

**AGENCE SPATIALE CANADIENNE
CANADIAN SPACE AGENCY**



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**MODERNIZATION OF EMERGENCY GENERATOR CONTROLS
PROJECT: A13-4.4.1**

**ELECTRICAL
TECHNICAL SPECIFICATIONS**

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For tender

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Division 26 - Electrical

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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 “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.

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 m²: square metre
 - .10 mm²: square millimetre
 - .11 ft²: square foot
 - .12 in²: 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 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.

1.4 Site visit

- .1 Before submitting his bid, the contractor must visit the site so as to visualize the existing conditions and correctly evaluate the scope of work for the dismantling and the relocation as well as the installations to be carried out. No claim due to the ignorance of the local conditions will be considered with the party with whom the contract is signed.

1.5 Reference Plans

- .1 In preparing his bid, the contractor must consult all electrical 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 contractor 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 contractor 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 contractor for work not included in contract, unless the contractor obtains a written authorization from the Party with whom the contract is signed.

1.8 Equivalences of materials

- .1 When products are specified, these specifications are given to indicate the quality and the characteristics for the equipment. The contractor may select a product that he judges to be equivalent as long as he respects the set of characteristics for the specified product.
- .2 All equipment supplied by the contractor must meet the set of characteristics of the specified product.

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.

1.10 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.
- .3 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 The contractor (and if required, his subcontractor) 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 The contractor must, before the beginning of works, carry out an exhaustive survey of the existing installations, verify the time delay for the delivery of electrical equipment and precisely establish the works to be carried out.
- .2 Following the obtained information, the contractor must produce a schedule (Microsoft project) and present it to the Departmental Representative for validation. Once validated, this schedule must be scrupulously followed.
- .3 In the event that a situation calls for the modification of the schedule, the contractor must submit, to the Departmental Representative, the modification details, the reasons explaining their fulfillment and the impact on the original planning. Following this presentation, the same validation process applies and, at the Departmental Representative's request, a revised schedule could be demanded.

1.14 Cost breakdown

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

1.15 Shop drawings

- .1 The 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 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 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 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 contractor must assume the risk associated with ordering materials or performing any work prior to the receipt of drawings verified by the Departmental Representative.
- .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 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 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.
- .11 The 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.
- .12 The 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.
- .13 Documentation must be submitted on sheets with dimensions less than 836 mm x 1143 mm.
- .14 Unless otherwise indicated, all materials must be new and free from manufacturing defects.
- .15 Unless otherwise indicated, use products of a single manufacturer in the case of materials and equipment of same type.

1.16 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.

1.17 Safety measures during construction work

- .1 The 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 The contractor 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 contractor must follow the most stringent requirements.

1.18 Additional precautionary measures

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

1.19 Cleaning

- .1 During construction, the contractor 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 contractors shall block the open end of all ipes 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.
- .2 During final cleaning, the 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.

1.20 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 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 contractor must store materials and equipment in accordance with instructions received from suppliers.
- .4 The 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 contractor must move equipment or stored materials that hinder building operation or work achievement.
- .6 The contractor must obtain from the Project Manager the authorization to store equipment in areas identified by him.

1.21 Lifting

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

1.22 Scaffolding

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

1.23 Openings, sleeves and patching

- .1 Before opening a hole in a load-bearing member or a slab, the contractor must obtain permission from the Departmental Representative. If necessary and if requested by the Departmental Representative, the contractor shall perform an X-ray analysis.
- .2 All openings must be carried out 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 steel 40. 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. Sealing must be done by the contractor.

1.24 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 the Departmental Representative's approval.

1.25 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.

1.26 Access doors and panels

- .1 The contractor shall provide access doors in ceilings, partitions, etc., to allow access and maintenance of material, fittings, equipment such as junction and pull boxes.
- .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 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. Otherwise, they must be painted the same color as the adjacent surface.
- .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			

1.27 Identification

- .1 General
 - .1 All identifications must be made in French. Before performing the work, the contractor must request the Departmental Representative to verify and approve the list of identifications.
- .2 Equipment identification
 - .1 The contractor must identify with nameplates (glued and screwed lamicoïd 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:

	Base colour	Complementary colour
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 added if the load is connected to “normal/emergency power” or “UPS”.

- “Normal/ emergency power” : orange;
- “UPS”: 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 contractor 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 contractor 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 lamicoïd sheets and plates).

1.28 Tests and start-up

.1 Tests – General

- .1 The contractor shall provide all materials and labour required to perform tests, including costs incurred by the independent laboratory and manufacturers.
- .2 The contractor must ensure that tests are not destructive for equipment and, if necessary, disconnect or isolate certain components.
- .3 The contractor must notify the Departmental Representative 48 hours before testing day. The Departmental Representative will confirm his presence to the contractor if the Departmental Representative wants to assist to tests.
- .4 In the event that tests indicate deficiencies regarding expected results, the contractor 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 contractor 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 contractor (C) 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		
Coordination study		
Grounding test		
Dielectric test (low voltage)		
Generator test	X	M
UPS test		
Fire alarm system test		
Lighting control system test		
Camera test		
Intrusion alarm test		
Data transfer and “WEB” page	X	M

.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 contractor 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).

