRODUCT DATA

- .1 Submit product data in accordance with Section 260500E – Common Work Results for Electrical.

## PARTIE 2 - PRODUCTS

### 2.1 BUILDING WIRES

- .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.

### 2.2 CONTROL CABLES

- .1 Type LVT: 2 soft annealed copper conductors, sized as indicated, with thermoplastic insulation, outer covering of cotton braid thermoplastic jacket, and armour of closely wound aluminum wire.
- .2 Low energy 300 V control cable: solid annealed copper conductors, sized as indicated, with PVC insulation type TW with shielding of wire.
- .3 Fire alarm system cables FAS105.

## PARTIE 3 - EXECUTION

### 3.1 INSTALLATION OF BUILDING WIRES

- .1 Install wiring as follows:
  - .1 In conduit systems in accordance with Section 260534E;
  - .2 Install one “return” conductor (White) per circuit; no shared "return" allowed.

### 3.2 INSTALLATION OF CONTROL CABLES

- .1 Install control cables in conduit in accordance with section 260534E.
- .2 Ground control cable shield.

### 3.3 CONDUCTOR RATING

- .1 Ratings indicated herein are minimum. Contractor to install required conductors to limit voltage drops to values below those prescribed in Electrical Code. Selection of conductors and cables take into account derating of cables, as required by Electrical Code.

### 3.4 IDENTIFIED WHITE NEUTRAL CONDUCTORS

- .1 Each single-pole circuit must have an identified white neutral conductor.

End of section

## PARTIE 1 - GENERAL

### 1.1 RELATED WORK

- .1 Fastening and supports: Section 260500E – Common Work Results for Electrical.

### 1.2 SHOP DRAWINGS AND PRODUCT DATA

- .1 Submit shop drawings and product data in accordance with Section 260500E – Common Work Results for Electrical.

## PARTIE 2 - PRODUCTS

### 2.1 SUPPORT CHANNELS

- .1 U shape, size 41 x 41 mm, 3 mm thick, surface mounted or suspended.
- .2 Materials: steel, galvanized steel.

## PARTIE 3 - EXECUTION

### 3.1 INSTALLATION

- .1 Unless otherwise indicated, use following materials:
  - .1 Outside:
    - ☐ galvanized steel
    - ☐ aluminum
    - ☐ PVC
    - ☐
  - .2 Dry area:
    - ☒ steel
    - ☐
  - .3 Damp and wet areas:
    - ☐ galvanized steel
    - ☐ aluminum
    - ☐ PVC
- .2 Secure equipment to hollow solid masonry, tile and plaster surfaces with lead anchors or nylon shields.
- .3 Secure equipment to poured concrete with expandable inserts.
- .4 Secure equipment to hollow masonry walls or suspended ceilings with toggle bolts.
- .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 structure or support system using straps.
  - .1 One hole malleable iron steel straps to secure surface conduits and cables 50 mm and smaller.
  - .2 Two hole steel straps for conduits larger than 50 mm.



- .3 Beam clamps to secure conduit to exposed steel work.
- .7 Suspended support systems.
  - .1 Support individual conduit runs with 6 mm dia threaded rods and spring clips.
  - .2 Support 2 or more conduits on channels supported by 6 mm dia threaded rod hangers where direct fastening to building construction is impractical.
- .8 For surface mounting of two or more conduits use channels.
- .9 Provide metal brackets, frames, hangers, clamps and related types of support structures where indicated or as required to support conduit runs.
- .10 Ensure adequate support for raceways dropped vertically to equipment where there is no wall support.
- .11 Do not use wire lashing or perforated strap to support or secure raceways.
- .12 Do not use supports or equipment installed for other trades for conduit support except with permission of other trade and approval of Departmental Representative.
- .13 Install fastenings and supports as required for each type of equipment conduits, and in accordance with manufacturer's installation recommendations.

End of section

## PARTIE 1 - GENERAL

### 1.1 SHOP DRAWINGS AND PRODUCT DATA

- .1 Submit shop drawings and product data in accordance with Section 260500E – Common Work Results for Electrical.

## PARTIE 2 - PRODUCTS

### 2.1 SPLITTERS

- .1 Sheet metal enclosure, welded corners and formed hinged cover suitable for locking in closed position.
- .2 Main and branch lugs and connection bars to match required size and number of incoming and outgoing conductors as indicated.

### 2.2 JUNCTION AND PULL BOXES

- .1 Welded steel construction with screw on flat covers for surface mounting.
- .2 Covers with 13 mm minimum extension all around, for flush mounted pull and junction boxes.

