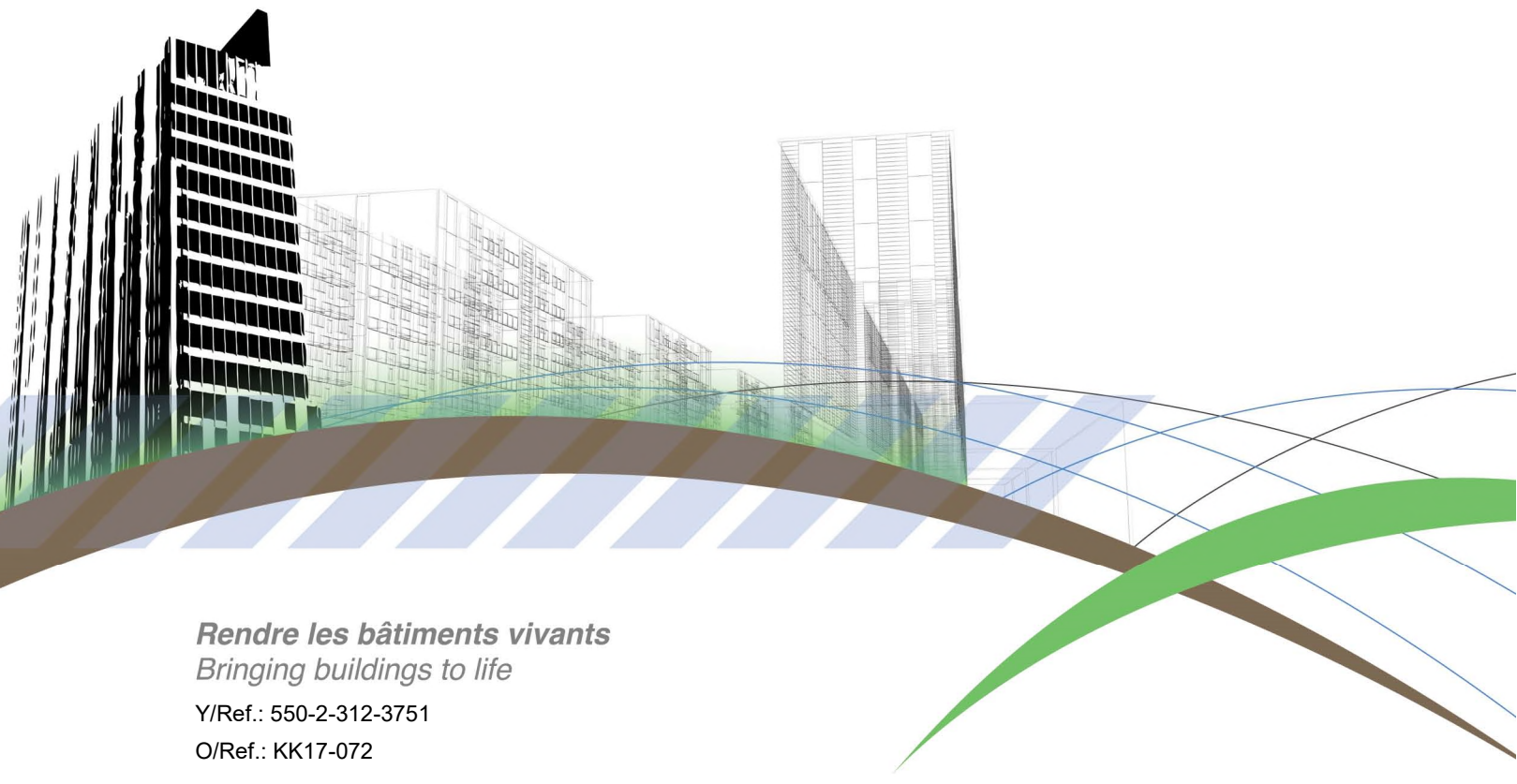


Federal Training Center
C27 Electrical Substation and Generator
Replacement
600 Montée St-François, Laval, Quebec
Specifications Issued for Tender

March 29, 2018



Rendre les bâtiments vivants
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Y/Ref.: 550-2-312-3751

O/Ref.: KK17-072

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C27 Electrical Substation and Generator
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ELECTRICAL

PREPARED BY:

Frederic Bernard, ing., P.Eng

03/29/2018

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PART 1 GENERAL**1.1 REFERENCES**

- .1 National Building Code of Canada (NBC) 2015, including all amendments up to the date of bid closing.

1.2 DESCRIPTION OF THE WORK

- .1 The project includes the following work. The list below is not necessarily exhaustive and in no way releases the Contractor from the obligation of carrying out the project in its entirety according to generally accepted practices as well as the intentions and general principles as described in these specifications and drawings.

- .1 The Contractor is responsible for the request for intervention and coordination of the work with Hydro-Québec. The resulting invoice shall be submitted to CSC who will be responsible for the costs.
- .2 The cleaning of the Hydro-Québec vault.
- .3 Temporary electrical connection via a mobile generator.
- .4 Demolition.
- .5 Supply and install new cable tray for the electrical installations.
- .6 Supply and install new transformers.
- .7 Supply and install new low voltage switchgear.
- .8 Supply and install a new circuit breaker distribution panel.
- .9 Supply and install new genset.
- .10 Supply and install new automatic switchgear installation.
- .11 Hire the services of Régulvar for the programming of the controls and enteliWEB interfaces.

1.3 SECURITY SCREENING

- .1 All workers shall undergo security screening in order to be granted a security classification as required by the Correctional Service of Canada and Public Works and Government Services Canada.
- .2 Section 01 35 13 – CSC Security Requirements provides a detailed description of the procedures involved in the security screening.
- .3 At the start of work, a job-site special meeting will be held with institution representatives to define the instructions governing security and site operation in a correctional environment.

1.4 CODES

- .1 The specifications will require that the work and materials comply with the National Building Code of Canada (NBC) and all other applicable provincial or local codes. The strictest requirements shall apply in case of contradiction or discrepancy.

- .2 The work shall be performed in a manner that meets or exceeds the following requirements:
 - .1 Contract documents
 - .2 Specified standards and codes as well as other documents cited as references

1.5 REQUIRED DOCUMENTS

- .1 A copy of the following documents shall be kept at the job site:
 - .1 Contract drawings;
 - .2 Specifications;
 - .3 Amendments;
 - .4 Amended shop drawings;
 - .5 Modification orders;
 - .6 Other contract amendments;
 - .7 On-site test reports;
 - .8 Approved work schedule;
 - .9 Manufacturer installation and start-up instructions;
 - .10 License of occupation of public space.

1.6 WORK SCHEDULE

- .1 The successful bidder shall initiate work immediately upon receiving notice that the contract has been awarded. The work covered by this document, including measures to correct construction deficiencies, must be completed within the schedule specified herein. Failure to comply with the schedule shall be dealt with as provided for in the Standard Acquisition Clauses and Conditions (SACC) Manual, Public Works and Government Services Canada (PWGSC).
- .2 Within 5 business days of contract award, submit a work schedule for the various project phases and the completion date, which must be within 10 weeks of contract award.
- .3 Within 5 business days of contract award, submit security screening applications for approval.
- .4 The work sequence is as follows:
 - .1 Start-up meeting and schedule submission, shop drawings, technical data sheets, samples, and security screening applications for approval.
 - .2 Approval of documents submitted.
 - .3 Construction start-up.
 - .4 Order of works:
 - .5 Submission of operating and maintenance manuals for approval.
 - .6 Provisional acceptance.
 - .7 Correction of deficiencies
 - .8 Final approval
- .5 Within five (5) business days of contract award, the Contractor shall provide, in a format acceptable to the Project Manager, a work schedule indicating:
 - .1 Dates for submitting shop drawings, lists of materials, and samples.

CSC GENERAL INSTRUCTIONS

- .2 Delivery dates for the equipment and materials.
- .3 Start-up and completion dates for the work described in each section of the specifications.
- .4 Final completion date with respect to the completion date stipulated in the contract documents.
- .6 Changes to milestones in the submitted schedule shall be at the discretion of the CSC Project Manager. The schedule shall be updated by the Contractor with the cooperation and approval of the CSC Project Manager.
- .7 The following work shall be performed outside normal working hours: the PLC replacement. This work must be coordinated with the CSC Project Manager.
- .8 The building will be maintained in operation during works. The residents are permanent 24 hours a day.

1.7 ACCEPTANCE OF EQUIVALENTS

- .1 Firms suggesting substitutes or replacements for the products given in the specifications, plans, or other contractual clauses must include to relevant technical data sheets for approval by the assessment committee. These substitutes or replacements must be equal or superior to those in the specifications or the bid will be rejected. The financial proposal must reflect the substitutions and replacements.
- .2 The Contractor shall be responsible for providing supporting data of equivalence. The substitution request must be presented clearly and include all the details required to analyze it properly.
- .3 The main criteria for accepting substitutions are: construction, performance, capacity, dimensions, arrangement of connections, availability of replacement parts, ease of maintenance, delivery times, the existence of similar equipment in service for some time.
- .4 If a proposed substitution requires changes to installations shown on plans or in specifications, the General Contractor shall be responsible for such changes and shall also assume responsibility for the ensuing modifications that may be required to the work of specialized subcontractors.

1.8 COST BREAKDOWN

- .1 With the bid, the Contractor shall present an itemized breakdown of the costs related to this contract, including the overall contract value, **on the bid summary provided as an attachment**. Once approved, the cost breakdown will be used as a baseline for calculating progress payments.

1.9 PAYMENT

- .1 Payments shall be made monthly on a pro rata basis according to work progress. Before submitting an invoice, the Contractor shall submit an itemized request for payment, as per the bid summary, for approval with the percent of progress for each item. Ten percent of the total amount of the request for payment, before tax deductions, will be held back. The hold back is payable upon final acceptance of the work.

1.10 MEASUREMENTS FOR PAYMENT PURPOSES

- .1 The Engineer must be informed sufficiently prior to the start of work so that he or she can make the measurements required for payment purposes.

1.11 CONTRACTOR'S USE OF THE SITE

- .1 The institution must remain fully operational during construction. With this end in view, the CSC Project Manager or the institution's head of security can require the Contractor to halt work immediately on a temporary basis to prevent institution activities from being compromised.
- .2 Use of premises: limited access to the job site. Work and affected engineering structures outside the construction site must be carried out by a crew accompanied by an escort provided by CSC (see Section 01 35 13 – CSC Security Requirements).
- .3 Within 5 business days of contract award, submit a construction site plan.
- .4 The license of occupation of public space is contractor's responsibility.
- .5 The Contractor shall perform the work so as to disturb the occupants as little as possible and, to the degree possible, ensure that normal use can be made of the facilities. The Contractor shall also cooperate with the CSC Project Manager to facilitate performance of the work. The work schedule shall be previously planned and authorized.
- .6 Existing services in the buildings must be maintained during the project.

1.12 NOISY ENVIRONMENT AND CELL-PHONE USE

- .1 No radios or "boom boxes" shall be tolerated at the job site.
- .2 Cell telephones are prohibited within the perimeter of the penitentiary.

1.13 JOB-SITE MEETINGS

- .1 Job-site meetings shall be held at times and places subject to the approval of the CSC Project Manager.
- .2 The Project Manager shall organize job-site meetings, set their dates and times, and ensure that minutes are drafted and distributed.

1.14 LOCATION OF EQUIPMENT AND VARIOUS PIECES OF EQUIPMENT

- .1 The location of various devices and pieces of equipment as well as the electrical outlets indicated on the drawings and in the specifications must be considered approximate.
- .2 The Contractor shall install equipment and devices as well as distribution networks so as to limit hindrances and keep the largest amount of useful space possible while complying with manufacturer recommendations related to safety, access, and maintenance.

1.15 CONCEALED WORK

- .1 Unless indicated otherwise, pipes, conduits, ducts, and wiring in floors, walls, and ceilings in finished areas shall be concealed.

1.16 DRILLING AND SEALING

- .1 The Engineer's approval shall be obtained before cutting or drilling in bearing members or inserting sleeves.
- .2 Drilling and sealing shall be performed so as to ensure that connections are exact and with no play.

- .3 Holes and openings must be clean, straight, and smooth.
- .4 When the addition of a new structure requires modifications to an existing one, all required drilling, sealing, and other repairs shall be carried out to restore the existing structure to its condition prior to the work.

1.17 EXISTING SYSTEMS

- .1 When connections must be made to existing systems, the work shall be carried out at times determined by local authorities and performed so as to minimize disruption of pedestrian and vehicular traffic.
- .2 Should installations be discovered during the course of work, the Engineer shall be immediately informed and a written report containing the observations provided to him.

1.18 MODIFICATIONS, ADDITIONS, OR RENOVATION OF EXISTING BUILDINGS

- .1 The Contractor shall perform the work so as to disturb the occupants as little as possible and, to the degree possible, ensure that normal use can be made of the facilities. The Contractor shall also cooperate with the CSC Project Manager to facilitate performance of the work.
- .2 At no time shall the safety measures be relaxed because of the work to be carried out under this contract. The Contractor shall take the steps required to ensure the level of safety required.
- .3 The Contractor shall use only those elevators, freight elevators, conveyors, and escalators reserved for his or her use to move materials and personnel. Before the Contractor uses an elevator, the cabin walls shall be protected as directed by the Engineer. The Contractor accepts liability for any damage to such devices, for their safe and proper use, and for any overloading of the existing equipment.
- .4 When work is to be carried out in occupied spaces, the Contractor shall provide and install whatever is required to protect the furnishings, equipment, and finish work; install dust barriers, partitions, and temporary notices; and clean the area at the end of each work day.

1.19 SUPPLEMENTAL DRAWINGS

- .1 The Engineer may provide supplemental drawings for clarification. Such supplemental drawings shall be considered to have the same meaning and scope as the contract documents.

1.20 REMAINS AND ANTIQUES

- .1 Remains, antiques, and other items of historical or scientific interest, such as cornerstones and their contents, commemorative plaques, and other objects bearing inscriptions discovered during the project.
- .2 The CSC Project Manager shall be informed immediately; authorization in writing is required before work can be resumed.
- .3 Remains, antiques, and other items of historical or scientific interest are the property of the Crown.

1.21 RESTRICTIONS RELATED TO TOBACCO USE

- .1 Restrictions regarding the use of tobacco inside buildings shall be complied with. Smoking inside the buildings is prohibited.

1.22 ASBESTOS

- .1 Removing sprayed or troweled-on asbestos can be a health risk. If, during the course of the work, the Contractor encounters materials that appear to be sprayed or troweled-on asbestos, he shall halt work and immediately inform CSC Project Manager. Work shall not be resumed unless so authorized in writing by the Project Manager.