1.29 Spare parts and special tools

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

1.30 Equipment Operation and Maintenance Manual

- .1 Upon completion of work, the 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. Unless otherwise indicated, it must be prepared in accordance with the following:
 - .1 Write data on loose leaves 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.

1.31 Certificate of substantial completion

- .1 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".
- .2 After written confirmation from the contractor that work 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".

- .3 At this stage, the works are deemed compliant with plans and specifications to the satisfaction of the Departmental Representative, 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 the Departmental Representative.
- .4 The Departmental Representative will then use the “Certificate of substantial completion of works” 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.
- .5 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 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.
- .6 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.
- .7 The above procedure is not intended to unduly penalize the contractor, but rather to seek their full cooperation to complete their work and avoid that their negligence cause unnecessary cost to the Departmental Representative.
- .8 The Departmental Representative will, at his discretion, inspect the site, but he will make known to the Contractor the deficiencies he observes.

1.32 Required certificate with acceptance request

- .1 No acceptance request for work made by may be considered, unless it is accompanied by delivery of all the required certificates.
- .2 These documents and certificates are the following:
 - .1 Warranty of work.
 - .2 Operation and Maintenance Manuals.
 - .3 Certificates of equipment start-up.
 - .4 Verification and certification reports attesting that the system is fully functional.

1.33 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 The contractors must guarantee his works 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. PART 1 – GENERAL

1.1 Related sections

- .1 Other technical specifications sections.

1.2 Fields of application

- .1 Unless otherwise specified, the requirements of this document apply to each emergency generator.
- .2 The emergency generators affected by the scope of these works are:
 - .1 Emergency generator, 310 kW (Prime), 347/600 V in room A-104.
 - .2 Emergency generator, 600 kW, 347/600 V in room K-100 (outside enclosure).
 - .3 Emergency generator, 1 250 kW, 347/600 V in room 6B-101.

1.3 Scope of work

- .1 The works include but are not limited to:
 - .1 Supply and install, for the duration of works on each generators set of 310 kW and 1 250 kW, a mobile generator.
 - .2 Remove the existing control panels for the 310 kW and 1 250 kW emergency generators.
 - .3 Supply, install and connect the new control panels for the emergency generators indicated in the previous item.
 - .4 Modify the control panel for the 600kW emergency generator so as to permit it connection to the Canadian space agency's Ethernet network.
 - .5 Integrate supervised points for the three emergency generators to the Canadian Space Agency existing supervision system.
 - .6 Perform all other related works required.
 - .7 Perform all required tests to ensure that each supervision point appears correctly and that each command performs adequately. Submit a written report indicating the tests performed and the results.
 - .8 Perform, for each emergency generator, a "full load" test with load blank and submit report.
 - .9 Perform a personnel training session.

1.4 Responsibility

- .1 This contractor is responsible for the completion of all work, including coordination with the Departmental Representative and his subcontractors.
- .2 This contractor shall include in his bid all work required to obtain an optimal performance of all emergency generators.
- .3 This contractor may subcontract some work to complete the required works (electrical contractor, integration and IP networking contractor, finishing contractor (for touch ups), etc.). The costs of these subcontractors are part of its tender bid.

2. PART 2 – PRODUCTS

2.1 Not applicable

3. PART 3 – EXECUTION

3.1 Not applicable

1. PART 1 - GENERAL

1.1 Section includes

- .1 Wire connectors and boxes, material and related materials as well as their installation.

1.2 References

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

2. PART 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 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 Appropriate size for conductors as indicated.
- .3 Clamps or connectors for armoured cable, aluminum sheathed cable, mineral insulated cable, flexible metal conduits, as required to: CAN/CSA-C22.2 No.18.

3. PART 3 - EXECUTION

3.1 Installation

- .1 Remove insulation carefully from ends of conductors and according to installation:
 - .1 Apply coat of zinc joint compound on aluminum conductors prior to installation of connectors.
 - .2 Install mechanical pressure type connectors and tighten screws with appropriate compression tool recommended by manufacturer. Installation shall meet secure tests in accordance with CSA C22.2 No.65.
 - .3 Install fixture type connectors and tighten. Replace insulating cap.
 - .4 Install bushing stud connectors in accordance with EEMAC 1Y-2.

1. PART 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.
- .2 CAN/CSA-C22.2 No 131, TECK 90 type cables.

1.3 Shop drawings and product data

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

2. PART 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.

3. PART 3 – EXECUTION

3.1 Installation of building wires

- .1 Install wiring as follows:
 - .1 In conduit systems in accordance with Section 260534E.

3.2 Conductor (cables) rating

- .1 Ratings indicated herein are minimums. Contractor to install required conductors (cables) to limit voltage drops to values below those prescribed in the Electrical Code. Selection of conductors and cables take into account derating of cables, as required by the Electrical Code.
- .2 Minimum rating for protection as follows:
 - .1 15A: #12;
 - .2 20A: #12;
 - .3 30A: #10;
 - .4 40A: #8;
 - .5 For protection above 40A, minimum conductor and cable rating are indicated on drawings.