### 2.3 MATERIALS

- .1 Steel, galvanized steel.

## PARTIE 3 - PART 3 – EXECUTION

### 3.1 GENERAL

- .1 Unless otherwise indicated, use following materials:

- |                        |   |
|------------------------|---|
| .1 Outside:            | <input type="checkbox"/> galvanized steel |
|                        | <input type="checkbox"/> aluminum         |
|                        | <input type="checkbox"/> PVC              |
|                        | <input type="checkbox"/>                  |
| .2 Dry area:           | <input checked="" type="checkbox"/> steel |
| .3                     | <input type="checkbox"/>                  |
| .4 Damp and wet areas: | <input type="checkbox"/> galvanized steel |
|                        | <input type="checkbox"/> aluminum         |
|                        | <input type="checkbox"/> PVC              |

### 3.2 JUNCTION, PULL BOXES AND CABINETS INSTALLATION

- .1 Install pull boxes in inconspicuous but accessible locations.
- .2 Mount cabinets with top not higher than 2 m above finished floor.
- .3 Install terminal block as indicated in Type T cabinets.

- .4 Only main junction and pull boxes are indicated.

### 3.3 IDENTIFICATION

- .1 Provide equipment identification in accordance with Section 260500E – Common Work Results for Electrical.
- .2 Install identification labels indicating system name, voltage and phase.

End of section

## PARTIE 1 - GENERAL

### 1.1 REFERENCES

#### .1 Canadian Standards Association (CSA)

- .1 CAN/CSA C22.2 No. 18, Outlet Boxes, Conduit Boxes, and Fittings and Associated Hardware.
- .2 CSA C22.2 No. 45, Rigid Metal Conduit.
- .3 CSA C22.2 No. 56, Flexible Metal Conduit and Liquid Tight Flexible Metal Conduit.
- .4 CSA C22.2 No. 83, Electrical Metallic Tubing.

## PARTIE 2 - PRODUCTS

### 2.1 CONDUITS

- .1 Rigid metal conduit: to CSA C22.2 No. 45, galvanized steel hot dipped galvanized steel aluminum threaded.
- .2 Electrical metallic tubing (EMT): to CSA C22.2 No. 83, with couplings with expanded ends.
- .3 Flexible metal conduit: to CSA C22.2 No. 56, steel aluminum liquid tight flexible metal.

### 2.2 CONDUIT FASTENINGS

- .1 One hole malleable iron steel straps to secure surface conduits NPS 50 mm and smaller. Two hole steel straps for conduits larger than NPS 50 mm.
- .2 Beam clamps to secure conduits to exposed steel work.
- .3 Channel type supports for two or more conduits.
- .4 Threaded rods, 6 mm dia., to support suspended channels.
- .5 PVC spacers with stainless steel fastenings.

### 2.3 CONDUIT FITTINGS

- .1 Fittings: manufactured for use with conduit specified.
- .2 Factory made elbows where 90° bends are required for NPS 1" and larger conduits.

### 2.4 EXPANSION FITTINGS FOR RIGID CONDUIT

- .1 Weatherproof expansion fittings with internal bonding assembly suitable for 100 mm linear expansion.

### 2.5 PULL CORD

- .1 Polypropylene.

### PARTIE 3 - EXECUTION

#### 3.1 GENERAL

- .1 Unless otherwise indicated, use following conduits:
  - .1 Outside:
    - ☐ galvanized steel
    - ☐ aluminum
    - ☐ PVC
    - ☐
  - .2 Dry area:
    - ☒ EMT
    - ☐ galvanized steel
    - ☐
  - .3 Damp and wet areas:
    - ☐ galvanized steel
    - ☐ aluminum
    - ☐ PVC
  - .4 Damage prone area:
    - ☒ galvanized steel

#### 3.2 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 in unfinished areas.
- .3 Surface mount conduits except as indicated.
- .4 Bend conduit cold. Replace conduit if kinked or flattened more than 1/10th of its original diameter.
- .5 Mechanically bend steel conduit over 19 mm dia.
- .6 Field threads on rigid conduit must be of sufficient length to draw conduits up tight.
- .7 Install fish cord in empty conduits.
- .8 Remove and replace blocked conduit sections. Do not use liquids to clean out conduits.
- .9 Dry conduits out before installing wire.
- .10 Install green wire of required rating in all conduits.

#### 3.3 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 surface 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.