1.23 OPERATING MANUAL

- .1 The Contractor shall submit, for approval, three (3) copies of an operating manual containing the following items:
 - .1 Table of contents
 - .2 List of suppliers and their contact information
 - .3 Warranties
 - .4 Approved shop drawings
 - .5 Operating and maintenance guides
 - .6 As-built drawings

PART 2 PRODUCTS**2.1 NOT USED****PART 3 EXECUTION****3.1 TEMPORARY SHUTDOWN**

- .1 The owner or user of a storage system who temporarily shut downs the service to the system or to one of its components must record the date of the shutdown in a register and ensure that the following measures are taken:
 - .1 Maintain the cathodic protection system in service during the shutdown, if the storage system is equipped with one.
 - .2 Perform a precision leak test of the tanks in compliance with Article 21 prior to bringing the system back online, if the storage system includes a sublevel tank, besides the vertical subterranean tanks or the above ground tanks fabricated in shop and if the shutdown lasts more than a year.
 - .3 Proceed with an inspection of the bottom of the tanks prior to bringing back online, using the following tests: ultrasonic, videographic or under vacuum, if the system involves above ground tanks built on the spot or vertical sublevel tanks and if the shutdown lasts more than a year.
 - .4 Identify the system's fill pipe indicating that it is temporarily out of service.

- .2 The following is the Complexe Laval site map identifying the locations of the spill kits.



3.2 USE OF TEMPORARY GENERATORS

- .1 The temporary generators tanks must meet the codes of STSPAPPR.
- .2 The Contractor must have in his possession at least 100 absorbing sheets, regarding the, protected from the elements (ex.: stored in a bag), besides each temporary generator in case of spills. The surplus must be remitted to the CSC when the work is complete.

END OF SECTION

PART 1 GENERAL SPECIFICATIONS**1.1 RELATED SECTIONS**

- .1 Division 01 – General Requirements.

1.2 DEFINITIONS

- .1 The following definition(s) are/is applicable to all specification sections for this project:
 - .1 Engineer: The term “Engineer” is used to represent the terms Consultant, Departmental Representative, engineering firm, assigned to the project.

1.3 REFERENCES

- .1 Applicable Codes (publications in effect)
 - .1 Quebec Construction Code, Chapter I, Building, and National Building Code of Canada;
 - .2 National Building Code of Canada;
 - .3 National Fire Code of Canada;
 - .4 Canada Labour Code.

1.4 PRIORITY

- .1 Sections of Division 01 (electromechanical) have priority over technical sections in other divisions of these specifications, if applicable.

1.5 APPLICABLE ITEMS

- .1 The following items found in this section are applicable:
 - .1 Items related to general requirements;
 - .2 Items related to electrical requirements.

1.6 DISCREPANCIES

- .1 In case of discrepancies between English and French tender documents, French document requirements apply.

1.7 MECHANICAL AND ELECTRICAL GENERAL SPECIFICATIONS

- .1 Specifications analysis, drawings, and site visits
 - .1 The Contractor must examine the location prior to tendering in order to be familiarized with the existing environment, which can affect the execution of the project. The Contractor will be able to, at a later date and time, request a second visit. No additional costs will be granted due to the Contractor omitting equipment. In case of errors or omissions, the Contractor will have the responsibility, during the examination of the documents for tender, to notify the representatives responsible in order to request appropriate clarifications and/or necessary corrections.
 - .2 Dimensions cannot be taken directly from drawings, unless specifically indicated.
 - .3 If needed, consult the Engineer prior to the execution of unclear work. If unclear work is executed, the Engineer reserves the right to order the work to be redone at the Contractor's expense.

GENERAL INSTRUCTIONS – ELECTROMECHANICAL

- .4 All addenda are an integral part of the tender documents.
- .2 Normalization, codes, security, and permits
 - .1 All the work relating to the drawings and specifications shall be completed according to the last editions of codes and pertinent rules established by the municipal, provincial, and federal commissions. All work shall respect trade standards for installation and disposal.
 - .2 The Contractor will need to obtain, at his own expense, all permits required in order to complete the work and in accordance with regulating codes and laws.
 - .3 The Contractor shall ensure that all work executed on the project will correspond to the latest editions and bulletins of the revisions of laws, codes, and rules, following:
 - .1 Occupational health and safety legislation.
 - .2 Regulations respecting industrial and commercial establishments.
 - .3 Safety codes for the construction industry.
 - .4 The Contractor shall also ensure that all workers possess the required qualifications for the realization of the work.
 - .5 The Contractor shall have a copy of all engineering construction documents, signed and sealed onsite for the duration of the work.
- .3 Equivalencies
 - .1 Five (5) days prior to the end of the tender period, Contractors can propose equivalencies for all new equipment. All equivalencies are to be approved by the Engineer and the Owner. All equivalencies submitted after the tender period will automatically be refused.
 - .2 All additional costs related to the submittal and approval of equivalencies (electrical changes and dimension changes, etc.) will be covered 100% by the submitting Contractor, without exceptions.
- .4 Equipment Supplied by Owner
 - .1 All equipment supplied by the Owner shall be visually inspected and tested. All materials supplied by the Owner must be installed and connected by the Contractor. When the Contractor takes possession, in presence of the Owner, he must ensure that all visible parts are in perfect condition and that the equipment is in working condition. From this acceptance, the Contractor is responsible for loading, unloading, handling, installing, connecting, and commissioning, without damaging the equipment. If damage occurs, the Contractor is responsible for repairing or replacing the equipment, to the satisfaction of the Engineer.
 - .2 All costs related to the replacement of the equipment after the Contractor has taken possession will be the responsibility of the Contractor.
- .5 Delivery, Storage and Manipulation
 - .1 Immediately after signing the contract, verify the requirements for the delivery and anticipate any delays. Notify the Engineer of any delays, allowing measures to be taken to either substitute the product or to proceed with corrective actions at an early stage to so as to prevent delays.
 - .2 If the Engineer is not advised of any delays at the onset of the work, and if the work appears to be delayed, the Engineer has the right to substitute the anticipated product for an equivalent that can be delivered faster, without increasing the price of the contract.
 - .3 Handle and store to avoid any damage or alteration of the products, while following the manufacturer's instructions.
 - .4 Store in their original packaging any bundled or grouped products, leave the packaging label and the manufacturer's seal intact. Do not open or untie any products prior to installation.
 - .5 Products likely to be damaged by the weather shall be contained under a weatherproof enclosure.

GENERAL INSTRUCTIONS – ELECTROMECHANICAL

- .6 Without any additional charges, replace the damaged products to the satisfaction of the Engineer.
- .6 Transportation
 - .1 The Contractor will be responsible for all costs related to the transportation, storage, and manipulation of all necessary equipment in order to execute his work.
- .7 Submittals
 - .1 Shop Drawings
 - .1 As soon as possible, after the contract is signed, the Contractor must submit shop drawings for approval of all equipment to be installed, as well as the list of materials that he proposes to use including the manufacturers names and catalogue numbers.
 - .2 The shop drawings must be identified equipment using the naming provided by the shop drawings and/or specifications.
 - .3 Shop drawings must be supplied in batches by discipline, such as:
 - .1 Electrical;
 - .2 Firestopping.
 - .4 If more than one product is on the same shop drawing, the contractor must clearly identify which equipment is proposed.
 - .5 The contractor can submit the shop drawings as follows:
 - .1 PDF format.
 - .6 Shop drawings will be automatically refused if:
 - .1 They are not identified following the naming specified on the drawings;
 - .2 They are unclear or unreadable;
 - .3 Equipment is not identified on each drawing;
 - .4 Drawings are not submitted in batches.
- .8 Motors and Electric Controls
 - .1 Provide ball bearings motors when this type of motor is available, built with materials that will provide the least vibration while working in a continuous service at 1800 revolutions per minute (rpm) without any overload. Every motor will have to be built in accordance with ACNOR and CEMA standards, for a temperature rise of 40°C, and shall be delivered with a terminal board installed at the specified location with an overload protection at the starter.
 - .2 Install the 50 volts or less electric controls wiring, the electric controls and the mechanical material sensors mechanically actuated. The wiring will be executed with approved conductors and classification of location.
 - .3 Submit for approval sketches showing the wiring and the controls of the controllers, with specifications.

GENERAL INSTRUCTIONS – ELECTROMECHANICAL

- .9 Materials
 - .1 All the materials used for this project shall be new, of a superior quality and approved by the Canadian Standards Association (CSA).
- .10 Coordination
 - .1 The General Contractor will be responsible for the coordination of all the work and will be responsible for the coordination between himself and the sub-contractors (mechanical and electrical). Related costs due to the lack of coordination will be absorbed 100% by the General Contractor.
 - .2 The General Contractor will be responsible of coordinating with the sub-contractors (mechanical and electrical) and the Owner for all power shut-downs and any other shut-downs required.
 - .3 A notice of required shut-downs shall be submitted in writing to the owner a minimum of 72 hours in advance.
- .11 Access Doors
 - .1 Access doors shall be supplied by the Contractor and installed by the General Contractor and shall have a fire rating (if required).
 - .2 Provide the following access doors (for each discipline):
 - .1 For all equipment behind gypsum walls or ceiling;
 - .2 Isolation valves;
 - .3 For all other auxiliary devices.
 - .3 The doors shall be made of galvanized steel with a thickness of 3 mm, installed with hidden stainless steel hinges equipped with a self-closing system that can be opened using a screwdriver. The frame dimensions shall be 300 x 300 mm, minimum, and 600 x 600 mm, maximum, depending on the requirements. The frame shall be appropriate with the type of wall or ceiling construction. The General Contractor is responsible for determining the exact placement of the access doors.
- .12 Hiding and Accessibility
 - .1 Unless otherwise specified or indicated, hide all pipework in partitions and walls, below floors or in suspended ceilings. Install the required strapping.
 - .2 All installations shall be aligned with the building orientation and axis.
 - .3 The installation of access doors or other approved devices is required to facilitate the access for maintenance and repairs of the hidden installations.
- .13 Openings and Sleeves
 - .1 All openings shall be coordinated (dimensions and exact locations) between the General Contractor and subcontractors (mechanical and electrical).
 - .2 The subcontractors (mechanical and electrical) shall be responsible for all openings in walls and floors of 200 mm (8") or less.
 - .3 The General Contractor shall be responsible for all openings in walls and floors of 225 mm (9") or more.
 - .4 The General Contractor shall be responsible for all openings in the roof structure or system.
 - .5 All the required resurfacing will be executed by the General Contractor at his expense, new resurfacing to match existing or as specified by the Architect or Structural Engineer (if applicable).
 - .6 The General Contractor will be responsible of all X-rays required prior to making openings.

GENERAL INSTRUCTIONS – ELECTROMECHANICAL

- .7 The General Contractor is responsible to seek a work analysis from a structural engineer in order to prevent compromise of the integrity structural components prior to boring or cutting.
- .8 The use of a jack hammer is prohibited.
- .9 All openings in an existing building shall be coordinated by the General Contractor with the Owner beforehand (time and date).
- .14 Breaking, Excavation, Filling-Up and Compacting
 - .1 All work relating to breaking, excavation, filling-up and compacting for the installation of the mechanical and electrical systems will be the responsibility of the General Contractor, unless otherwise indicated.
- .15 Paint
 - .1 The General Contractor shall be responsible for the painting of the following equipment:
 - .1 All visible equipment, colour by Owner;
 - .2 All natural gas piping on the roof, colour by Owner or yellow;
 - .3 Visible piping and duct canvas, colour by Owner.
- .16 Vibration and Seismic Controls Devices
 - .1 The mechanical and electrical contractors shall be responsible for obtaining the services of an engineer for the preparation of the documents necessary for the seismic installations. A compliance report, signed and sealed, will also be required after completion of the work, to be included in the operations and maintenance manual. The mechanical and electrical contractors shall be responsible for supplying and installing the seismic supports and anti-vibrating devices required for the installation of any mechanical or electrical equipment, according to documents prepared by the seismic engineer.
- .17 Inspection of Work
 - .1 The General Contractor shall be responsible for advising the Engineer, in writing, 48 hours in advance before closing walls and ceilings to allow for inspection of the work executed.
 - .2 If the General Contractor proceeds with closing the walls and ceilings prior to the completion of the inspection, the Engineer reserves the right to demand that the walls and ceilings be reopened at the General Contractor's expenses.
- .18 Tests and Adjustments
 - .1 At the end of the project, the Contractors shall execute all testing and adjusting per drawings, specifications and manufacturer's recommendations, to obtain maximum efficiency. If the results are not satisfactory, the Engineer has the right to request assistance from the manufacturer and the Contractors shall bear all additional costs. An inspection shall be conducted when all final adjustments have been done. The Engineer shall analyze all reports submitted by the Contractors. In the event that the figures do not correspond to the desired outcome, the Contractors shall redo necessary testing and adjusting until they obtain the prescribed results, per the drawings and specifications.
- .19 As-Built Drawings
 - .1 Each subcontractor shall have the responsibility to produce, at the end of the project, the as-built drawings for plumbing, heating, HVAC, controls, and electrical.
 - .2 Each subcontractor shall need to mark with red pens all the modifications to the tender drawings on a paper copy. If he desires, the Contractor can obtain extra copies from the Engineer in exchange for the cost of reproduction.
 - .3 Each subcontractor shall identify individual as-built drawings as "as-built" and include their address, company name, and date.

GENERAL INSTRUCTIONS – ELECTROMECHANICAL

- .20 Replacement Parts
- .1 The Contractor must deliver to the Owner, prior to the final reception of work, the materials mentioned in their specifications and drawings. He must submit to the Engineer a list of the materials delivered with a signed copy of the receipt by the Owner.
- .21 Warranty
- .1 The Contractor must deliver to the Owner all the documents listed in this specification and a warranty document that honours the materials used in the project are free of defects and that the work executed was done according to standards. The warranty shall cover a full year from the date of acceptance of the work and any equipment failure shall be replaced immediately.
- .22 Closeout Submittals (Operation & Maintenance Manuals)
- .1 At the end of the project, the General Contractor will have the responsibility to create and compile an operation manual, in a binder, three (3) copies, which will be used for maintenance. The manual shall include:
- .1 The shop drawings approved by the Engineer;
- .2 The warranty letters;
- .3 The "as built" drawings;
- .4 The control diagrams;
- .5 The seismic compliance reports;
- .6 A list of the replacement components;
- .7 Contractor shall provide full CMMS data sheet for new equipment;
- .8 Contractor shall update and provide all CMMS data sheets of existing equipment affected by the work;
- .9 The above list is neither limiting nor exhaustive.
- .23 Training
- .1 The General Contractor as well as the mechanical and electrical contractors are responsible for providing training to the building Operation & Maintenance personnel in order for them to operate all mechanical and electrical systems.
- .1 Provide a 4-hour training session for the building Operation & Maintenance personnel in presence of Engineer.
- .24 Fire Stopping
- .1 Fire stopping shall be according to architectural requirements, if applicable.
- .2 Fire stopping shall be according to CAN4-S115.
- .3 Supply all materials/sealants required to seal all holes in walls requiring fire rating.

PART 2 GENERAL**2.1 TAXES**

- .1 Pay all taxes properly levied by law including federal, provincial and municipal taxes.

2.2 FEES, PERMITS AND CERTIFICATES

- .1 Pay all fees and obtain all permits. Provide authorities with drawings and information for acceptance certificates. Provide inspection certificates as evidence that work complies with requirements of Authorities having jurisdiction.