3.3 Identified white neutral conductors

- .1 Each single-pole circuit must have an identified white neutral conductor (no shared returns are allowed).

1. PART 1 – GENERAL

1.1 References

- .1 Quebec Construction Code – Chapter V - Electricity.

2. PART 2 – PRODUCTS

2.1 Equipment

- .1 Clamps for grounding of conductor: size as indicated to electrically conductive underground water pipe.
- .2 Grounding conductors: bare stranded copper, tinned, soft annealed size as indicated.
- .3 Insulated grounding conductors: green, type RW.
- .4 Ground bus: copper, size as indicated, complete with insulated supports, fastenings, connectors.
- .5 Non corroding accessories necessary for grounding system, type, size, material as indicated, including but not necessarily limited to:
 - .1 Grounding and bonding bushings.
 - .2 Protective type clamps.
 - .3 Bolted type conductor connectors.
 - .4 Thermit welded type conductor connectors.
 - .5 Bonding jumpers, straps.
 - .6 Pressure wire connectors.

3. PART 3 – EXECUTION

3.1 Installation – General

- .1 Install complete permanent, continuous grounding system including electrodes, conductors, connectors, accessories. Where EMT is used, run ground wire in conduit.
- .2 Install connectors in accordance with manufacturer's instructions.
- .3 Protect exposed grounding conductors from mechanical injury.
- .4 Use mechanical connectors for grounding connections to equipment provided with lugs.
- .5 Soldered joints not permitted.
- .6 Install bonding wire for flexible conduit, connected at both ends to grounding bushing, solderless lug, clamp or cup washer and screw with Belleville ring.
- .7 Install flexible ground straps for bus duct enclosure joints, where such bonding is not inherently provided with equipment.
- .8 Make grounding connections in radial configuration only, with connections terminating at one point only at street side of water pipe. Avoid loop connections.
- .9 Ground secondary service pedestals.

3.2 System and circuit grounding

- .1 Install system and circuit grounding connections to neutral secondary 120/208 V system.

3.3 Appliance grounding

- .1 Execute prescribed grounding connections for the material ensemble, such as: branch appliances, transformers, main pipes, motor housings, motor command centers, starters, command panels, distribution panels and exterior lighting circuits.

3.4 Field Quality Control

- .1 Perform tests in accordance with Section 260500E – Common Work Results for Electrical.
- .2 Perform ground continuity and resistance tests using method appropriate to site conditions and to approval of local authority having jurisdiction over installation.
- .3 Perform tests before energizing electrical system.
- .4 Disconnect ground fault indicator during tests.

1. PART 1 – GENERAL

1.1 Related work

- .1 Fastening and supports: General architectural specifications – General requirements for products (if applicable).

1.2 Shop drawings and product data

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

2. PART 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, aluminium and/or PVC as indicated.

3. PART 3 – EXECUTION

3.1 Installation

- .1 Unless otherwise indicated, use following materials:
 - .1 Outside:
 - galvanized steel;
 - aluminium;
 - PVC;
 -
 - .2 Dry area :
 - steel;
 -
 - .3 Wet area :
 - galvanized steel;
 - aluminium;
 - 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 and cables larger than 50 mm.
 - .3 Beam clamps to secure conduit to exposed steel work.

- .7 Suspended support systems.
 - .1 Support individual cable or conduit runs with 6 mm dia threaded rods and spring clips.
 - .2 Support 2 or more cables or 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 and cable runs.
- .10 Ensure adequate support for raceways and cables dropped vertically to equipment where there is no wall support.
- .11 Do not use wire lashing or perforated strap to support or secure raceways or cables.
- .12 Do not use supports or equipment installed for other trades for conduit or cable support except with permission of other trade and approval of Departmental Representative.
- .13 Install fastenings and supports as required for each type of equipment cables and conduits, and in accordance with manufacturer's installation recommendations.

1. PART 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.

2. PART 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.
- .3 At least three spare terminals on each set of lugs in splitters less than 400 A.

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, aluminium and/or PVC as indicated.

3. PART 3 – EXECUTION

3.1 General

- .1 Unless otherwise indicated, use following materials:
 - .1 Outside:
 - galvanized steel
 - aluminum
 - PVC
 -
 - .2 Dry area:
 - steel
 - galvanized steel
 - aluminum
 -
 - .3 Damp and wet areas:
 - galvanized steel
 - aluminum
 - PVC
 -
- .2 Outside, in damp and wet areas, all fittings to be weatherproof.

3.2 Splitter installation

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

3.3 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. Install pull boxes so as not to exceed 30 m of conduit run between pull boxes or three elbows at 90°.

3.4 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.

1. PART 1 – GENERAL

1.1 References

- .1 CSA C22.1, Quebec Construction Code – Chapter V - Electricity.