#### 3.4 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.

End of section

## PARTIE 1 - GENERAL

### 1.1 GENERATOR SET.

- .1 The generator set will be used as an automatic standby source. It shall be CSA approved and wear its label.
- .2 The generator set consists of :
  - .1 Diesel engine.
  - .2 Alternator.
  - .3 Control panel.
  - .4 Battery and battery charger.
  - .5 Starting system.
  - .6 Fuel supply system.
  - .7 Exhaust system.
  - .8 Steel skid.
- .3 Generator set design is based on prototype testing.

### 1.2 STANDARDS.

- .1 The emergency power system shall meet the following standards :
  - .1 CSA B139-15 Installation code for oil burning equipment.
  - .2 ISO 6798:1995 Reciprocating internal combustion engines – Measurement of emitted airborne noise – Engineering method and survey method.
  - .3 Quebec construction code, chapter 1.
  - .4 Quebec construction code, chapter 5.
  - .5 Quebec construction code, chapter 8.
  - .6 ISO-8528-1 2005 Reciprocating internal combustion engine driven alternating current generating sets -- Part 1: Application, ratings and performance
  - .7 ISO-3046-1 Reciprocating internal combustion engines - Performance - Part 1: Declarations of power, fuel and lubricating oil consumptions, and test methods - Additional requirements for engines for general use.
  - .8 The alternator shall meet the requirements of the NEMA MG1, IEEE, and ANSI standards for temperature rise and motor starting capacity.

### 1.3 GARANTIE

- .1 The warranty shall cover the generator set for 5 years / 3 000 hours, whichever occurs first.
- .2 During this period, the following elements will be covered :
  - .1 Parts.
  - .2 Labor.
  - .3 Technician traveling.
- .3 Parts and labor shall be available by the generator set supplier 24 hours a day, and 7 days a week.

- .4 The supplier shall repair or replace defective equipment during this period without additional fees to the client.
- .5 The warranty shall not be conditionnal to the procurement of a contract performed by the generator supplier to make it applicable.
- .6 Accessories shall be covered for a period of 1 year.

#### 1.4 SHOP DRAWINGS.

- .1 Submit shop drawings, indicating brand, model, type and specifications of the following equipments :
  - .1 Engine and its power @ 1800 RPM.
  - .2 Alternator.
  - .3 Specifications of the whole generator set.
  - .4 Voltage regulator.
  - .5 Batteries and their capacities.
  - .6 Battery charger.
  - .7 Complete electrical starting system.
  - .8 Generator set control panel.
  - .9 Engine cooling system diagram.
  - .10 Generator set control wiring diagram.
  - .11 Exhaust muffler.
  - .12 Warranty documents.
- .2 Include :
  - .1 Skid mounted generator set side view, showing vibration isolators position, electrical and mechanical applicable connexions, and total weight.
  - .2 Drawing of the generator enclosure.
  - .3 Enclosure specifications :
    - Dimensions.
    - Noise level.
    - Construction materials.
    - Accessories description.
  - .4 Construction dimensions of the concrete base intended for generator set mounting.
  - .5 Effective standby power at full load, at nominal power factor.

#### 1.5 OPERATION AND MAINTENANCE MANUALS.

- .1 Provide french operation manuals.
- .2 Provide operation and maintenance instructions for the following components :
  - .1 Engine.



- .2 Alternator.
  - .3 Voltage regulator.
  - .4 Battery(ies).
  - .5 Battery charger.
  - .6 Fuel supply system
  - .7 Engine cooling system.
  - .8 Exhaust flexible.
  - .9 Generator set control panel.
  - .10 Electronic governor.
  - .11 Breaker(s).
  - .12 Any other information relevant to the project.
- .3 Provide a description of the generator operation steps.

#### 1.6 FACTORY QUALITY CONTROL.

- .1 Submit the whole generator set that will be shipped to the field to a factory inspection.
  - .1 Verification for glycol and oil leaks and level.
  - .2 AC voltage verification.
  - .3 Frequency verification.
  - .4 Bloc heater, battery charger and accessories verification.
  - .5 Alarms verification.
- .2 Provide the factory inspection report to the client.

#### 1.7 WARNING SIGN.

- .1 A bilingual warning sign shall be installed on the generator set room door, with white writing on red background, measuring 8'' high x 12'' wide, with the following text: « ATTENTION. Ce groupe électrogène peut démarrer à tout moment. Danger. This automatic unit may start at any time ».

#### 1.8 TRAINING.

- .1 Provide a training on the generator set and transfer switch(s) to the owner's representative. The training shall be done the same day the start-up is performed.