2.3 REGULATORY REQUIREMENTS

- .1 References and Codes
 - .1 Materials must be new and work shall comply with the minimum applicable standards of the “References” indicated in the specification sections, the Building Code(s) in effect and all applicable Provincial and Municipal codes. In the case of conflict or discrepancy, the most stringent requirement shall apply.
- .2 Building Smoking Environment
 - .1 Smoking is not permitted in the Building. Obey smoking restrictions on building property.
- .3 Hazardous Material Discovery
 - .1 Stop work immediately when material resembling spray or trowel-applied asbestos, Polychlorinated Biphenyl (PCB), mould or other designated substance is encountered during demolition work.
 - .1 Take preventative measure and promptly notify Engineer.
 - .2 Do not proceed until written instructions have been received from Engineer.

2.4 FIRE SAFETY REQUIREMENTS

- .1 Comply with both the Building Code in effect and the National Fire Code in effect for safety of persons in buildings in the event of a fire and the protection of buildings from the effects of fire, as follows:
 - .1 Building Code in effect: for fire safety and fire protection features that are required to be incorporated in a building during construction.
 - .2 The National Fire Code:
 - .1 The on-going maintenance and use of the fire safety and fire protection features incorporated in buildings.
 - .2 The conduct of activities that might cause fire hazards in and around buildings.
 - .3 Limitations on hazardous contents in and around buildings.
 - .4 The establishment of fire safety drawings.
 - .5 Fire safety at construction and demolition sites.
 - .3 Where work requires interruption or cause activation of fire alarms or fire suppression, extinguishing or protection systems:
 - .1 Provide “Watchman Service” as described in Building Code and Fire Code; In general, watchman service is defined as an individual conversant with “Fire Emergency Procedures”, performing fire picket duty within an unprotected and unoccupied (no workers) area once per hour.
 - .2 Retain services of manufacturer for fire protection systems on daily basis or as approved by Engineer, to isolate and protect all devices relating to:
 - .1 modification of fire alarms, fire suppression, extinguishing or protection systems;
 - .2 cutting, welding, soldering or other construction activities that might activate fire protection systems.
 - .3 Immediately upon completion of work, restore fire protection systems to normal operations and verify that all devices are fully operational.
 - .4 Inform fire alarm system monitoring agency and local Fire Department immediately prior to isolation and immediately upon restoration of normal operation.

2.5 HAZARDOUS MATERIALS

- .1 Hazardous Materials: product, substance, or organisms that may cause adverse impact to environment or adversely affect health of persons, animals, or plant life when released into the environment.
- .2 Comply with the requirements of the Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of hazardous materials, and regarding labelling and the provision of Material Safety Data Sheets (MSDS).
- .3 For work in occupied buildings, provide 48 hours' notice to Engineer for work involving designated substances, hazardous substances (Canada Labour Code Part II Section 10), and before painting, caulking, installing carpet or using adhesives and other materials, that cause off gassing.

2.6 COMMON PRODUCT REQUIREMENTS

- .1 Quality of Work:
 - .1 Carry out work using qualified licensed workers or apprentices in accordance with Provincial Act respecting manpower vocational training and qualification.
 - .2 Permit employees registered in Provincial apprenticeship program to perform specific tasks only if under direct supervision of qualified licensed workers.
 - .3 Determine permitted activities and tasks by apprentices, based on level of training attended and demonstration of ability to perform specific duties.
- .2 Storage, Handling and Protection:
 - .1 Handle and store products in manner to prevent damage, adulteration, deterioration and soiling and in accordance with manufacturer's instructions.
 - .2 Store packaged or bundled products in original and undamaged condition with manufacturer's seal and labels intact. Do not remove packaging or bundling until required in work.
- .3 Manufacturer's Instructions: unless otherwise indicated in specifications, install or erect products in accordance with manufacturer's instructions. Do not rely on labels or enclosures provided with products. Obtain written instructions directly from manufacturers.

2.7 CLEANING

- .1 Inspect site and examine conditions predisposed to influence the execution of the work and ensure to fully understand the existing conditions onsite.
- .2 Prior to start of work, define layout and exact locations of underground utility lines and services located within the work area. Provide information to Engineer.
- .3 Clean up as work progresses. At the end of each work period and more often if ordered by the Engineer, remove debris from site, neatly stack material for use, and clean up generally.
- .4 Upon completion, remove scaffolding, temporary protection and surplus materials. Make good defects noted at this stage.
- .5 Clean and polish glass, mirrors, ceramic tile, aluminum, chrome, stainless steel, baked or porcelain enamel, plastic laminate and other plastic surfaces, floors, hardware and washroom fixtures. Clean manufactured articles in accordance with manufacturer's written instructions.

GENERAL INSTRUCTIONS – ELECTROMECHANICAL

- .6 Clean areas under contract to a condition equal to what previously existed and to approval of Engineer.

2.8 COST BREAKDOWN

- .1 Before submitting first progress claim, submit breakdown of Contract Amount in detail as directed by Engineer and aggregating the Contract Amount. After approval by Engineer, cost breakdown will be used as the basis of progress payments.

PART 3 SHOP DRAWINGS LISTS

3.1 NOT USED

- .1 Not used.

PART 4 EXECUTION

4.1 NOT USED

- .1 Not used.

END OF SECTION

PART 1 GENERAL**1.1 PURPOSE**

- .1 To ensure that both the construction project and the institutional operations may proceed without undue disruption or hindrance and that the security of the Institution is maintained at all times.

1.2 DEFINITIONS

- .1 "Contraband" means:
- .1 an intoxicant, including alcoholic beverages, drugs and narcotics,
 - .2 a weapon or a component thereof, ammunition for a weapon, and anything that is designed to kill, injure or disable a person or that is altered so as to be capable of killing, injuring or disabling a person, when possessed without prior authorization,
 - .3 an explosive or a bomb or a component thereof,
 - .4 currency over any applicable prescribed limit \$50.00,
 - .5 any item not described in paragraphs .1 to .4 that could jeopardize the security of a Penitentiary or the safety of persons, when that item is possessed without prior authorization.
- .2 "Unauthorized Smoking Items" means all smoking items including, but not limited to, cigarettes, cigars, tobacco, chewing or snuffing tobacco, cigarette making machines, matches and lighters.
- .3 "Commercial Vehicle" means any motor vehicle used for the shipment of material, equipment and tools required for the construction project.
- .4 "CSC" means Correctional Service Canada.
- .5 "Director" means Director or Warden of the Institution as applicable or their representative.
- .6 "Construction employees" mean persons working for the general contractor, the sub-contractors, equipment operators, material suppliers, testing and inspection companies and regulatory agencies.
- .7 "Departmental Representative" means the Public Works and Government Services Canada (PWGSC) or the Correctional Service Canada (CSC) project manager depending on project.
- .8 "Perimeter" means the fenced or walled area of the institution that restrains the movement of the inmates.
- .9 "Construction zone" means the area as shown on the contract drawings where the contractor will be allowed to work. This area may or may not be isolated from the security area of the institution.

1.3 PRELIMINARY PROCEEDINGS

- .1 Prior to the commencement of work, the contractor shall meet with the Director to:
 - .1 Discuss the nature and extent of all activities involved in the Project.
 - .2 Establish mutually acceptable security procedures in accordance with this instruction and the institution's particular requirements.
- .2 The contractor will:
 - .1 Ensure that all construction employees are aware of the CSC security requirements.
 - .2 Ensure that a copy of the CSC security requirements is always prominently on display at the job site.
 - .3 Co-operate with institutional personnel in ensuring that security requirements are observed by all construction employees.

1.4 CONSTRUCTION EMPLOYEES

- .1 Submit to the Director a list of the names with date of birth of all construction employees to be employed on the construction site and a security clearance form for each employee.
- .2 Allow two (2) weeks for processing of security clearances. Employees will not be admitted to the Institution without a valid security clearance in place and a recent picture identification such as a provincial driver's license. Security clearances obtained from other CSC institutions are not valid at the institution where the project is taking place.
- .3 The Director may require that facial photographs may be taken of construction employees and these photographs may be displayed at appropriate locations in the institution or in an electronic database for identification purposes. The Director may require that Photo ID cards be provided for all construction workers. ID cards will then be left at the designated entrance to be picked upon arrival at the institution and shall be displayed prominently on the construction employees clothing at all time while employees are at the institution.
- .4 Entry to Institutional Property will be refused to any person there may be reason to believe may be a security risk.
- .5 Any person employed on the construction site will be subject to immediate removal from Institutional Property if they:
 - .1 appear to be under the influence of alcohol, drugs or narcotics.
 - .2 behave in an unusual or disorderly manner.
 - .3 are in possession of contraband.

1.5 VEHICLES

- .1 Drivers of delivery vehicles for material required by the project shall not require security clearances but must remain with their vehicle the entire time that the vehicle is in the Institution. The director may require that these vehicles be escorted by Institutional staff or Commissionaires while in the Institution.
- .2 All unattended vehicles on CSC property shall have windows closed; doors and trunks shall be locked and keys removed. The keys shall be securely in the possession of the owner or an employee of the company that owns the vehicle.

CSC SECURITY REQUIREMENTS

- .3 No trailer shall be permitted to be left outside the hours of work.
- .4 The director may limit at any time the number and type of vehicles allowed within the Institution.

1.6 PARKING

- .1 The parking area(s) to be used by construction employees will be designated by the Director. Parking in other locations will be prohibited and vehicles may be subject to removal.

1.7 SHIPMENTS

- .1 All shipments of project material, equipment and tools shall be addressed in the Contractor's name to avoid confusion with the institution's own shipments. The contractor must have his own employees on site to receive any deliveries or shipments. CSC staff will NOT accept receipt of deliveries or shipments of any material equipment or tools for the contractor.

1.8 WORK HOURS

- .1 Work hours within the Institution are: Monday to Friday 07:30 AM to 4:00 PM.
- .2 Work will not be permitted during weekends and statutory holidays without the permission of the Director. A minimum of three days advance notice will be required to obtain the required permission. In case of emergencies or other special circumstances, this advance notice may be waived by the Director.

1.9 OVERTIME WORK

- .1 No overtime work will be allowed without permission of the Director. Give a minimum forty-eight (48) hours advance notice when overtime work on the construction project is necessary and approved. If overtime work is required because of an emergency such the completion of a concrete pour or work to make the construction safe and secure, the contractor shall advise the Director as soon as this condition is known and follow the directions given by the Director. Costs to Canada for such events may be attributed to the contractor.
- .2 When overtime work, weekend statutory holiday work is required and approved by the Director, extra staff members may be posted by the Director or his designate, to maintain the security surveillance. The actual cost of this extra staff may be attributed to the contractor.

1.10 TOOLS AND EQUIPMENT

- .1 Maintain on site a complete list of all tools and equipment to be used during the construction project. Make this inventory available for inspection when required.
- .2 Throughout the construction project maintain an up-to-date list of tools and equipment specified above.
- .3 Keep all tools and equipment under constant supervision, particularly power-driven and cartridge-driven tools, cartridges, files, saw blades, rod saws, wire, rope, ladders and any sort of jacking device.
- .4 Store all tools and equipment in approved secure locations.

CSC SECURITY REQUIREMENTS

- .5 Lock all tool boxes when not in use. Keys to remain in the possession of the employees of the contractor.
- .6 Scaffolding shall be secured and locked when not erected and when erected, shall be secured in a manner agreed upon with the director.
- .7 All missing or lost tools or equipment shall be reported immediately to the Director.
- .8 The Director will ensure that the security staff members carry out checks of the Contractor's tools and equipment against the list provided by the Contractor.
- .9 If propane or natural gas is used for heating the construction, the institution will require that an employee of the contractor supervise the construction site during non-working hours.

1.11 PRESCRIPTION DRUGS

- .1 Employees of the contractor who are required to take prescription drugs during the workday shall obtain approval of the Director to bring a one-day supply only into the Institution.

1.12 SMOKING RESTRICTIONS

- .1 Contractors and construction employees are not permitted to smoke inside correctional facilities or outdoors within the perimeter of a correctional facility and must not possess unauthorized smoking items within the perimeter of a correctional facility.
- .2 Contractors and construction employees who are in violation of this policy will be requested to immediately cease smoking or dispose of any unauthorized smoking items and, if they persist, will be directed to leave the institution.
- .3 Smoking is only permitted outside the perimeter of a correctional facility in an area to be designated by the Director.

1.13 CONTRABAND

- .1 Weapons, ammunition, explosives, alcoholic beverages, drugs and narcotics are prohibited on institutional property.
- .2 The discovery of contraband on the construction site and the identification of the person(s) responsible for the contraband shall be reported immediately to the Director.
- .3 Contractors should be vigilant with both their staff and the staff of their sub-contractors and suppliers that the discovery of contraband may result in cancellation of the security clearance of the affected employee. Serious infractions may result in the removal of the company from the Institution for the duration of the construction.
- .4 Presence of arms and ammunition in vehicles of contractors, sub-contractors and suppliers or employees of these will result in the immediate cancellation of security clearances for the driver of the vehicle.

1.14 ELECTRONIC APPLIANCES

- .1 Cell phones, laptops, USB flash drives and other electronic appliances are not permitted within the perimeter of the institution unless prior approval of the Director is received.

1.15 SEARCHES

- .1 All vehicles and persons entering institutional property may be subject to search.
- .2 When the Director suspects, on reasonable grounds, that an employee of the Contractor is in possession of contraband or unauthorized items, he may order that person to be searched.
- .3 All employees entering the Institution may be subject to screening of personal effects for traces of contraband drug residue.

1.16 ACCESS TO AND REMOVAL FROM INSTITUTIONAL PROPERTY

- .1 Construction personnel and commercial vehicles will not be admitted to the institution after normal working hours, unless approved by the Director.

1.17 MOVEMENT OF VEHICLES

- .1 The contractor shall advise the Director twenty-four (24) hours in advance to the arrival on the site of heavy equipment such as concrete trucks, cranes, etc.
- .2 Vehicles being loaded with soil or other debris, or any vehicle considered impossible to search, must be under continuous supervision by CSC staff or Commissionaires working under the authority of the Director.
- .3 Vehicles shall be refused access to institutional property if, in the opinion of the Director, they contain any article which may jeopardize the security of the institution.
- .4 Private vehicles of construction employees will not be allowed within the security perimeter of medium or maximum-security institutions without the authorization of the Director.

1.18 MOVEMENT OF CONSTRUCTION EMPLOYEES ON INSTITUTIONAL PROPERTY

- .1 Subject to the requirements of good security, the Director will permit the Contractor and his employees as much freedom of action and movement as is possible.
- .2 However, notwithstanding paragraph above, the Director may:
 - .1 Prohibit or restrict access to any part of the institution.
 - .2 Require that in certain areas of the institution, either during the entire construction project or at certain intervals, construction employees only be allowed access when escorted by a member of the CSC security staff or a commissionaire.
- .3 Construction employees are not permitted to eat in the officer's lounge or the dining room of the institution.