2. PART 2 – PRODUCTS

2.1 Outlet and conduit boxes – General

- .1 Size boxes in accordance with CSA C22.1.
- .2 100 mm square or larger outlet boxes as required for special devices.
- .3 Gang boxes where wiring devices are grouped.
- .4 Blank cover plates for boxes without wiring devices.
- .5 347 V outlet boxes for 347 V switching devices.
- .6 Combination boxes with barriers where outlets for more than one system are grouped.

2.2 Outlet boxes

- .1 Single and multi gang flush device boxes for flush installation, minimum size 75 x 50 x 13 mm or as indicated. 50 mm square outlet boxes when more than one conduit enters one side with extension and plaster rings as required.
- .2 Electro galvanized steel utility boxes for outlets connected to surface mounted EMT conduit, minimum size 100 x 50 x 50 mm.
- .3 50 mm square or octagonal outlet boxes for lighting fixture outlets.
- .4 50 mm square outlet boxes with extension and plaster rings for flush mounting devices in finished plaster walls.

2.3 Branch boxes (for conduits)

- .1 Cast FS or FD aluminum ferrous alloy boxes with factory threaded hubs and mounting feet for surface wiring of switches and receptacle c/w grounding.

2.4 Fittings – General

- .1 Bushing and connectors with nylon insulated throats.
- .2 Knock out fillers to prevent entry of debris.
- .3 Conduit outlet bodies for conduit up to 6 mm and pull boxes for larger conduits.
- .4 Double locknuts and insulated bushings on sheet metal boxes.

2.5 Materials

- .1 Steel, galvanized steel, aluminium and/or PVC as indicated.

3. PART 3 – EXECUTION

3.1 General

- .1 Unless otherwise indicated, use following materials:
 - .1 Outside:
 - galvanized steel;
 - aluminium;
 - PVC;
 -
 - .2 Dry area:
 - steel;
 - aluminium;
 -
 - .3 Wet area:
 - galvanized steel;
 - aluminium;
 - PVC;
 -
- .2 Outside, in wet areas, all fittings to be weatherproof.

3.2 Installation

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

1. PART 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.
 - .5 CSA C22.2 No. 211.2, Rigid PVC (Unplasticized) Conduit.
 - .6 CAN/CSA C22.2 No. 227.3, Flexible Nonmetallic Tubing.

2. PART 2 – PRODUCTS

2.1 Conduits

- .1 Electrical metallic tubing (EMT): to CSA C22.2 No. 83, with couplings with expanded ends.
- .2 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 Spacers in PVC with stainless steel fastenings.

2.3 Conduit fittings

- .1 Fittings: manufactured for use with conduit specified. Coating: same as conduit.
- .2 Factory "ells" 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 Watertight expansion fittings with integral bonding jumper suitable for linear expansion and 19 mm deflection in all directions.
- .3 Weatherproof expansion fittings for linear expansion at entry to panel.

2.5 Fish cord

- .1 Polypropylene.

3. PART 3 – EXECUTION

3.1 General

- .1 Unless otherwise indicated, EMT conduits shall be used.

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 Use flexible metal conduit for connection to transformers, motors, and vibrating equipment.
- .5 Bend conduit cold. Replace conduit if kinked or flattened more than 1/10th of its original diameter.
- .6 Mechanically bend steel conduit over 19 mm dia.
- .7 Field threads on rigid conduit must be of sufficient length to draw conduits up tight.
- .8 Install fish cord in empty conduits.
- .9 For each flush mounting panel board, run 2-25 mm spare conduits up to ceiling space. Terminate these conduits in 300 x 300 x 150 mm junction boxes in ceiling space.
- .10 Remove and replace blocked conduit sections. Do not use liquids to clean out conduits.
- .11 Dry out conduits before installing wire.
- .12 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.

1. PART 1 – GENERAL

1.1 Related sections

- .1 Other sections of technical specifications.

1.2 References

- .1 NFPA-110
- .2 CSA C282
- .3 CSA C22.2
- .4 UL-508
- .5 Directive CE

1.3 Shop drawings and product data

- .1 Submit product data in accordance with Section 260500E – Common Work Results for Electrical.
- .2 Submit installation and connection drawings for each emergency generator clearly indicating each executed connection.

2. PART 2 – PRODUCTS

2.1 Control panel

- .1 The control panel must have a microprocessor technology.
- .2 The control panel must offer an advanced control system, system surveillance, and a diagnostic capacity for an optimum performance. The rendered information from the control panel must be in French.
- .3 An alphanumeric display, sealed membrane buttons (start/stop, reset, automatic, manual) and an arrowed selector must provide access to the information.
- .4 Display characteristics:
 - .1 LCD type;
 - .2 retro-lighting;
 - .3 64 x 128 pixels;
 - .4 Equipped with a heating element which will activate itself at 0°C and will deactivate itself at 5 °C.
- .5 The control panel must be equipped with:
 - .1 Status lights (LEDs) :
 - .1 stop (red),
 - .2 auto (green),
 - .3 on (green),
 - .4 charge supply (green),
 - .5 not in automatic (red),
 - .6 alarms (red/flashing).
 - .2 Stop button for the sound alarm;
 - .3 Test button for status lights;
 - .4 Emergency stop button;
 - .5 Automatic mode switch button;