#### 1.9 EQUIVALENCE

- .1 The generator set described is the KD900 model from KOHLER, distributed by Drumco Energy, with associated equipments. The installation fees inherent to an equivalence shall be charged to the contractor.
- .2 Acceptable equivalent products if proposed equipment meets the technical requirements of this specification:
  - .1 Caterpillar, distributed by Toromont.
  - .2 Cummins, distributed by Cummins Sales & Service
  - .3 MTU Onsite Energy, distributed by Wajax Power Systems

- .4 Genérac, distributed by Le Groupe Roger Faguy

## PARTIE 2 - PRODUCTS

### 2.1 GENERATOR SET

#### .1 Mounting :

- .1 The engine and alternator shall stand on neoprene vibration isolators having a 85% minimum efficiency @ 30Hz. They shall be installed between the skid base and the engine-generator assembly. Breaker(s), control panel, exhaust muffler, radiator, and skid shall be isolated from vibrations generated by the engine-generator assembly.

#### .2 Power :

- .1 The generator set shall provide 900 kW / 1 125 kVA of standby power, at 0.8PF, 60Hz, 3Ø, 4W, 347/600V.

#### .3 Engine :

- .1 Four stroke diesel engine, turbocharged, electronic injection, EPA tier 2 certified, with synchronous speed of 1800RPM  
.2 Minimum displacement of 27L.  
.3 Protective guard on mobile components.  
.4 Protective guard or insulated blanket on exhaust manifold, turbo(s), and exhaust flexible(s), if they are accessible to the maintenance staff.  
.5 The maximum effective power in kW (break) complies with the maximum power defined by the ISO-3046 standard.

#### .4 Engine cooling system :

- .1 Liquid cooled using heavy duty industrial generator mounted on the generator set skid, engine driven pushing fan, thermostatic control, and containing antifreeze remaining non-viscous down to -46°C.  
.2 Fan air flow shall be 1212 m³/min under a 125 Pa restriction.  
.3 The cooling system shall allow a full load continuous engine running, in a 50°C ambient temperature.  
.4 A sensor connected to the control panel shall stop the engine in case of low coolant level.  
.5 The thermostatic bloc heater shall use a forced circulation pump, with 6000W @ 208V/3Ø capacity.  
.6 Provide ball valves to the block heater for ease of maintenance.

#### .5 Engine speed regulation :

- .1 Electronic type governor providing an isochronous frequency regulation and a ±0.25% stability when providing power to a fixed load between 0% and 100% of the generator set nominal rating.

#### .6 Engine lubricating system :

- .1 Engine driven lubricating pump.  
.2 Lubricating oil filter.  
.3 Lubricating oil cooler.  
.4 Engine sump drain valve.  
.5 Oil vapor recuperation system.

.7 Electrical starting system :

- .1 24 VDC starter.
- .2 Cranking limiter : shall allows 3 starting attempts, making 10 sec cranking with 10 sec rest at each attempt.
- .3 Engine driven battery charging alternator.
- .4 Lead acid battery, with sufficient power to crank the engine for 60 seconds in an ambient temperature of 10°C. the batteries must be installed on the left, on the existing concrete base.
- .5 20 amps, 24 VDC automatic battery charger:
  - Meets NFPA-110 and ANSI C62.41A, cUL-1236 certified.
  - Can operate in a -40°C to +50°C ambient.
  - Input:
    - a) Uses a high frequency charging technology with power factor correction circuitry, allowing an operating range of 105 to 264 Vac, and frequency range of 45 to 65Hz.
    - b) Fuse protected.
    - c) Transient protection.
    - d) AC power DEL.
  - AC to DC isolation.
  - Output:
    - a) 2.15 to 2.35V adjustable voltage range per cell for lead batteries.
    - b)  $\leq \pm 0.5\%$  output voltage regulation for a  $\pm 10\%$  input voltage variation.
    - c) Fuse protection.
    - d) Shuts down when overheated.
    - e) Ouput current limit adjustable from 50% to 105% with DEL indication.
    - f) Temperature compensation that can be disactivated.
  - Instrumentation:
    - a) LDC.
    - b) DC voltage reading.
    - c) DC current reading.
    - d) 1% accuracy.
  - Charger failure contact form C.
  - Wall mounting, powder coat finish.