1.19 SURVEILLANCE AND INSPECTION

- .1 Construction activities and all related movement of personnel and vehicles will be subject to surveillance and inspection by CSC security staff members to ensure that established security requirements are met.
- .2 CSC staff members will ensure that an understanding of the need to carry out surveillance and inspections, as specified above, is established among construction employees and maintained throughout the construction project.

CSC SECURITY REQUIREMENTS**1.20 STOPPAGE OF WORK**

- .1 The director may order at any time that the contractor, his employees, sub-contractors and their employees to not enter or to leave the work site immediately due to a security situation occurring within the Institution. The contractor's site supervisor shall note the name of the CSC staff member giving this instruction, the time of the request and obey the order as quickly as possible.
- .2 The contractor shall advise the Departmental Representative of this interruption of the work within 24 hours.

1.21 CONTACT WITH INMATES

- .1 Unless specifically authorized, it is forbidden to come into contact with inmates, to talk with them, to receive objects from them or to give them objects. Any construction employee doing any of the above will be removed from the site and his security clearance revoked.
- .2 It is to be noted that cameras are not allowed on CSC property.
- .3 Notwithstanding the above paragraph, if the director approves of the usage of cameras, it is strictly forbidden to take pictures of inmates, of CSC staff members or of any part of the Institution other than those required as part of this contract.

1.22 COMPLETION OF CONSTRUCTION PROJECT

- .1 Upon completion of the construction project or, when applicable, the takeover of a facility, the Contractor shall remove all remaining construction material, tools and equipment that are not specified to remain in the Institution as part of the construction contract.

PART 2 PRODUCTS**2.1 NOT USED**

- .1 Not Used.

PART 3 EXECUTION**3.1 NOT USED**

- .1 Not Used.

END OF SECTION

PART 1 GENERAL**1.1 CONTENT**

- .1 The general contractor must make sure that during his activities, the public and his employees' health and safety and the protection of the environment will always prevail on cost or schedule issues.

1.2 REFERENCES

- .1 Publications in effect
 - .1 Working Canadian Code, part II, Canada Occupational Safety and Health Regulations.
 - .2 Canadian Standard Association (CSA).
 - .3 Workplace Hazardous Materials Information System (SIMDUT) /Health Canada.
 - .1 Data sheet.
 - .4 Act respecting Occupational health and safety, L.R.Q. Chapitre S-2.1.
 - .5 Safety Code for the construction industry, S-2.1, r.6.

1.3 DOCUMENTS/SAMPLES

- .1 10 days before construction start, transmit to the CSC representative and to the *Commission de la santé et de la sécurité du travail* (CSST) the health and safety program specific to the construction activity as described in the section 1.8. If necessary, the contractor must update his prevention program to reflect any changes to the initial plans. Following the reception of the prevention program and at any time during the work, the CSC representative can ask for its modification to adapt it to the work on site. The contractor will have to proceed with the required modifications before work start.
- .2 Transmit to the CSC representative a copy of any federal or provincial inspector's inspection reports, notice of corrections or recommendations within 24 hours of their reception.
- .3 Transmit to the CSC representative any investigation report concerning any accident with injury or pointing out any potential hazard for health and safety within 24 hours of their reception.
- .4 Transmit to the CSC representative the data sheet for all controlled product at least three (3) days before they are used on site.
- .5 Transmit to the CSC representative a copy of the formation certificates required for the application of the prevention program including:
 - .1 General health and safety course on work sites;
 - .2 Security agent certificate;
 - .3 First-aid and CPR on work sites;
 - .4 Work subject to asbestos conditions;
 - .5 Work in enclosed spaces;
 - .6 Locking/securing procedures;
 - .7 Wearing and adjustment of individual protection equipment;

- .8 Forklift truck safe use;
 - .9 Working platform lift;
 - .10 And any other formation required by regulations or by the prevention program.
- .6 Medical examinations: when required by law, regulation, directive, specification or by a prevention program, the general contractor must:
- .1 Before mobilisation, transmit to the CSC representative the medical examination certificate for all surveillance employees and any other employee attending the first site meeting concerned by this article's first paragraph.
 - .2 Afterwards, transmit as one goes along and without any delays all medical examination certificates of any new incoming worker concerned by this article's first paragraph.
- .7 Emergency plan: the emergency plan, as described in the article 1.7.3, must be transmitted to the CSC representative with the prevention program.
- .8 Notice of work start: the notice of work start must be transmitted to *Commission de la santé et de la sécurité du travail* before the work start and copied to the CSC representative. A copy of this notice must be available and visible on site at all time. During demobilisation, the notice of end of work must be transmitted to the CSST with a copy to the CSC representative.
- .9 Engineer's plans and notice of conformity: the general contractor must transmit to the CSST and to the CSC representative an engineer' signed and sealed copy of all the plans and notice of conformity required in virtue of the Safety Code for the construction industry (S-2.1, r. 6), of any other law, rules or any clause from the specifications or the contract. A copy of those documents must be available at all time on the work site.
- .10 Certificate of conformity delivered by the CSST: the certificate of conformity is a document delivered by the CSST and confirms that the general contractor complies with the CSST requirements, that he has paid all amount due in relation with the awarded contract. This document must be transmitted to the CSC representative at the end of work.

1.4 EVALUATION OF THE RISKS

- .1 The general contractor must identify all related risks to the various tasks on site.
- .2 The general contractor must plan and organize his work in order to favour the elimination of the danger at the source or the collective protection and minimize the use of individual protection equipment. When the use of individual protection equipment is required in situations of falling hazards, the workers must use a safety harness in conformity with the norm CAN/CSA-Z-259.10-M90. The safety belt must not be used as a falling protection.
- .3 Any equipment, tool or mean of protection that cannot be installed or used without compromising the health and safety of the workers is considered inadequate for the work.
- .4 All mechanical equipment must be inspected before their delivery on site. Before using a mechanical equipment, the general contractor must transmit to the CSC representative a certificate of conformity signed by an approved mechanic. At any time, if the CSC representative suspects a defect or a risk of accident, he can order the immediate shutdown of the machine and require a second inspection performed by a specialist of his choice.

1.5 MEETINGS

- .1 A decision-making representative of the general contractor must attend all meetings about job site health and safety issues.

1.6 RULING AGENCY REQUIREMENTS

- .1 Comply with all rules, regulations and applicable norms for the execution of the work.
- .2 Follow the prescribed norms and rules in order to assure a normal course of events in the work progress in situations of contaminated grounds by toxic products.
- .3 Despite the publication date of the indicated norms in the Safety Code for the construction industry, always use its most recent and applicable version during work.

1.7 HEALTH AND SAFETY MANAGEMENT

- .1 Accept and assume all tasks and obligations normally assigned to the master-builder in accordance with the *Loi sur la santé et la sécurité du travail* (L.R.Q., chapitre S-2.1) and the Safety Code for the construction industry (S-2.1, r.6).
- .2 Develop a prevention program specific for the work based on identification of the risks and put this program in application from the beginning of work to its demobilization. The prevention program must take into account the information in the article 1.7. It must be transmitted to all person involved in conformity with the article 1.2. The prevention program must include
 - .1 The business policy regarding health and safety;
 - .2 The description of the work, the total cost of the work, the schedule with its workforce chart;
 - .3 A flowchart of the health and safety's responsibilities;
 - .4 The physical and material organization of the job site;
 - .5 The first-aid norms;
 - .6 The identified risks on the job site;
 - .7 The identification of the risks related to the work to be executed, including the prevention program and their applicability modality;
 - .8 The required formation;
 - .9 The procedures in situation of accident/injuries;
 - .10 A written commitment from all stakeholders to comply with this prevention program;
 - .11 A job site inspection schedule based on the prevention measures.
- .3 The general contractor must develop an efficient emergency plan, in relation with the job site characteristics and conditions. The emergency plan must be transmitted to all involved stakeholders, in conformity with the article 1.2. The emergency plan must include:
 - .1 The evacuation procedure;
 - .2 The identification of the resources (police, firefighter, ambulance, etc.);
 - .3 The identification of the persons in charge of the job site;
 - .4 The identification of the first-aiders;
 - .5 The required formation for the persons in charge of its application;

.6 And any other information necessary related to the job site characteristics.

1.8 RESPONSABILITIES

- .1 No matter what is the size of the job site or the number of workers on site, always have an identified competent supervisor responsible of the health and safety. Take all necessary measures to assure the health and safety of peoples and goods on and in the proximity of the job site that could be affected by the execution of the work.
- .2 Take all necessary measures to assure the application and the respect of all health and safety requirements indicated in the contractual documents, the federal and provincial regulations, the applicable norms and the prevention program specific for the job site and comply immediately to any prescription or notice of correction issued by the CSST.
- .3 Take all necessary measures to maintain the job site clean and in good order during the work.

1.9 COMMUNICATION AND SIGNAGE

- .1 Take all necessary measures to assure an efficient communication of the health and safety information on the job site. As soon as they arrive on the job site, all workers must be informed of the particularities of the prevention program, of their obligations and rights. The general contractor must insist on the worker's right to refuse to execute a work if they believe this work could imperil their health, their safety, their own physical integrity or the one of the other persons on the job site. The general contractor must maintain on the job site an updated register with the information transmitted and the signature of all the workers who received this formation.
- .2 The following information and documents must be displayed in an easily accessible place for the workers:
 - .1 Notice of work start;
 - .2 Identification of the master-builder;
 - .3 The business policy regarding health and safety at work;
 - .4 The prevention program specific to the job site;
 - .5 The emergency plan;
 - .6 Data sheet of all controlled products used on the job site;
 - .7 Minutes of meeting of the construction site committee;
 - .8 Name of the first-aiders;
 - .9 Intervention and correction reports published by the CSST.

1.10 UNFORSEENS

- .1 When a source of danger not specified in the specifications and not identified during the preliminary inspection of the job site occurs during the execution of the work, the contractor must immediately stop the work, set up temporary protection measures for the workers and the public and warn the CSC representative verbally and by writing.
- .2 The contractor must afterwards proceed with the necessary modifications to the prevention program for the work to resume safely.

1.11 CAULKING GUNS AND OTHER CARTRIDGE DEVICES

- .1 Caulking guns or any other cartridge devices are forbidden on the CSC property. Refer to Section 01 35 13 – CSC Security.

PART 2 PRODUCTS

2.1 NOT USED

- .1 Not used.

PART 3 EXECUTION

3.1 NOT USED

- .1 Not used.

END OF SECTION

PART 1 GENERAL**1.1 RELATED SECTIONS**

- .1 Section 01 10 10 – General Instructions – Mechanical and Electrical.
- .2 Section 01 91 31 – Commissioning (Cx) Plan.

1.2 ACRONYMS

- .1 AFD - Alternate Forms of Delivery, service provider.
- .2 BMM - Building Management Manual.
- .3 Cx - Commissioning.
- .4 EMCS - Energy Monitoring and Control Systems.
- .5 O&M - Operation and Maintenance.
- .6 PI - Product Information.
- .7 PV - Performance Verification.
- .8 TAB - Testing, Adjusting and Balancing.

1.3 GENERAL

- .1 Cx is a planned program of tests, procedures and checks carried out systematically on systems and integrated systems of the finished Project. Cx is performed after systems and integrated systems are completely installed, functional and Contractor's Performance Verification responsibilities have been completed and approved. Objectives:
 - .1 Verify installed equipment, systems and integrated systems operate in accordance with contract documents and design criteria and intent.
 - .2 Ensure appropriate documentation is compiled into the BMM.
 - .3 Effectively train O&M staff.
- .2 Contractor assists in Cx process, operating equipment and systems, troubleshooting and making adjustments as required.
 - .1 Systems to be operated at full capacity under various modes to determine if they function correctly and consistently at peak efficiency. Systems to be interactively with each other as intended in accordance with Contract Documents and design criteria.
 - .2 During these checks, adjustments to be made to enhance performance to meet environmental or user requirements.
- .3 Design Criteria: as per client's requirements or determined by designer. To meet Project functional and operational requirements.

1.4 COMMISSIONING OVERVIEW

- .1 For Cx responsibilities refer to Section 01 91 31 – Commissioning (Cx) Plan.
- .2 Cx to be a line item of Contractor's cost breakdown.

GENERAL COMMISSIONING (CX) REQUIREMENTS

- .3 Cx activities supplement field quality and testing procedures described in relevant technical sections.
- .4 Cx is conducted in concert with activities performed during stage of project delivery. Cx identifies issues in Planning and Design stages which are addressed during Construction and Cx stages to ensure the installations are constructed and proven to operate satisfactorily under weather, environmental and occupancy conditions to meet functional and operational requirements. Cx activities include transfer of critical knowledge to facility operational personnel.
- .5 The Engineer will issue Interim Acceptance Certificate when:
 - .1 Completed Cx documentation has been received, reviewed for suitability and approved by Engineer.
 - .2 Equipment, components and systems have been commissioned.
 - .3 O&M training has been completed.

1.5 NON-CONFORMANCE TO PERFORMANCE VERIFICATION REQUIREMENTS

- .1 Should equipment, system components, and associated controls be incorrectly installed or malfunction during Cx, correct deficiencies, re-verify equipment and components within the dysfunctional system, including related systems as deemed required by the Engineer, to ensure effective performance.
- .2 Costs for corrective work, additional tests, inspections, to determine acceptability and proper performance of such items to be borne by Contractor. Above costs to be in form of progress payment reductions or hold-back assessments.

1.6 PRE-CX REVIEW

- .1 Before Construction:
 - .1 Review contract documents, confirm in writing to Engineer.
 - .1 Adequacy of provisions for Cx.
 - .2 Aspects of design and installation pertinent to success of Cx.
- .2 During Construction:
 - .1 Coordinate provisions, location and installation of provisions for Cx.
- .3 Before start of Cx, ensure:
 - .1 Have completed Cx Plan up-to-date.
 - .2 Ensure installation of related components, equipment, sub-systems, systems is complete.
 - .3 Fully understand Cx requirements and procedures.
 - .4 Have Cx documentation shelf-ready.
 - .5 Understand completely design criteria and intent and special features.
 - .6 Submit complete start-up documentation to Engineer.
 - .7 Have Cx schedules up-to-date.
 - .8 Ensure systems have been cleaned thoroughly.
 - .9 Complete TAB procedures on systems, submit TAB reports to Engineer for review and approval.
 - .10 Ensure "As-Built" system schematics are available.
- .4 Inform Engineer in writing of discrepancies and deficiencies on finished works.

GENERAL COMMISSIONING (CX) REQUIREMENTS**1.7 CONFLICTS**

- .1 Report conflicts between requirements of this section and other sections to Engineer before start-up and obtain clarification.
- .2 Failure to report conflict and obtain clarification will result in application of most stringent requirement.

1.8 SUBMITTALS

- .1 Submittals: in accordance with Section 01 10 10 – General Instructions – Mechanical and Electrical.
 - .1 Submit no later than 4 weeks after award of Contract:
 - .1 Draft Cx documentation.
 - .2 Preliminary Cx schedule.
 - .2 Request in writing to Engineer for changes to submittals and obtain written approval at least 4 weeks prior to start of Cx.
 - .3 Submit proposed Cx procedures to Engineer where not specified and obtain written approval at least 4 weeks prior to start of Cx.
 - .4 Provide additional documentation relating to Cx process required by Engineer.