- .6 Stop button;
- .7 Start-up button;
- .8 Four (4) menu navigation arrows;
- .9 A programming button;
- .10 A zero reset button;
- .11 A sound alarm;
- .12 Dedicated inputs:
 - .1 Remote emergency stop,
 - .2 16 programmable inputs.
- .13 A RTU Modbus communication module via an integrated RS-485.
- .6 Operation parameter:
 - .1 Operation temperature: -40 °C to 70 °C;
 - .2 Storage temperature: -40 °C to 85 °C.
 - .3 Voltage: 12 ou 24 Vdc, operation parameter 6 to 32 Vdc.
 - .4 Consumption: 5W in night setback and 14.2W during operation with heating element in operation and 6 activated relays.
- .7 Control operation:
 - .1 A clock (energised by a lithium battery with a life expectancy of 10 years) and a real time calendar which records moments of events (such as the stopping of a motor) and permits the determination of a start-up date as well as the number of days of operation.
 - .2 A cooling operation for the motor permitting the user to program a cooling schedule before the motor stops.
 - .3 To preserve the accumulator's energy, the display will shut itself off following its use. The display will reactivate itself by the pressing of any button on the keyboard.
 - .4 A start-up control function allows cycled or continuous start-up cycles (quantity and duration).
 - .5 The number of successful start-ups is recorded and can be displayed.
 - .6 The start-up delay function delays the start-up according to a time programmed by the user.
- .8 The control panel must be equipped with an automatic motor shut-off with a red fault display light and an alphanumeric display for the following conditions:
 - .1 Loss of communication with the motor sensors;
 - .2 Motor over speed;
 - .3 Motor under speed;
 - .4 High motor temperature;
 - .5 Low level refrigerant level;
 - .6 Low oil pressure;
 - .7 Won't start;
 - .8 Emergency stop;
 - .9 Fuel leak;
 - .10 Critical low limit fuel level.
- .9 The control panel must be equipped with an alarm (without stopping of the motor) with a yellow fault light and an alphanumeric display for the following conditions:
 - .1 Loss of communication with the motor's sensors;
 - .2 Accumulator's charger fault;
 - .3 Accumulator low tension;
 - .4 Accumulator high tension;
 - .5 Low motor temperature;
 - .6 Low ambient temperature;
 - .7 Closed BC circuit;
 - .8 Open disconnect;

- .9 Bypass transfer switch;
- .10 Motor high temperature;
- .11 Oil low pressure;
- .12 Motor overcharge kW (3 levels);
- .13 Maintenance interval timer schedule;
- .14 Low level of refrigerant;
- .15 Low level of fuel;
- .16 Fuel leak;
- .17 High level of fuel.
- .10 All alarms and pre-alarms must be configurable (activate/deactivate) through a programming software. It must be possible to add desired alarms and pre-alarms on demand.
- .11 A fault historic (stops and alarms) must be memory stored for diagnostic purposes (up to 99 events), and may be reset to zero.
- .12 A PLC must allow the programming or simple combination operations to account for field constraints.
- .13 The display must be able to indicate the following menus and sub-menus:
 - .1 System overview:
 - .1 Active start-up and stops;
 - .2 Total motor operation time;
 - .3 Voltage switches;
 - .4 Fuel level (%);
 - .5 Duration of motor operation (h);
 - .6 Maintenance timer.
 - .2 Motor instrumentation:
 - .1 Motor speed;
 - .2 Source of speed signal;
 - .3 Actual charge;
 - .4 Refrigerant liquid temperature;
 - .5 Oil pressure;
 - .6 Voltage accumulator(s);
 - .7 Supply header air pressure;
 - .8 Supply air temperature;
 - .9 Operation time;
 - .10 Fuel temperature;
 - .11 ECU supply voltage;
 - .12 Actual tork;
 - .3 Alternator instrumentation:
 - .1 Total load and per phase in kVA;
 - .2 Total load and per phase in kW;
 - .3 Total load and per phase in KVAR ;
 - .4 Load factor (LF) and its state (“ Lead – Lag”);
 - .5 % of the nominal load;
 - .6 Voltage L-L and L-N on each line;
 - .7 Current on each line;
 - .8 Frequency.