.8 Alternator :

- .1 Compliant to NEMA MG-1 standard.
- .2 936kW / 1170kVA, nominal 3Ø power, 347/600V, 60Hz, class H insulation, 150°C rise in an ambient temperature of 40°C, 3700 start kVA under a 35% transient voltage dip.
- .3 7.2% subtransient reactance.
- .4 Brushless rotating field.
- .5 Drip proof.
- .6 Damper winding.
- .7 Synchronous type.
- .8 Dynamically balanced rotor, permanently aligned with the engine using flex plates coupling.
- .9 Permanent magnet excitation providing a 300% current capacity for 10 seconds, and 150% for 1 minute. This performance ensures alternator initial flashing in any condition, and allows selective coordination with downstream breakers (as required by CSA C282-09, articles 8.6 and 8.7.1).
- .10 Junction box allows easy access to breakers.

.9 Voltage regulator :

- .1 Digital technology with 3Ø reading.
- .2  $\pm 0.5\%$  regulation for a fixed load.
- .3 V/Hz function with programmable slope

.10 Control panel:

- .1 Microprocessor type, installed on the generator set, and isolated from vibrations. Backlit display, providing the following informations:
  - AC metering :
    - a) Line to line and line to neutral voltage reading on each phase.
    - b) Current on each phase.
    - c) Frequency
    - d) Real power (KW).
    - e) Apparent power (KVA).
  - Engine metering :
    - a) Oil pressure.
    - b) Engine temperature.
    - c) Hourmeter.
    - d) Fuel level.
    - e) DC voltage.
  - Active fault(s).

- Last event log.
- .2 Engine start push button.
- .3 Engine stop push button.
- .4 Rest push button.
- .5 Silence push button.
- .6 Lamp test push button.
- .7 Emergency stop push button.
- .8 Automatic shutdown in case of :
  - Overcrank.
  - High engine temperature.
  - Low oil pressure.
  - Overspeed.
  - Overvoltage.
- .9 Alarm warnings (no engine stop) in case of :
  - Low engine temperature.
  - High engine temperature.
  - Low oil pressure.
  - Low fuel level.
  - Not in auto.
  - Low battery voltage.
  - Low coolant level.
  - Fuel leak.
  - ATS in bypass mode.
  - Underfrequency.
  - Overcurrent.
  - Undervoltage.
  - Main breaker open.
- .10 Piezo-electric type alarm horn.
- .11 Communication ports:
  - USB for computer connexion (for service and programming).
  - RS-485 with Modbus communication protocol.

- .12 Measurement units using metric or english.
- .13 Overload protection coordinated with alternator thermal curve.
- .14 Pushbutton/rotary type selector dial for menu navigation.
- .15 Additionnal input/output module :
  - 2 digital inputs.
  - 4 outputs :
    - a) 2A form C relay (qty = 2).
    - b) 10A form C relay (qty = 2).
    - c) Program 2A ouputs to indicate common fault and low fuel level.
- .16 Run relay 3 pole form C.
- .17 0-20 sec stopping sequence timing relay for existing solenoid valve.
- .11 Breaker :
  - .1 Molded case type, 3P, 600V.
  - .2 Rated 1000A @ 100%.
  - .3 LSIG electronic trip unit.
  - .4 Breaker open position contact wired to the control panel.
  - .5 4 lugs 3/0 to 500MCM per pole.
- .12 Exhaust system :
  - .1 The exhaust system shall include a minimum 18 inch stainless steel flexible.
  - .2 The muffler will be provided by the plumber.
  - .3 The engine shall operate with 8.5 kPa maximum restriction without performance loss. The engine must allow for the future addition of exhaust gas post treatment equipment in order to be certified TIER-4.
  - .4 The exhaust flow shall not exceed 189.4 m<sup>3</sup>/min at full load.

## 2.2 FUEL SYSTEM.

- .1 Runs using #2 diesel complying to ONGC 3-GP-6c.
- .2 Fuel supply system :
  - .1 Direct electronic injection.
  - .2 Mechanical fuel pump, 6 meters, 49 liters/hour
  - .3 Flexible lines to be terminated on a transition plate at the base of the generator set, where the building piping network will be connected.
  - .4 Fuel filters including water separator.
  - .5 Air filter.

.3 Full cooler

- .1 Built in to the cooling radiator the fuel cooler must be designed in order to allow the proper operation of the generator set connected to the tank while respecting the allowed temperature rise for the operation of the generator set as dictated by it's manufacturer. The fuel cooler must limit the fuel return temperature at 38°C, at 35°C intake air temperature.

.4 Existing fuel tanks will be reused.