1.9 COMMISSIONING DOCUMENTATION

- .1 Engineer to review and approve Cx documentation.
- .2 Provide completed and approved Cx documentation to Engineer.

1.10 COMMISSIONING MEETINGS

- .1 Convene Cx meetings following project meetings.
- .2 Purpose: to resolve issues, monitor progress, identify deficiencies, relating to Cx.
- .3 Continue Cx meetings on regular basis until commissioning deliverables have been addressed.
- .4 At 60% construction completion stage, a separate Cx scope meeting shall be convened to review progress, discuss schedule of equipment start-up activities and prepare for Cx. Issues at meeting to include:
 - .1 Review duties and responsibilities of Contractor and subcontractors, addressing delays and potential problems.
 - .2 Determine the degree of involvement of trades and manufacturer's representatives in the commissioning process.
- .5 Thereafter Cx meetings to be held until project completion and as required during equipment start-up and functional testing period.
- .6 Meeting will be chaired by Engineer, who will record and distribute minutes.

1.11 STARTING AND TESTING

- .1 Contractor assumes liabilities and costs for inspections. Including disassembly and re-assembly after approval, starting, testing and adjusting, including supply of testing equipment.

GENERAL COMMISSIONING (CX) REQUIREMENTS**1.12 WITNESSING OF STARTING AND TESTING**

- .1 Provide 14 days' notice prior to commencement.
- .2 Engineer to witness of start-up and testing.
- .3 Contractor's Cx Agent to be present at tests performed and documented by sub-trades, suppliers and equipment manufacturers.

1.13 MANUFACTURER'S INVOLVEMENT

- .1 Obtain manufacturer's installation, start-up and operations instructions prior to start-up of components, equipment and systems and review with Engineer.
 - .1 Compare completed installation with manufacturer's published data, record discrepancies, and review with manufacturer.
 - .2 Modify procedures detrimental to equipment performance and review same with manufacturer before start-up.
- .2 Integrity of warranties
 - .1 Use manufacturer's trained start-up personnel where specified elsewhere in other divisions or required to maintain integrity of warranty.
 - .2 Verify with manufacturer that testing as specified will not void warranties.
- .3 Qualifications of manufacturer's personnel
 - .1 Experienced in design, installation and operation of equipment and systems.
 - .2 Ability to interpret test results accurately.
 - .3 To report results in clear, concise, logical manner.

1.14 PROCEDURES

- .1 Verify that equipment and systems are complete, clean, and operating in normal and safe manner prior to conducting start-up, testing and Cx.
- .2 Conduct start-up and testing in following distinct phases:
 - .1 Included in delivery and installation:
 - .1 Verification of conformity to specification, approved shop drawings and completion of PI report forms.
 - .2 Visual inspection of quality of installation.
 - .2 Start-up: follow accepted start-up procedures.
 - .3 Operational testing: document equipment performance.
 - .4 System PV: include repetition of tests after correcting deficiencies.
 - .5 Post-substantial performance verification: to include fine-tuning.
- .3 Correct deficiencies and obtain approval from Engineer after distinct phases have been completed and before commencing next phase.
- .4 Documents require tests on approved PV forms.

1.15 START-UP DOCUMENTATION

- .1 Assemble start-up documentation and submit to Engineer for approval before commencement of commissioning.

GENERAL COMMISSIONING (CX) REQUIREMENTS

- .2 Start-up documentation to include:
 - .1 Factory and on-site test certificates for specified equipment.
 - .2 Pre-start-up inspection reports.
 - .3 Signed installation/start-up check lists.
 - .4 Start-up reports,
 - .5 Step-by-step description of complete start-up procedures, to permit Engineer to repeat start-up at any time.

1.16 TEST RESULTS

- .1 If start-up, testing and/or PV produce unacceptable results, repair, replace or repeat specified starting and/or PV procedures until acceptable results are achieved.
- .2 Provide manpower and materials, assume costs for re-commissioning.

1.17 START OF COMMISSIONING

- .1 Notify Engineer at least 21 days prior to start of Cx.
- .2 Start Cx after elements of building affecting start-up and performance verification of systems have been completed.

1.18 INSTRUMENTS/EQUIPMENT

- .1 Submit to Engineer for review and approval:
 - .1 Complete list of instruments proposed to be used.
 - .2 Listed data including, serial number, current calibration certificate, calibration date, calibration expiry date and calibration accuracy.
- .2 Provide the following equipment as required:
 - .1 2-way radios.
 - .2 Ladders.
 - .3 Equipment as required to complete work.

1.19 COMMISSIONING PERFORMANCE VERIFICATION

- .1 Carry out Cx:
 - .1 Under actual or accepted simulated operating conditions, over entire operating range, in all modes.
 - .2 On independent systems and interacting systems.
- .2 Cx procedures to be repeatable and reported results are to be verifiable.
- .3 Follow equipment manufacturer's operating instructions.
- .4 EMCS trending to be available as supporting documentation for performance verification.

1.20 WITNESSING COMMISSIONING

- .1 Engineer to witness activities and verify results.

GENERAL COMMISSIONING (CX) REQUIREMENTS**1.21 CHECKS AND ADJUSTMENTS**

- .1 Make adjustments and changes which become apparent as Cx proceeds.
- .2 Perform static and operational checks as applicable and as required.

1.22 DEFICIENCIES, FAULTS, DEFECTS

- .1 Correct deficiencies found during start-up and Cx to satisfaction of Engineer.
- .2 Report problems, faults or defects affecting Cx to Engineer in writing. Stop Cx until problems are rectified. Proceed with written approval from Engineer.

1.23 COMPLETION OF COMMISSIONING

- .1 Upon completion of Cx leave systems in normal operating mode.
- .2 Except for warranty and seasonal verification activities specified in Cx specifications, complete Cx prior to issuance of Interim Certificate of Completion.
- .3 Cx to be considered complete when contract Cx deliverables have been submitted and accepted by Engineer.

1.24 ACTIVITIES UPON COMPLETION OF COMMISSIONING

- .1 When changes are made to baseline components or system settings established during Cx process, provide updated Cx form for affected item.

1.25 TRAINING

- .1 In accordance with Section 01 10 10 – General Instructions – Mechanical and Electrical.

1.26 MAINTENANCE MATERIALS, SPARE PARTS, SPECIAL TOOLS

- .1 Supply, deliver, and document maintenance materials, spare parts, and special tools as specified in contract.

1.27 OCCUPANCY

- .1 Cooperate fully with Engineer during stages of acceptance and occupancy of facility.

1.28 INSTALLED INSTRUMENTATION

- .1 Use instruments installed under Contract for TAB and PV if:
 - .1 Calibration certificates have been deposited with Engineer.
- .2 Calibrated EMCS sensors may be used to obtain performance data provided that sensor calibration has been completed and accepted.

PART 2 PRODUCTS**2.1 NOT USED**

- .1 Not used.

GENERAL COMMISSIONING (CX) REQUIREMENTS

PART 3 EXECUTION

3.1 NOT USED

.1 Not used.

END OF SECTION

PART 1 GENERAL**1.1 RELATED SECTIONS**

- .1 Section 01 91 33 – Commissioning (Cx) Forms: Installation Check Lists.

1.2 REFERENCES

- .1 Underwriters' Laboratories of Canada (ULC).

1.3 GENERAL

- .1 Provide a fully functional installation:
 - .1 Systems, equipment and components meet user's functional requirements before date of acceptance, and operate consistently at peak efficiencies and within specified energy budgets under normal loads.
 - .2 Facility users and O&M personnel have been fully trained in aspects of installed systems.
 - .3 Optimized life cycle costs.
 - .4 Complete documentation relating to installed equipment and systems.
- .2 Term "Cx" in this section means "Commissioning".
- .3 Use this Cx Plan as master planning document for Cx:
 - .1 Outlines organization, scheduling, allocation of resources, documentation, pertaining to implementation of Cx.
 - .2 Communicates responsibilities of team members involved in Cx Scheduling, documentation requirements, and verification procedures.
 - .3 Sets out deliverables relating to O&M, process and administration of Cx.
 - .4 Describes process of verification of how built works meet design requirements.
 - .5 Produces a complete functional system prior to issuance of Certificate of Occupancy.
 - .6 Management tool that sets out scope, standards, roles and responsibilities, expectations, deliverables, and provides:
 - .1 Overview of Cx.
 - .2 General description of elements that make up Cx Plan.
 - .3 Process and methodology for successful Cx.
- .4 Acronyms:
 - .1 Cx - Commissioning.
 - .2 BMM - Building Management Manual.
 - .3 EMCS - Energy Monitoring and Control Systems.
 - .4 MSDS - Material Safety Data Sheets.
 - .5 PI - Product Information.
 - .6 PV - Performance Verification.
 - .7 TAB - Testing, Adjusting and Balancing.
 - .8 WHMIS - Workplace Hazardous Materials Information System.
- .5 Commissioning terms used in this Section:
 - .1 Bumping: short term start-up to prove ability to start and prove correct rotation.

COMMISSIONING (CX) PLAN

- .2 Deferred Cx - Cx activities delayed for reasons beyond Contractor's control due to lack of occupancy, weather conditions, need for heating/cooling loads.

1.4 REFINEMENT OF CX PLAN

- .1 During construction phase, revise, refine and update Cx Plan to include:
 - .1 Changes resulting from Client program modifications.
 - .2 Approved design and construction changes.
- .2 Include testing parameters at full range of operating conditions and check responses of equipment and systems.

1.5 COMPOSITION, ROLES AND RESPONSIBILITIES OF CX TEAM

- .1 Engineer to maintain overall responsibility for project and is sole point of contact between members of commissioning team.
- .2 Project Manager will select Cx Team consisting of following members:
 - .1 Engineer is responsible for:
 - .1 Organizing Cx.
 - .2 Monitoring operations Cx activities.
 - .3 Witnessing, certifying accuracy of reported results.
 - .4 Witnessing and certifying TAB and other tests.
 - .5 Ensuring implementation of final Cx Plan.
 - .6 Performing verification of performance of installed systems and equipment.
 - .2 Construction Team: contractor, sub-contractors, suppliers and support disciplines, is responsible for construction/installation in accordance with contract documents, including:
 - .1 Testing.
 - .2 TAB.
 - .3 Performance of Cx activities.
 - .4 Delivery of training and Cx documentation.
 - .3 Contractor's Cx agent implements specified Cx activities including:
 - .1 Demonstrations.
 - .2 Training.
 - .3 Testing.
 - .4 Preparation, submission of test reports.
 - .4 Property Manager: represents lead role in Operation Phase and onwards and is responsible for:
 - .1 Receiving facility.
 - .2 Day-To-Day operation and maintenance of facility.

1.6 CX PARTICIPANTS

- .1 Employ the following Cx participants to verify performance of equipment and systems:
 - .1 Installation contractor/subcontractor:
 - .1 Equipment and systems except as noted.
 - .2 Equipment manufacturer: equipment specified to be installed and started by manufacturer.
 - .1 To include performance verification.

COMMISSIONING (CX) PLAN

- .3 Specialist subcontractor: equipment and systems supplied and installed by specialist subcontractor.
- .4 Client: responsible for intrusion and access security systems.
- .5 Ensure that Cx participant:
 - .1 Could complete work within scheduled time frame.
 - .2 Available for emergency and troubleshooting service during first year of occupancy by user for adjustments and modifications outside responsibility of O&M personnel, including:
 - .1 Changes to heating or cooling loads beyond scope of EMCS.
 - .2 Changes to EMCS control strategies beyond level of training provided to O&M personnel.
- .6 Provide names of participants to Engineer and details of instruments and procedures to be followed for Cx two (2) months prior to starting date of Cx for review and approval.

1.7 EXTENT OF CX

- .1 Commission electrical systems and associated equipment:
 - .1 Dry Type Transformers up to 600 V Primary.
 - .2 Low Voltage Switchgear.
 - .3 Panelboards Breaker Type.
 - .4 Breakers.
 - .5 Diesel Electric Generating Units – Air Cooled.
 - .6 Automatic Transfer SwitchesNew switchboard.

1.8 DELIVERABLES RELATING TO O&M PERSPECTIVES

- .1 General requirements:
 - .1 Compile French and English documentation.
 - .2 Documentation to be computer-compatible format ready for inputting for data management.
- .2 Provide deliverables:
 - .1 Warranties.
 - .2 Project record documentation.
 - .3 Inventory of spare parts, special tools and maintenance materials.
 - .4 Maintenance Management System (MMS) identification system used.
 - .5 WHMIS information.
 - .6 MSDS data sheets.

1.9 DELIVERABLES RELATING TO THE CX PROCESS

- .1 General:
 - .1 Start-up, testing and Cx requirements, conditions for acceptance and specifications form part of relevant technical sections of these specifications.
- .2 Definitions:
 - .1 Cx as used in this section includes:

COMMISSIONING (CX) PLAN

- .1 Cx of components, equipment, systems, subsystems, and integrated systems.
- .2 Factory inspections and performance verification tests.
- .3 Deliverables: provide:
 - .1 Cx Specifications.
 - .2 Startup, pre-Cx activities and documentation for systems, and equipment.
 - .3 Completed installation checklists (ICL).
 - .4 Completed product information (PI) report forms.
 - .5 Completed performance verification (PV) report forms.
 - .6 Results of Performance Verification Tests and Inspections.
 - .7 Description of Cx activities and documentation.
 - .8 Description of Cx of integrated systems and documentation.
 - .9 Tests performed by Owner/User.
 - .10 Training Plans.
 - .11 Cx Reports.
 - .12 Prescribed activities during warranty period.
- .4 Engineer to witness and certify tests and reports of results provided to Engineer.

1.10 PRE-CX ACTIVITIES AND RELATED DOCUMENTATION

- .1 Items listed in this Cx Plan include the following:
 - .1 Pre-Start-Up inspections: by Engineer prior to permission to start up and rectification of deficiencies to Engineer's satisfaction.
 - .2 Engineer will monitor some of these pre-start-up inspections.
 - .3 Include completed documentation with Cx report.
 - .4 Conduct pre-start-up tests: conduct pressure, static, flushing, cleaning, and "bumping" during construction as specified in technical sections. To be witnessed and certified by Engineer and does not form part of Cx specifications.
 - .5 Engineer will monitor some of these inspections and tests.
 - .6 Include completed documentation in Cx report.
- .2 Pre-Cx activities – ELECTRICAL INSTALLATIONS:
 - .1 Electrical equipment and systems:
 - .1 "Bump" each item of equipment in its "stand-alone" mode.
 - .2 At this time, complete pre-start-up checks and complete relevant documentation.
 - .3 After equipment has been started, test related systems in conjunction with control systems on a system-by-system basis.
 - .4 Perform TAB on systems. TAB reports to be approved by Engineer.