- .4 Alternator protection :
 - .1 Undervoltage (27);
 - .2 Reverse power (32);
 - .3 Exciter loss (40Q);
 - .4 Overvoltage (59);
 - .5 Overfrequency (81O);
 - .6 Underfrequency (81U).
- .5 Cumulative use of the emergency generator:
 - .1 Global hours and minutes;
 - .2 Hours and minutes with load;
 - .3 Hours and minutes without load.
- .6 Last genset use;
 - .1 Total hours and minutes;
 - .2 Hours and minutes with load;
 - .3 Hours and minutes without load.
- .14 The controls must be equipped with the following inputs and outputs:
 - .1 Inputs :
 - .1 16 numerical programmable inputs;
 - .2 1 analog input 30-240Ω for the fuel level;
 - .3 A particular mane may be attributed for each input, not in a pre-established list, but at the choice of the operator.
 - .2 Outputs :
 - .1 Genset on duty contact of 30 amps;
 - .2 two other programmable contacts of 30 amps;
 - .3 12 programmable contacts of 2 amps;
 - .4 Reaction time between the moment where :
 - .1 a signal is sent on a numerical input and the time where the output relay is closed:
215ms;
 - .2 a signal is sent on a numerical input and the motor's stop command is given:
490ms.
- .15 The prototype must have been tested against radio interferences with a 5W source emitting random frequencies centered on 144 and 440 MHz with an antenna situation 6" from the control, both in the vertical and the horizontal plane.
- .16 To enable the frequency readings, the control panel must use two sources, that is a magnetic receiver or a speed signal from the CANbus and the controller must automatically transfer its reading to the alternator's CA.

3. PART 3 – EXECUTION

3.1 General

- .1 Refer to section 263214.3F – Work description.

1. PART 1 – GENERAL

1.1 Related sections

- .1 Other sections of technical specifications.

1.2 Shop drawings and technical sheets

- .1 Submit required as per section technical sheets 260500F – Common work results for electrical.
- .2 Submit complete connection diagram. No typical diagram will be approved.
- .3 Submit the identifications of addresses used and the description of available points.

2. PART 2 – PRODUCTS

2.1 Remote controller

- .1 The controller must allow the supervision one or more emergency generators.
- .2 The controller must allow the supervision of a unit in real time in a compact display.
- .3 The link between the control panel of the emergency generator and the remote controller must be a shielded cable or a communication cable.
- .4 The controller must be completely tactile but must be conceived to receive a keyboard or a mouse via a USB port.
- .5 The display must be accessible and controllable by a computer connected to the network through the navigator “WEB” page.
- .6 Specifications:
 - .1 Supply: 120 V;
 - .2 Dimensions: 20" (length) x 16" (height) x 8 13/16" (depth);
 - .3 Communication: Modbus RTU and TCP/IP;
 - .4 Connections: 4 units;
 - .5 Wall mounted;
 - .6 Display 10.4" tactile.

3. PART 3 – EXECUTION

3.1 General

- .1 Refer to section 263214.3F – Work description.

1. PART 1 – GENERAL

1.1 Related requirements

- .1 Other specification sections.

1.2 Application field

- .1 The works described in the present section applies all three emergency generators.

2. PART 2 – PRODUCTS

2.1 Not applicable.

3. PART 3 – EXECUTION

3.1 Installation

- .1 The contractor shall, but not limit to:
 - .1 Establish a schedule which clearly indicates the required interventions, the duration of the works and their impact.
 - .2 Obtain the authorisation of the Departmental Representative before commencement of works.
 - .3 Coordinate with the Departmental Representative all work phases for the project.
 - .4 Supply and install mobile emergency generators (250 kW for the 310 kW emergency generator and 800 kW for the 1 250 kW emergency generator). Connect each emergency generator to the connection points provided for this purpose. Include in his tender price the fuel required for the duration of the use of the emergency generators.
 - .5 For the 310 kW and 1 250 kW emergency generators:
 - .1 Disconnect the existing control panels, the supervision and command cables. Clearly identify each conductor. Ensure bypassing all alerts of the associated disconnections.
 - .2 Remove existing control panels.
 - .3 Supply new control panels and install on each an anti-vibration base.
 - .4 Connect the supervision and command cables on each control panel.
 - .5 Carry out the start up and check the control panels operation including the commands, displays, supervisions, alarms, etc.
 - .6 For the 600 kW emergency generator, supply and install in the existing control panel a converter module with an musbus/TCP output. Carry out the programming and the start up.
 - .7 Supply a HMI control panel and install in room 6B-102. The controller's final location will be determined on site. Connect the controller (120V) to the circuit supplied by the Departmental Representative.
 - .8 Connect Ethernet wiring to controls panels, switches, server, remote controller, PC, etc. (see appendix). Include in tender the services for a Trane technician and for a new Trane ES software licence.
 - .9 Coordinate with the Departmental Representative and define the desired supervision.
 - .10 Execute the modifications and the programming required on the HMI remote controller and the existing system (Tracer ES) for the desired displays.

- .11 Execute all related works required to obtain a fully functional assembly.
- .12 Once all tests are conclusive and to the Departmental Representative satisfaction, disconnect the mobile emergency generators.
- .13 Execute required touch ups (ex.: paint) so as to render the finished surfaces identical to those prior to works.