2.3 REMOTE COMMUNICATION MODULE WITH WEB PAGE.

- .1 Provide, install and connect an Ethernet TCP/IP communication module, with secured access allowing generator set and automatic transfer switch monitoring and control in a web page accessible by computer, touchpad or smartphone.
- .2 The web page must allow :
  - .1 Display normal and emergency presence.
  - .2 Display automatic transfer switch position.
  - .3 Display normal source readings :
    - Line to neutral voltage per phase.
    - Line to line voltage per phase.
    - Frequency.
  - .4 Display emergency source readings :
    - Real power.
    - Apparent power.
    - Current per phase.
    - Average current.
    - Line to neutral voltage per phase.
    - Line to neutral average voltage.
    - Line to line voltage per phase.
    - Line to line average voltage.
    - Frequency.
    - Battery voltage.
    - Fuel level.
    - Engine temperature.
    - RPM.
    - Generator set status.
- .5 Display active alarms.

- .6 Display alarm history.
- .7 Display alarm summary.
- .8 Display trend curves of :
  - Real power.
  - Average current.
  - Generator average line to neutral voltage.
  - Generator average line to line voltage.
  - Fuel level.
- .9 Generator set start and stop.
- .10 Generator set no load test start and stop.
- .11 Generator set loaded test start and stop.
- .12 Start and stop generator set and transfer building load to proceed peak shaving to meet utility program in peak load period.
- 3 The communication module must send an email when a power failure occurs. The email shall state which parameter is wrong and its value.
- 4 There shall be no annual fees for web page hosting.

### PARTIE 3 - EXECUTION

#### 3.1 INSTALLATION

- .1 Install the generator set in accordance with indication in contract documents and applicable codes.
- .2 Carry out the connections, including the supervisions (ex. tanks).

#### 3.2 VERIFICATIONS

- .1 Supplier tests
  - .1 Advise the ministerial representative of the tests at least two (2) weeks in advance, check for leaks and level of liquids. Make a visual inspection of the generator set. Measure the resistance of the cold engine block heater, then check that the thermostat opens the circuit when the engine heats up. Check the operation of control protections. Adjust the governor frequency, the alternator voltage and the V/Hz function. Check that the battery charging alternator operates. Apply the full load and confirm the ability of the generator set to feed it. Submit to the consultant a report of the supported loads; this is to be done at the supplier's premises and submitted in French.
- .2 Tests on site
  - .1 Obtain a manufacturer's representative for the initial start-up and verification of the installation.
  - .2 Advise the ministerial representative of the conducting of these tests five work days before the due date.
  - .3 Supply necessary fuel for the tests.
  - .4 The supplier is responsible for the initial start-up and must submit a report to the ministerial representative. This report must state any anomaly or deficiency. The commissioning will include tests at the work site as prescribed in standard CAN/CSA C282-05. These tests shall include:



- A simulation of the loss of normal power by opening the normal feed upstream of the transfer switch. This test must be performed in cold start-up condition. Let the generator set function with the building load for an hour, then reestablish the normal power and check the retransfer and shut-down of generator set.
- During this test record the following data:
  - a) Starting delay;
  - b) Duration of starting;
  - c) Time required to acquire a stabilized operation after transfer of the transfer switch;
  - d) Voltage, current and frequency during start-up and load fluctuations (response to transient loads);
  - e) Oil pressure, engine temperature and rate of battery charging, with reading every five minutes for the first fifteen minutes then every fifteen minutes;
  - f) Retransfer time delay;
  - g) Idle time delay;
  - h) The proper operation of the electrical systems, the ventilation, controls, exhaust and fuel.
- After the one hour running test with the building load, demonstrate that the generator set can take a sudden 900 kW load.
- After demonstrating the ability to take the sudden load, apply for four hours the maximum specified load as indicated on the generator set. Check the voltage and frequency.
- Check that exhaust gasses are not sucked in by air intakes.
- Supply a load bank for these tests and record data every fifteen minutes until the end testing.
- Check that the ventilation system modulates the ambient temperature while the full load is applied to the generator set.
- Carry out two start refusal tests. Check that the battery(ies) voltage at the end of the two start cycles is at least 80 % of the nominal voltage.
- Check the operation of audible alarm.
- Carry out a test of the pilot lights.
- Check the security shut-downs and alarms.
- A french written report of the commissioning must be submitted to the ministerial representative. This report must state any anomaly or deficiency.
- Check proper operation of the existing load transfer switch and submit a report to the ministerial representative.

End of section