1.11 START-UP

- .1 Start-up components, equipment and systems.
- .2 Equipment manufacturer, supplier, installing specialist sub-contractor, as appropriate, to start-up, under Contractor's direction, following equipment, systems:
 - .1 Dry Type Transformers up to 600 V Primary.
 - .2 Low Voltage Switchgear.
 - .3 Panelboards Breaker Type.

COMMISSIONING (CX) PLAN

- .4 Breakers.
- .5 Diesel Electric Generating Units – Air Cooled.
- .6 Automatic Transfer SwitchesNew switchboard.
- .3 Engineer to monitor some of these start-up activities.
 - .1 Rectify start-up deficiencies to satisfaction of Engineer.
- .4 Performance Verification (PV):
 - .1 Approved Cx Agent to perform.
 - .1 Repeat when necessary until results are acceptable to Engineer.
 - .2 Use procedures modified generic procedures to suit project requirements.
 - .3 Engineer to witness and certify reported results using approved PI and PV forms.
 - .4 Engineer to approve completed PV reports and provide to Engineer.
 - .5 Failure of randomly selected item shall result in rejection of PV report or report of system start-up and testing.

1.12 CX ACTIVITIES AND RELATED DOCUMENTATION

- .1 Engineer to monitor Cx activities.
- .2 Upon satisfactory completion, Cx agency performing tests to prepare Cx Report using approved PV forms.
- .3 Engineer to witness, certify reported results of, Cx activities and forward to Engineer.
- .4 Engineer reserves right to verify a percentage of reported results at no cost to contract.

1.13 INSTALLATION CHECK LISTS (ICL)

- .1 Refer to Section 01 91 33 – Commissioning (Cx) Forms: Installation Check Lists and Product Information (PI) / Performance Verification (PV) Forms.

1.14 PRODUCT INFORMATION (PI) REPORT FORMS

- .1 Refer to Section 01 91 33 – Commissioning (Cx) Forms: Installation Check Lists and Product Information (PI) / Performance Verification (PV) Forms.

1.15 PERFORMANCE VERIFICATION (PV) REPORT

- .1 Refer to Section 01 91 33 – Commissioning (Cx) Forms: Installation Check Lists and Product Information (PI) / Performance Verification (PV) Forms.

1.16 DELIVERABLES RELATING TO ADMINISTRATION OF CX

- .1 General:
 - .1 Because of risk assessment, complete Cx of occupancy, weather and seasonal-sensitive equipment and systems in these areas before building is occupied.

1.17 CX REPORTS

- .1 Submit reports of tests, witnessed and certified by Engineer to Engineer who will verify reported results.

COMMISSIONING (CX) PLAN

- .2 Include completed and certified PV reports in properly formatted Cx Reports.
- .3 Before reports are accepted, reported results to be subject to verification by Engineer.

1.18 ACTIVITIES DURING WARRANTY PERIOD

- .1 Cx activities must be completed before issuance of Interim Certificate, it is anticipated that certain Cx activities may be necessary during Warranty Period, including:
 - .1 Fine tuning of electrical systems.

1.19 FINAL SETTINGS

- .1 Upon completion of Cx to satisfaction of Engineer lock control devices in their final positions, indelibly mark settings marked and include in Cx Reports.

PART 2 PRODUCTS**2.1 NOT USED**

- .1 Not used.

PART 3 EXECUTION**3.1 NOT USED**

- .1 Not used.

END OF SECTION

PART 1 GENERAL**1.1 RELATED SECTIONS**

- .1 01 91 31 – Commissioning (Cx) Plan.

1.2 INSTALLATION/START-UP CHECK LISTS

- .1 Include the following data:
 - .1 Product manufacturer's installation instructions and recommended checks.
 - .2 Special procedures as specified in relevant technical sections.
 - .3 Items considered good installation and engineering industry practices deemed appropriate for proper and efficient operation.
- .2 Installer to sign check lists upon completion, certifying stated checks and inspections have been performed. Return completed check lists to Engineer. Check lists will be required during Commissioning and will be included in Building Maintenance Manual (BMM) at completion of project.
- .3 Use of check lists will not be considered part of commissioning process but will be stringently used for equipment pre-start and start-up procedures.

1.3 PRODUCT INFORMATION (PI) REPORT FORMS

- .1 Product Information (PI) forms compile gathered data on items of equipment produced by equipment manufacturer, includes nameplate information, parts list, operating instructions, maintenance guidelines and pertinent technical data and recommended checks that is necessary to prepare for start-up and functional testing and used during operation and maintenance of equipment. This documentation is included in the BMM at completion of work.
- .2 Prior to Performance Verification (PV) of systems complete items on PI forms related to systems and obtain Engineer's approval.

1.4 PERFORMANCE VERIFICATION (PV) FORMS

- .1 PV forms to be used for checks, running dynamic tests and adjustments carried out on equipment and systems to ensure correct operation, efficiently and function independently and interactively with other systems as intended with project requirements.
- .2 PV report forms include those developed by Contractor records measured data and readings taken during functional testing and Performance Verification procedures.
- .3 Prior to PV of integrated system, complete PV forms of related systems and obtain Engineer's approval.

1.5 COMMISSIONING FORMS

- .1 Use Commissioning forms to verify installation and record performance when starting equipment and systems.
- .2 Strategy for use:

COMMISSIONING FORMS

- .1 Contractor will provide required shop drawings information and verify correct installation and operation of items indicated on these forms.
- .2 Confirm operation as per design criteria and intent.
- .3 Identify variances between design and operation and reasons for variances.
- .4 Verify operation in specified normal and emergency modes and under specified load conditions.
- .5 Record analytical and substantiating data.
- .6 Verify reported results.
- .7 Form to bear signatures of recording technician and reviewed and signed off by Engineer.
- .8 Submit immediately after tests are performed.
- .9 Reported results in true measured SI unit values.
- .10 Provide Engineer with originals of completed forms.
- .11 Maintain copy on site during start-up, testing and commissioning period.

1.6 LANGUAGE

- .1 To suit the language profile of the awarded contract.

PART 2 PRODUCTS**2.1 NOT USED**

- .1 Not used.

PART 3 EXECUTION**3.1 NOT USED**

- .1 Not used.

END OF SECTION

PART 1 GENERAL**1.1 RELATED SECTIONS**

- .1 Section 01 10 10 – General Instructions – Electromechanical.

1.2 SUBMITTALS

- .1 Submittals: in accordance with Section 01 10 10 – General Instructions – Electromechanical.
- .2 Shop drawings to show but not limited:
 - .1 Certification of compliance to applicable codes.
- .3 Closeout Submittals:
 - .1 Provide operation and maintenance data for incorporation into manual specified in Section 01 10 10 – General Instructions – Electromechanical.
 - .2 Operation and maintenance manual approved by, and final copies deposited with, Engineer before final inspection.
 - .3 Operation data to include:
 - .1 Control schematics for systems including environmental controls.
 - .2 Description of systems and their controls.
 - .3 Description of operation of systems at various loads together with reset schedules and seasonal variances.
 - .4 Operation instruction for systems and component.
 - .5 Description of actions to be taken in event of equipment failure.
 - .6 Colour coding chart.
 - .4 Maintenance data to include:
 - .1 Servicing, maintenance, operation and trouble-shooting instructions for each item of equipment.
 - .2 Data to include schedules of tasks, frequency, tools required and task time.
 - .5 Approvals:
 - .1 Submit one (1) copy of draft Operation and Maintenance Manual to Engineer for approval. Submission of individual data will not be accepted unless directed by Engineer.
 - .2 Make changes as required and re-submit as directed by Engineer.
 - .6 Additional data:
 - .1 Prepare and insert into operation and maintenance manual additional data when need for it becomes apparent during specified demonstrations and instructions.
 - .7 Site records:
 - .1 Engineer will provide one (1) set of reproducible mechanical drawings. Provide sets of white prints as required for each phase of work. Mark changes as work progresses and as changes occur. Include changes to

COMMON WORK RESULTS FOR HVAC

- existing mechanical systems, control systems and low voltage control wiring.
- .2 Transfer information weekly to reproducibles, revising reproducibles to show work as actually installed.
- .3 Use different colour waterproof ink for each service.
- .4 Make available for reference purposes and inspection.
- .8 As-built drawings:
 - .1 Prior to start of Testing, Adjusting and Balancing for HVAC, finalize production of as-built drawings.
 - .2 Identify each drawing in lower right hand corner in letters at least 12 mm high as follows: - "AS BUILT DRAWINGS: THIS DRAWING HAS BEEN REVISED TO SHOW MECHANICAL SYSTEMS AS INSTALLED" (Signature of Contractor) (Date).
 - .3 Submit to Engineer for approval and make corrections as directed.
 - .4 Perform testing, adjusting and balancing for HVAC using as-built drawings.
 - .5 Submit completed reproducible as-built drawings with Operating and Maintenance Manuals.

1.3 QUALITY ASSURANCE

- .1 Quality Assurance: in accordance with Section 01 10 10 – General Instructions – Electromechanical.
- .2 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 10 10 – General Instructions – Electromechanical.

1.4 DELIVERY, STORAGE, AND HANDLING

- .1 Waste Management and Disposal:
 - .1 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse and recycling in accordance with Section 01 10 10 – General Instructions – Electromechanical.

PART 2 PRODUCTS**2.1 NOT USED**

- .1 Not used.

PART 3 EXECUTION**3.1 PAINTING REPAIRS AND RESTORATION**

- .1 Do painting in accordance with Section 01 10 10 – General Instructions – Electromechanical.
- .2 Prime and touch up marred finished paintwork to match original.

COMMON WORK RESULTS FOR HVAC

.3 Restore to new condition, finishes which have been damaged.

3.2 FIRE STOPPING

.1 Fire stopping shall be supplied and installed by the Division 23 Contractor.

3.3 FIELD QUALITY CONTROL

.1 Manufacturer's Field Services:

.1 Provide manufacturer's field services consisting of product use recommendations site visits for inspection of product installation in accordance with manufacturer's instructions.

.2 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit to engineer.

3.4 PROTECTION

.1 Protect equipment and systems openings from dirt, dust, and other foreign materials with materials appropriate to system.

3.5 CLEANING

.1 Clean in accordance with Section 01 10 10 – General Instructions – Electromechanical.

END OF SECTION

PART 1 GENERAL**1.1 RELATED SECTIONS**

- .1 Section 23 05 05 – Installation of Pipework.
- .2 Section 23 08 01 – Performance Verification Mechanical Piping System.
- .3 Section 23 08 02 – Cleaning and Start-Up of Mechanical Piping Systems.

1.2 REFERENCES

- .1 American Society of Mechanical Engineers (ASME)
 - .1 ASME-B16.3-2011, Malleable-Iron Threaded Fittings: Classes 150 and 300.
 - .2 ASME-B16.9-2012, Factory-Made Wrought Steel Buttwelding Fittings.
- .2 ASTM International
 - .1 ASTM A47/A47M-99(R2014), Standard Specification for Ferritic Malleable Iron Castings.
 - .2 ASTM A53/A53M-12, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc Coated, Welded and Seamless.
 - .3 ASTM B61-08(2013), Standard Specification for Steam or Valve Bronze Castings.
 - .4 ASTM B75/B75M-11), Standard Specification for Seamless Copper Tube.
- .3 Canadian Environmental Protection Act (CEPA)
 - .1 CCME PN 1326-2008, Environmental Code of Practice for Aboveground and Underground Storage Tank Systems for Petroleum Products and Allied Petroleum Products.
- .4 CSA International
 - .1 CSA-B139-09, Installation Code for Oil Burning Equipment.
 - .2 CSA-B140.0-03(R2013), Oil Burning Equipment: General Requirements.
 - .3 CSA-C282-09, Emergency Electrical Power Supply for Buildings.
- .5 Health Canada / Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).
- .6 Manufacturers Standardization Society of the Valve and Fitting Industry (MSS)
 - .1 MSS-SP-80-2013, Bronze Gate, Globe, Angle and Check Valves.
- .7 National Association of Corrosion Engineers (NACE)
 - .1 NACE SP0169-2013, Control of External Corrosion on Underground or Submerged Metallic Piping Systems.
- .8 National Fire Code of Canada (NFCC 2010)

FACILITY FUEL-OIL PIPING

- .9 Underwriter's Laboratories of Canada (ULC)
 - .1 CAN/ULC S603.1-11, External Corrosion Protection Systems for Steel Underground Tanks for Flammable and Combustible Liquids.
 - .2 ULC ORD-C107.12-1992, Line Leak Detection Devices for Flammable Liquid Piping.

1.3 SUBMITTALS

- .1 Provide submittals in accordance with Section 23 05 00 – Common Work Results for HVAC.
- .2 Product Data:
 - .1 Provide manufacturer's printed product literature, specifications and datasheets for piping, fittings and equipment and include product characteristics, performance criteria, physical size, finish and limitations.
 - .1 Indicate on manufacturer's catalogue literature the following:
 - .1 Valves.
 - .2 Provide two copies of WHMIS MSDS when required
- .3 Indicate VOC's for adhesive and solvents during application and curing.
- .4 Test Reports:
 - .1 Submit certified test reports from approved independent testing laboratories indicating compliance with specifications for specified performance characteristics and physical properties.
- .5 Certificates:
 - .1 Submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
- .6 Manufacturers' Instructions: provide manufacturer's installation instructions.
- .7 Closeout submittals
 - .1 Submit maintenance and engineering data for incorporation into manual specified in Section 23 05 00 – Common Work Results for HVAC.
- .8 Quality assurance
 - .1 Ensure piping is installed by company and individual authorized by authority having jurisdiction.

PART 2 PRODUCTS**2.1 FILL VENT AND CARRIER PIPE**

- .1 Materials as per CSA-B139, CEPA SOR/2008-197 and NFCC.
- .2 Steel: to ASTM A53/A53M, Schedule 40, continuous weld or electric resistance welded, screwed.

2.2 STEEL PIPE COATING

- .1 Bituminous paint: in accordance with manufacturer's recommendations.
- .2 Primers and paints: in accordance with manufacturer's recommendations for surface conditions.

2.3 JOINTING MATERIAL

- .1 Screwed fittings: Teflon tape or pulverized lead paste.

2.4 FITTINGS

- .1 Steel:
 - .1 Malleable iron: screwed, banded, class 150 to ASME-B16.3.
 - .2 Welding: butt-welding to ASME-B16.9.
 - .3 Unions: malleable iron, brass to iron, ground seat, screwed, to ASTM A47/A47M.
 - .4 Nipples: Schedule 40, to ASTM A53/A53M.

2.5 GLOBE VALVES

- .1 NPS 2 and under, screwed: to MSS-SP-80, class 125, 860 kPa, bronze body, screwed over bonnet, renewable composition disc suitable for oil service.
 - .1 Lockshield handles: as indicated.

2.6 BALL VALVES

- .1 NPS 2 and under: bronze body, screwed ends, TFE seal, hard chrome ball, 4 MPa, WOG.

2.7 SWING CHECK VALVES

- .1 NPS 2 and under, screwed: to MSS-SP-80, Class 125, 860 kPa, bronze body, renewable composition disc suitable for oil service, screw in cap, regrindable.