3.2 Tests

- .1 Execute on each emergency generator all required tests to confirm that all the equipment groups are 100 % functional. These tests shall include, but are not limited to:
 - .1 Command activation (ex.: start, stop).
 - .2 Control panel of the supervision points displays.
 - .3 Confirmation of the proper operation for all functions of the control panel
 - .4 Monitoring transfers on the Canadian Space Agency's IP communication network.
 - .5 Previously defined "Web" page supervision displays.
- .2 Execute a test 2 hour test with a load bank (100% charge of the tested emergency generator) and for each emergency generator.
- .3 Submit complete written and signed reports to the Departmental Representative indicating the executed tests and the obtained results. Ensure the proper operation of the equipment and submit a report.

3.3 Documentation

- .1 Transmit to the Departmental Representative the following documents:
 - .1 Warranty letter.
 - .2 Detailed tests report.
 - .3 Complete shop drawings and operations manuals indentifying the used addresses and a description of available points.

3.4 Formation

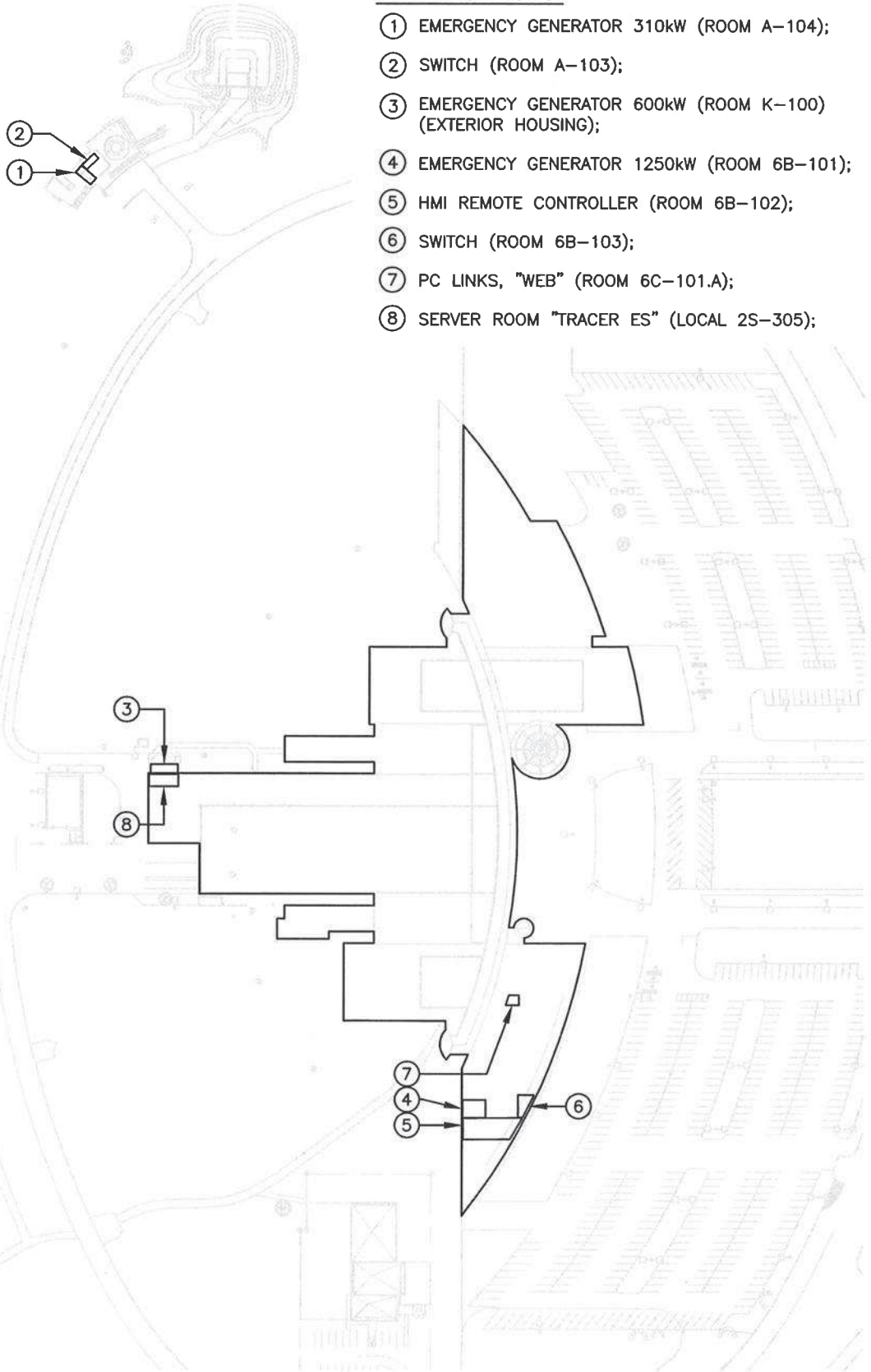
- .1 Supply the minimum required support (minimum of 8 hours) so that the Departmental Representative may familiarise himself with the operation of the new monitoring and command panels for the emergency generators.
- .2 Assign a technician with a minimum of 5 years of experience for the operation of emergency generators for the first points and for the integration to an IP network for the second point.

Appendix 1

Site plan

IDENTIFICATIONS:

- ① EMERGENCY GENERATOR 310kW (ROOM A-104);
- ② SWITCH (ROOM A-103);
- ③ EMERGENCY GENERATOR 600kW (ROOM K-100) (EXTERIOR HOUSING);
- ④ EMERGENCY GENERATOR 1250kW (ROOM 6B-101);
- ⑤ HMI REMOTE CONTROLLER (ROOM 6B-102);
- ⑥ SWITCH (ROOM 6B-103);
- ⑦ PC LINKS, "WEB" (ROOM 6C-101.A);
- ⑧ SERVER ROOM "TRACER ES" (LOCAL 2S-305);



Project: CANADIAN SPACE AGENCY
MODERNIZATION OF EMERGENCY
GENERATOR CONTROLS

Date: 19-06-2014
Scale: 1:2500
Prepared: FRANÇOIS DANSEREAU, ing.

ROCHON
EXPERTS-CONSEILS INC
Mécanique - Électrique

Project no.: ROCHON: 13-009-E / ASC: A13-4.4.1 Drawing no. APPENDIX 1

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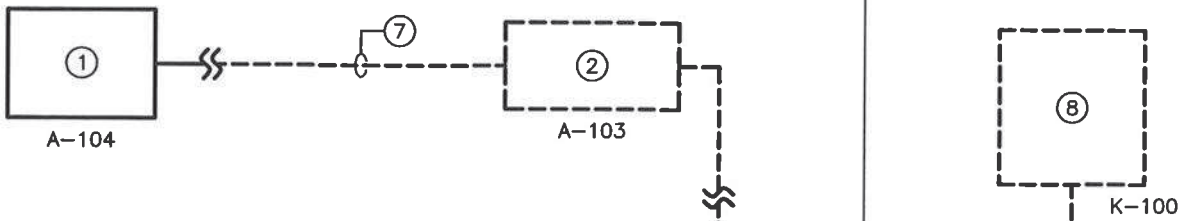
Téléphone: (450) 922-2270
Courriel: info@rochonexpert.com

Appendix 2

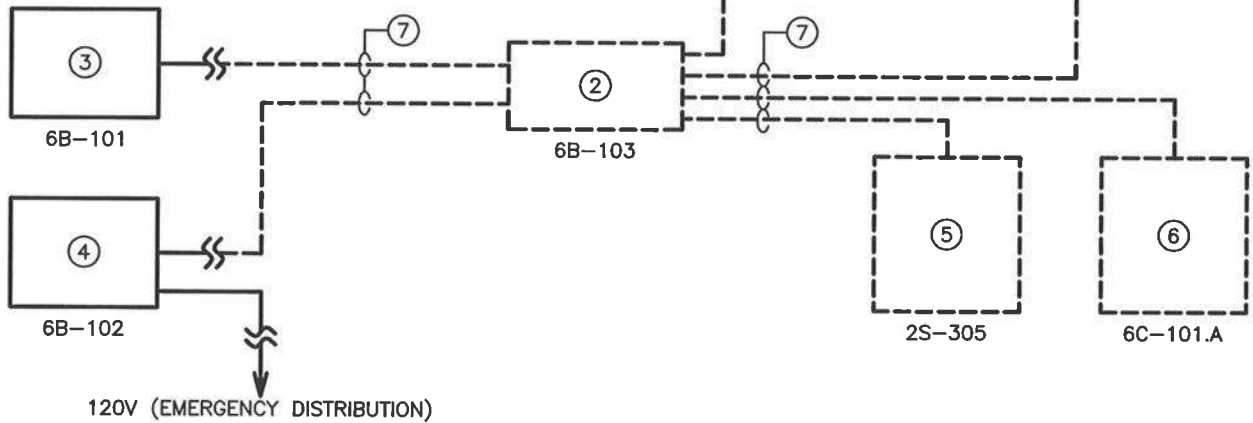
Typical wiring diagram

ANTENNA

**BUILDING K
(GENERATOR ENCLOSURE)**



MAIN BUILDING



LEGEND

----- : EXISTING

————— : NEW

IDENTIFICATIONS:

- ① CONTROL PANEL FOR 310kW. EMERGENCY GENERATOR.
- ② SWITCH.
- ③ CONTROL PANEL FOR 1250kW. EMERGENCY GENERATOR
- ④ REMOTE CONTROLLER SUCH AS ABB HMI CP650.
- ⑤ "TRACER ES" SERVER.
- ⑥ PC LINK ("WEB").
- ⑦ ETHERNET CABLE CAT.5e, C.21mmφ. SUPPLY AND INSTALL BY DEPARTMENTAL REPRESENTATIVE.
- ⑧ CONTROL PANEL FOR 600kW. EMERGENCY GENERATOR.

**TYPICAL WIRING DIAGRAM
NOT TO SCALE**

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Prepared: FRANÇOIS DANSEREAU, ing.

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Project no.: ROCHON: 13-009-E / ASC: A13-4.4.1 Drawing no. APPENDIX 2

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