2.8 LUBRICATED PLUG COCKS

- .1 NPS 2 and under, screwed: to ASTM B61, Class 150, 1 MPa, bronze body.

PART 3 EXECUTION**3.1 APPLICATION**

- .1 Manufacturer's Instructions: comply with manufacturer's written recommendations, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 PIPING

- .1 Install piping in accordance with Section 23 05 05 – Installation of Pipework, supplemented as specified.
- .2 Install oil piping system in accordance with NFCC, CSA-B139 and CSA-B140.0.
- .3 Slope piping down in direction of storage tank unless otherwise indicated.
- .4 Underground piping to be protected in conformance with CAN/ULC-S603.1.
- .5 Above ground piping to be protected from physical impact due to impact.
- .6 Piping inside building:
 - .1 Ensure piping in solid flooring is installed to CSA-B139.
 - .2 Use approved fitting to CSA-B139 for steel and copper piping.
 - .3 Install filter, gate valve, and fire valve at burners.
- .7 Fill, vent, suction piping outside building:
 - .1 Steel piping welded throughout except at tanks where electrically isolating fittings are used.
 - .2 Grading: slope piping at 1% minimum back to tanks.
- .8 Piping at tanks:
 - .1 Suction: terminate 150 mm from bottom of tank with foot valve and strainer.
 - .2 Return: terminate 75 mm from bottom of tank.
 - .3 Comply with CSA-B139 for piping for venting at tanks including venting whistle venting alarm.
 - .4 Fill pipes: install to comply with CSA-B139.
 - .1 Include liquid tight tamperproof cover.
 - .2 Equip fill pipes on tanks with capacity greater than 5000 L with liquid and vapour tight connections.
- .9 Interconnections between multiple tanks:
 - .1 Interconnect vent, suction, return to ensure equal level in tanks.
 - .2 Valve to permit isolation of tanks without interfering with use of other tanks.
 - .3 Mount tanks on common foundation
 - .4 Align tank tops at same elevation.
 - .5 Connect inlet fill pipe to one tank only.
 - .6 Install vent whistle to tank with vent pipe connected.
 - .7 Ensure connecting pipe between tank bottoms is at least equal to size of inlet pipe.
 - .8 Vent each tank separately from top.
 - .9 Terminate vent pipe to exterior location.
 - .10 Join separate vents to common vent pipe cross-connected to tops of each tank using vent manifold pipe located above highest liquid level in tanks.

FACILITY FUEL-OIL PIPING

- .11 Size common vent and manifold pipes to CSA-B139.
- .10 Clearly label piping runs in legible form indicating;
 - .1 Piping product content.
 - .2 Direction of flow.
 - .3 Identify transfer points in piping systems to CPPI Colour-Symbol System to Mark Equipment and Vehicles for Product Identification

3.3 VALVES

- .1 Install valves with stems upright or horizontal.
- .2 Install ball valves at branch take-offs, to isolate pieces of equipment and as indicated.
- .3 Install globe valves for balancing and in by-pass around control valves.
- .4 Install swing check valves on discharge of pumps and as indicated.
- .5 Install plug cocks as indicated.

3.4 OVERFILL AND SPILL PROTECTION

- .1 To CSA-B139.

3.5 FIELD QUALITY CONTROL

- .1 Execute work in compliance with
 - .1 B139
 - .2 NFCC-2015
 - .3 CCME PN-1326
 - .4 CSA C22.1
 - .5 CSA C282
- .2 Site Tests/Inspection:
 - .1 Test system to CSA-B139 and CSA-B140.0 and authorities having jurisdiction.
 - .2 Isolate tanks from piping pressure tests.
 - .3 Maintain test pressure during backfilling.
- .3 Manufacturer's Field Services:
 - .1 Have manufacturer of products, supplying materials for work of this Section, review Work involved in handling, installation/application, protection and cleaning, of its products and submit written reports, in acceptable format, to verify compliance of Work with Contract.
 - .2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.
 - .3 Schedule site visits, to review Work, at stages listed:

FACILITY FUEL-OIL PIPING

- .1 After delivery and storage of products, and when preparatory Work, or other Work, on which the Work of this Section depends, is complete but before installation begins.
- .2 Upon completion of the Work, after cleaning is carried out.
- .4 Obtain reports, within 3 days of review, and submit, immediately, to Engineer.

3.6**CLEANING**

- .1 Clean in accordance with Section 23 08 02 – Cleaning and Start-Up of Mechanical Piping Systems and manufacturer's written recommendations, supplemented as follows:
 - .1 Flush after pressure test with number 2 fuel oil for a minimum of two hours. Clean strainers and filters.
 - .2 Dispose of fuel oil used for flushing out in accordance with requirements of authority having jurisdiction.
 - .3 Ensure vents from regulators, control valves are terminated in approved location and are protected against blockage and damage.
 - .4 Ensure entire installation is approved by authority having jurisdiction.
 - .5 Clean in accordance with Section 23 05 00 – Common Work Results for HVAC.
 - .1 Remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

PART 1 GENERAL**1.1 RELATED SECTIONS**

- .1 Section 01 10 10 – General Instructions – Electromechanical.

1.2 REFERENCES

- .1 Publications in effect:
 - .1 Canadian Standards Association (CSA International)
 - .2 CSA C22.1, Canadian Electrical Code, Part 1 (22nd Edition), Safety Standard for Electrical Installations.
 - .3 CSA C22.2 No. 0-General Requirements – Canadian Electrical Code, Part II.
 - .4 CAN3-C235, Preferred Voltage Levels for AC Systems, 0 to 50,000 V.
 - .2 Electrical and Electronic Manufacturer's Association of Canada (EEMAC)
 - .1 EEMAC 2Y-1, Light Gray Colour for Indoor Switch Gear.
 - .3 Institute of Electrical and Electronics (IEEE)/National Electrical Safety Code Product Line (NESC)
 - .1 IEEE SP1122, The Authoritative Dictionary of IEEE Standards Terms, 7th Edition.

1.3 DEFINITIONS

- .1 Electrical and electronic terms: unless otherwise specified or indicated, terms used in these specifications, and on drawings, are those defined by IEEE SP1122.

1.4 DESIGN REQUIREMENTS

- .1 Operating voltages: to CAN3-C235.
- .2 Motors, electric heating, control and distribution devices and equipment to operate satisfactorily at 60 Hz within normal operating limits established by above standard.
 - .1 Equipment to operate in extreme operating conditions established in above standard without damage to equipment.
- .3 Language operating requirements: provide identification nameplates and labels for control items in English and French.
- .4 Use one nameplate or label for both languages.

1.5 SUBMITTALS

- .1 Submittals: in accordance with Section 01 10 10 – General Instructions – Electromechanical.

COMMON WORK RESULTS – ELECTRICAL

- .2 Submit for review single line electrical diagrams under plexiglass and locate as indicated.
 - .1 Electrical distribution system in main electrical room.
 - .2 Electrical power generation and distribution systems in power plant rooms.
- .3 Shop drawings:
 - .1 Submit drawings stamped and signed by professional Engineer registered or licensed in Province of Quebec, Canada.
 - .2 Submit wiring diagrams and installation details of equipment indicating proposed location, layout and arrangement, control panels, accessories, piping, ductwork, and other items that must be shown to ensure coordinated installation.
 - .3 Identify on wiring diagrams circuit terminals and indicate internal wiring for each item of equipment and interconnection between each item of equipment.
 - .4 Indicate of drawings clearances for operation, maintenance, and replacement of operating equipment devices.
 - .5 Submit 5 number of copies of 600 x 600 mm minimum size drawings and product data to authority having jurisdiction.
 - .6 If changes are required, notify Engineer of these changes before they are made.
- .4 Quality Control: in accordance with Section 01 10 10 – General Instructions - Electromechanical.
 - .1 Provide CSA certified equipment and material.
 - .2 Where CSA certified equipment and material is not available, submit such equipment and material to authority having jurisdiction for special approval before delivery to site.
 - .3 Submit test results of installed electrical systems and instrumentation.
 - .4 Permits and fees: in accordance with General Conditions of contract.
 - .5 Submit, upon completion of Work, load balance report as described in PART 3 - LOAD BALANCE.
 - .6 Submit certificate of acceptance from authority having jurisdiction upon completion of Work to Engineer.
- .5 Manufacturer's Field Reports: submit to Engineer manufacturer's written report, within 3 days of review, verifying compliance of Work and electrical system and instrumentation testing, as described in PART 3 - FIELD QUALITY CONTROL.

COMMON WORK RESULTS – ELECTRICAL**1.6 QUALITY ASSURANCE**

- .1 Quality Assurance: in accordance with Section 01 10 10 – General Instructions – Electromechanical.
- .2 Qualifications: electrical Work to be carried out by qualified, licensed electricians who hold valid Master Electrical Contractor license or apprentices in accordance with authorities having jurisdiction as per the conditions of Provincial Act respecting manpower vocational training and qualification.
 - .1 Employees registered in provincial apprentices program: permitted, under direct supervision of qualified licensed electrician, to perform specific tasks.
 - .2 Permitted activities: determined based on training level attained and demonstration of ability to perform specific duties.
- .3 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 10 10 – General Instructions - Electromechanical.

1.7 DELIVERY, STORAGE AND HANDLING

- .1 Material Delivery Schedule: provide Engineer with schedule within 2 weeks after award of Contract.
- .2 In accordance with Section 01 10 10 – General Instructions – Electromechanical.

1.8 SYSTEM STARTUP

- .1 Instruct Engineer and operating personnel in operation, care and maintenance of systems, system equipment and components.
- .2 Arrange and pay for services of manufacturer's factory service Engineer to supervise start-up of installation, check, adjust, balance and calibrate components and instruct operating personnel.
- .3 Provide these services for such period, and for as many visits as necessary to put equipment in operation and ensure that operating personnel are conversant will aspects of its care and operation.

1.9 OPERATING INSTRUCTIONS

- .1 Provide for each system and principal item of equipment as specified in technical sections for use by operation and maintenance personnel.
- .2 Operating instructions to include following:
 - .1 Wiring diagrams, control diagrams, and control sequence for each principal system and item of equipment.
 - .2 Start up, proper adjustment, operating, lubrication, and shutdown procedures.
 - .3 Safety precautions.
 - .4 Procedures to be followed in event of equipment failure.

COMMON WORK RESULTS – ELECTRICAL

- .5 Other items of instruction as recommended by manufacturer of each system or item of equipment.
- .3 Print or engrave operating instructions and frame under glass or in approved laminated plastic.
- .4 Post instructions where directed.
- .5 For operating instructions exposed to weather, provide weather-resistant materials or weatherproof enclosures.
- .6 Ensure operating instructions will not fade when exposed to sunlight and are secured to prevent easy removal or peeling.

PART 2 PRODUCTS**2.1 MATERIALS AND EQUIPMENT**

- .1 Provide material and equipment in accordance with accordance with Section 01 10 10 – General Instructions - Electromechanical.
- .2 Material and equipment to be CSA certified. Where CSA certified material and equipment are not available, obtain special approval from authority having jurisdiction before delivery to site and submit such approval as described in PART 1 - SUBMITTALS.
- .3 Factory assemble control panels and component assemblies.

2.2 ELECTRIC MOTORS, EQUIPMENT AND CONTROLS

- .1 Verify installation and co-ordination responsibilities related to motors, equipment and controls, as indicated.
- .2 Control wiring and conduit: in accordance with Section 01 10 10 – General Instructions - Mechanical and Electrical.

2.3 WARNING SIGNS

- .1 Warning Signs: in accordance with requirements of authority having jurisdiction and Engineer.
- .2 Porcelain enamel signs, minimum size 175 x 250 mm.

2.4 WIRING TERMINATIONS

- .1 Ensure lugs, terminals, screws used for termination of wiring are suitable for either copper or aluminum conductors.

2.5 EQUIPMENT IDENTIFICATION

- .1 Identify electrical equipment with nameplates and labels as follows:
 - .1 Nameplates: lamicoid 3 mm thick plastic engraving sheet matt white finish face, white core, lettering accurately aligned and engraved into core mechanically attached with self-tapping screws.

- .2 Sizes as follows:

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

- .2 Labels: embossed plastic labels with 6 mm high letters unless specified otherwise.
- .3 Wording on nameplates and labels to be approved by Engineer prior to manufacture.
- .4 Allow for minimum of twenty-five (25) letters per nameplate and label.
- .5 Nameplates for terminal cabinets and junction boxes to indicate system and/or voltage characteristics.
- .6 Identify equipment with Size 3 labels engraved "ASSET INVENTORY NO. X" as directed by Engineer.
- .7 Disconnects, starters and contactors: indicate equipment being controlled and voltage.
- .8 Terminal cabinets and pull boxes: indicate system and voltage.
- .9 Transformers: indicate capacity, primary and secondary voltages.

2.6 WIRING IDENTIFICATION

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

2.7 CONDUIT AND CABLE IDENTIFICATION

- .1 Colour code conduits, boxes, and metallic sheathed cables.
- .2 Code with plastic tape or paint at points where conduit or cable enters wall, ceiling, or floor, and at 15 m intervals.

- .3 Colours: 25 mm wide prime colour and 20 mm wide auxiliary colour.

	Prime	Auxiliary
up to 250 V	Yellow	
up to 600 V	Yellow	Green
up to 5 kV	Yellow	Blue
up to 15 kV	Yellow	Red
Telephone	Green	
Other Communication Systems	Green	Blue
Fire Alarm	Red	
Emergency Voice	Red	Blue
Other Security Systems	Red	Yellow

2.8 FINISHES

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

PART 3 EXECUTION

3.1 PROTECTIVE DEVICE COORDINATION STUDY

- .1 Prior to the installation of the electrical distribution system, provide a protective device coordination study to confirm the exact interrupting capacities to all electrical equipment. All the protective must be coordinated with Hydro-Québec.

3.2 INSTALLATION

- .1 Do complete installation in accordance with CSA C22.1 except where specified otherwise.
- .2 Do overhead and underground systems in accordance with CSA C22.3 No.1 except where specified otherwise.

3.3 NAMEPLATES AND LABELS

- .1 Ensure manufacturer's nameplates, CSA labels and identification nameplates are visible and legible after equipment is installed.

3.4 CONDUIT AND CABLE INSTALLATION

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

3.5 LOCATION OF OUTLETS

- .1 Do not install outlets back-to-back in wall; allow minimum 150 mm horizontal clearance between boxes.
- .2 Change location of outlets at no extra cost or credit, providing distance does not exceed 3000 mm, and information is given before installation.
- .3 Locate light switches on latch side of doors.
 - .1 Locate disconnect devices in mechanical and elevator machine rooms on latch side of floor.

3.6 MOUNTING HEIGHTS

- .1 Mounting height of equipment is from finished floor to centreline of equipment unless specified or indicated otherwise.
- .2 If mounting height of equipment is not specified or indicated, verify before proceeding with installation.
- .3 Install electrical equipment at heights indicated in drawings.

3.7 COORDINATION OF PROTECTIVE DEVICES

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

3.8 SEISMIC

- .1 Install equipment in accordance with Section 01 10 10 – General Instructions – Electromechanical.

3.9 ARC FLASH STUDY

- .1 The Contractor shall provide an arc flash hazard analysis on new or modified equipment as part of the project.
- .2 The study shall be done in accordance with CSA Z462 standard.
- .3 The arc flash hazard analysis shall include the following:
 - .1 Identification of equipment locations where an arc flash hazard analysis is required.
 - .2 Collection of pertinent data at each equipment location, including:
 - .1 Transformer kVA ratings, including voltage, current, percent impedance, winding ratio, and X/R ratio, plus wiring connections.
 - .2 Protective device ratings, including current, time-current characteristics, settings, and time delays.
 - .3 Switchgear data, including conductor phase spacing, type of grounding, and appropriate working distances.
 - .4 Preparation of a single-line diagram model of the system.
 - .5 Preparation of a short-circuit study to determine the three-phase bolted fault current at each location.

COMMON WORK RESULTS – ELECTRICAL

- .6 Preparation of arc-flash calculations in accordance with NFPA 70E and IEEE 1584, including:
 - .1 Calculation of arc current in accordance with applicable guidelines.
 - .2 Determination of protective device total-clearing times based upon the time-current characteristics.
 - .3 Calculation of arc-flash incident energy level based on the protective device total-clearing times and appropriate working distance.
- .4 Installation of the stickers on all electrical equipment affected by this project.

3.10 FIELD QUALITY CONTROL

- .1 Load Balance:
 - .1 Measure phase current to panelboards with normal loads (lighting) operating at time of acceptance; adjust branch circuit connections as required to obtain best balance of current between phases and record changes.
 - .2 Measure phase voltages at loads and adjust transformer taps to within 2% of rated voltage of equipment.
 - .3 Provide upon completion of work, load balance report as directed in PART 1 - SUBMITTALS: phase and neutral currents on panelboards, dry-core transformers and motor control centres, operating under normal load, as well as hour and date on which each load was measured, and voltage at time of test.
- .2 Conduct following tests in accordance with Section 01 10 10 – General Instructions – Electromechanical.
 - .1 Power generation and distribution system including phasing, voltage, grounding and load balancing.
 - .2 Circuits originating from branch distribution panels.
 - .3 Lighting and its control.
 - .4 Motors, heaters and associated control equipment including sequenced operation of systems where applicable.
 - .5 Systems: fire alarm system and communications.
 - .6 Insulation resistance testing:
 - .1 Megger circuits, feeders and equipment up to 350 V with a 500 V instrument.
 - .2 Megger 350-600 V circuits, feeders and equipment with a 1000 V instrument.
 - .3 Check resistance to ground before energizing.
- .3 Carry out tests in presence of Engineer.
- .4 Provide instruments, meters, equipment and personnel required to conduct tests during and at conclusion of project.
- .5 Manufacturer's Field Services:

COMMON WORK RESULTS – ELECTRICAL

- .1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in PART 1 - SUBMITTALS.
- .2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.
- .3 Schedule site visits, to review Work, as directed in PART 1 - QUALITY ASSURANCE.

3.11 CLEANING

- .1 Clean and touch up surfaces of shop-painted equipment scratched or marred during shipment or installation, to match original paint.
- .2 Clean and prime exposed non-galvanized hangers, racks and fastenings to prevent rusting.
- .3 Hydro-Quebec vault: the electrical contractor shall perform a complete cleaning of the vault including the electrical equipment.

END OF SECTION

PART 1 GENERAL**1.1 RELATED SECTIONS**

- .1 Not used.

1.2 SECTION INCLUDES

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

1.3 REFERENCES

- .1 Publications in effect:
 - .1 Canadian Standards Association (CSA International)
 - .1 CAN/CSA-C22.2No.18.2 Wiring devices.
 - .2 CSA C22.2No.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).

PART 2 PRODUCTS**2.1 MATERIALS**

- .1 Pressure type wire connectors to: CSA C22.2No.65, with current carrying parts of copper sized to fit copper conductors as required.
- .2 Fixture type splicing connectors to: CSA C22.2No.65, with current carrying parts of copper sized to fit copper conductors 10 AWG or less.
- .3 Bushing stud connectors: to EEMAC 1Y-2 to consist of:
 - .1 Connector body and stud clamp for stranded round copper conductors bar.
 - .2 Clamp for stranded round copper conductors bar.
 - .3 Stud clamp bolts.
 - .4 Bolts for copper conductors bar.
 - .5 Sized for conductors bars as indicated.
- .4 Clamps or connectors for armoured cable, mineral insulated cable, flexible conduit, as required to: CAN/CSA-C22.2No.18.

PART 3 EXECUTION**3.1 INSTALLATION**

- .1 Remove insulation carefully from ends of conductors and:
 - .1 Apply coat of zinc joint compound on aluminum conductors prior to installation of connectors.

WIRE AND BOX CONNECTORS 0-1000 V

- .2 Install mechanical pressure type connectors and tighten screws with appropriate compression tool recommended by manufacturer. Installation shall meet secureness tests in accordance with CSA C22.2No.65.
- .3 Install fixture type connectors and tighten. Replace insulating cap.
- .4 Install bushing stud connectors in accordance with EEMAC 1Y-2.

END OF SECTION

PART 1 GENERAL**1.1 RELATED SECTIONS**

- .1 Section 26 05 20 – Wire and Box Connectors - (0-1000 V).
- .2 Section 26 05 34 – Conduits, Conduit Fastenings and Conduit Fittings.

1.2 PRODUCT DATA

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

PART 2 PRODUCTS**2.1 BUILDING WIRES**

- .1 Conductors: stranded for 8 AWG and larger. Minimum size: 12 AWG.
- .2 Copper conductors: size as indicated, with 600 V insulation of cross-linked thermosetting polyethylene material rated RW90 XLPE and RWU90 XLPE, Non Jacketed.

2.2 TECK 90 CABLE

- .1 Cable: in accordance with Section 26 05 00 - Common Work Results for Electrical.
- .2 Conductors:
 - .1 Grounding conductor: copper.
 - .2 Circuit conductors: copper, size as indicated.
- .3 Insulation:
 - .1 Ethylene propylene rubber EP.
 - .2 Cross-linked polyethylene XLPE.
 - .3 Rating: 1000 V.
- .4 Inner jacket: polyvinyl chloride material.
- .5 Armour: galvanized steel.
- .6 Overall covering: thermoplastic polyvinyl chloride, compliant to applicable Building Code classification for this project.
- .7 Fastenings:
 - .1 One hole steel straps to secure surface cables 50 mm and smaller. Two hole steel straps for cables larger than 50 mm.
 - .2 Threaded rods: 6 mm diameter to support suspended channels.
- .8 Connectors:
 - .1 Watertight, approved for TECK cable.

PART 3 EXECUTION**3.1 FIELD QUALITY CONTROL**

- .1 Perform tests in accordance with Section 26 05 00 – Common Work Results for Electrical.
- .2 Perform 2 tests using method appropriate to site conditions and to approval of Engineer and local authority having jurisdiction over installation.
- .3 Perform tests before energizing electrical system.

3.2 GENERAL CABLE INSTALLATION

- .1 Terminate cables in accordance with Section 26 05 20 – Wire and Box Connectors - (0-1000 V).
- .2 Cable Colour Coding: to Section 26 05 00 – Common Work Results for Electrical.
- .3 Conductor length for parallel feeders to be identical.
- .4 Lace or clip groups of feeder cables at distribution centres, pull boxes, and termination points.
- .5 Provide numbered wire collars for control wiring. Numbers to correspond to control shop drawing legend. Obtain wiring diagram for control wiring.

3.3 INSTALLATION OF BUILDING WIRES

- .1 Install wiring as follows:
 - .1 In conduit systems in accordance with Section 26 05 34 – Conduits, Conduit Fastenings and Conduit Fittings.

3.4 INSTALLATION OF TECK90 CABLE (0 -1000 V)

- .1 Group cables wherever possible on U channels.
- .2 Install cable exposed, securely supported by hangers and straps.

END OF SECTION

CONNECTORS AND TERMINATIONS**PART 1 GENERAL****1.1 RELATED SECTIONS**

.1 Not used.

1.2 SECTION INCLUDES

.1 Materials and installation for connectors and terminations.

1.3 REFERENCES

.1 Publications in effect:

.1 Canadian Standards Association (CSA International)

.1 CSA C22.2 No.41, Grounding and Bonding Equipment.

1.4 PRODUCT DATA

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

1.5 CERTIFICATES

.1 Obtain inspection certificate of compliance covering high voltage stress coning from Engineer and include it with maintenance manuals.

PART 2 PRODUCTS**2.1 CONNECTORS AND TERMINATIONS**

.1 Copper compression connectors to CSA C22.2 No.65-13 as required sized for conductors.

.2 Contact aid for aluminum cables where applicable.

PART 3 EXECUTION**3.1 INSTALLATION**

.1 Install stress cones, terminations, and splices in accordance with manufacturer's instructions.

.2 Bond and ground as required to CSA C22.2 No.41.

3.2 CLEANING

.1 Proceed in accordance with Section 26 05 00 – Common Work Results – Electrical.

.2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

PART 1 GENERAL**1.1 RELATED SECTIONS**

- .1 Not used.

1.2 REFERENCES

- .1 Publications in effect:
 - .1 American National Standards Institute (ANSI)/Institute of Electrical and Electronics Engineers (IEEE).
 - .1 ANSI/IEEE 837, Qualifying Permanent Connections Used in Substation Grounding.
 - .2 Canadian Standards Association, (CSA International).

1.3 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials in accordance with Section 26 05 00 – Common Work Results – Electrical.

PART 2 PRODUCTS**2.1 EQUIPMENT**

- .1 Grounding conductors: bare stranded copper, tinned, soft annealed, size as required.
- .2 Insulated grounding conductors: green, type RW-90 XLPE.
- .3 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.

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.

GROUNDING – SECONDARY

- .4 Make buried connections, and connections to conductive water main, electrodes, using copper welding by thermit process.
- .5 Use mechanical connectors for grounding connections to equipment provided with lugs.
- .6 Soldered joints not permitted.
- .7 Install bonding wire for flexible conduit, connected at both ends to grounding bushing, solderless lug, clamp or cup washer and screw. Neatly cleat bonding wire to exterior of flexible conduit.
- .8 Install flexible ground straps for bus duct enclosure joints, where such bonding is not inherently provided with equipment.
- .9 Install separate ground conductor to outdoor lighting standards.
- .10 Connect building structural steel and metal siding to ground by welding copper to steel.
- .11 Make grounding connections in radial configuration only, with connections terminating at single grounding point. Avoid loop connections.
- .12 Each electrical room and telecommunication room to be provided with one ground bus bar.

3.2 EQUIPMENT GROUNDING

- .1 Install grounding connections to typical equipment included in, but not necessarily limited to following list. Service equipment, transformers, switchgear, duct systems, frames of motors, motor control centres, starters, control panels, building steel work, generators, elevators and escalators, distribution panels, outdoor lighting.
- .2 All exposed non-current carrying metallic parts of electrical equipment and raceway systems will be grounded.
- .3 All conduits shall have a separate insulated bonding ground wire installed in them.

3.3 FIELD QUALITY CONTROL

- .1 Perform tests in accordance with Section 26 05 00 – Common Work Results - Electrical.
- .2 Perform ground continuity and resistance tests using method appropriate to site conditions and to approval of Engineer and local authority having jurisdiction over installation.
- .3 Perform tests before energizing electrical system.
- .4 Disconnect ground fault indicator during tests.

3.4 CLEANING

- .1 Proceed in accordance with Section 26 05 00 – Common Work Results – Electrical.
- .2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

PART 1 GENERAL**1.1 RELATED SECTIONS**

- .1 Not used.

PART 2 PRODUCTS**2.1 SUPPORT CHANNELS**

- .1 U shape, size 41 x 41 mm, 2.5 mm thick, suspended.

PART 3 EXECUTION**3.1 INSTALLATION**

- .1 Secure equipment to solid masonry, tile and plaster surfaces with lead anchors.
- .2 Secure equipment to poured concrete with expandable inserts.
- .3 Secure equipment to hollow masonry walls or suspended ceilings with toggle bolts.
- .4 Secure surface mounted equipment with twist clip fasteners to inverted T bar ceilings. Ensure that T bars are adequately supported to carry weight of equipment specified before installation.
- .5 Support equipment, conduit or cables using clips, spring loaded bolts, cable clamps designed as accessories to basic channel members.
- .6 Fasten exposed conduit or cables to building construction or support system using straps.
 - .1 One-hole steel straps to secure surface conduits and cables 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 at 50 mm on centre spacing.
- .9 Provide metal brackets, frames, hangers, clamps and related types of support structures where indicated or as required to support conduit and cable runs.
- .10 Ensure adequate support for raceways and cables dropped vertically to equipment where there is no wall support.
- .11 Do not use wire lashing or perforated strap to support or secure raceways or cables.
- .12 Do not use supports or equipment installed for other trades for conduit or cable support except with permission of other trade and approval of Engineer.

HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

- .13 Install fastenings and supports as required for each type of equipment cables and conduits, and in accordance with manufacturer's installation recommendations.

3.2 CLEANING

- .1 Proceed in accordance with Section 26 05 00 – Common Work Results – Electrical.
- .2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

PART 1 GENERAL**1.1 RELATED SECTIONS**

- .1 Not used.

1.2 REFERENCES

- .1 Canadian Standards Association (CSA International)
 - .1 CSA C22.1, Canadian Electrical Code, Part 1, Publication in effect.

1.3 SUBMITTALS

- .1 Provide submittals in accordance with Section 26 05 00 – Common Work Results - Electrical.
- .2 Product Data:
 - .1 Provide manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Provide shop drawings: in accordance with Section 26 05 00 – Common Work Results - Electrical.

PART 2 PRODUCTS**2.1 JUNCTION AND PULL BOXES**

- .1 Construction: welded steel enclosure.
- .2 Covers Flush Mounted: 25 mm minimum extension all around.
- .3 Covers Surface Mounted: screw-on flat covers.

PART 3 EXECUTION**3.1 JUNCTION AND PULL BOXES INSTALLATION**

- .1 Install pull boxes in inconspicuous but accessible locations.
- .2 Only main junction and pull boxes are indicated. Install additional pull boxes as required by CSA C22.1.

3.2 IDENTIFICATION

- .1 Equipment Identification: to Section 26 05 00 – Common Work Results for Electrical.
- .2 Identification Labels: size 2 indicating system name, voltage and phase or as indicated.

END OF SECTION

PART 1 GENERAL**1.1 RELATED SECTIONS**

- .1 Not used.

1.2 REFERENCES

- .1 Publications in effect:
 - .1 Canadian Standards Association (CSA International)
 - .1 CAN/CSA C22.2 No. 18.2, Wiring Devices.
 - .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, Nonmetallic Mechanical Protection Tubing (NMPT), A National Standard of Canada (February 2006).
 - .7 CSA C22.1– Canadian electrical code, part I (22nd edition), safety standard for electrical installations

1.3 SUBMITTALS

- .1 Provide submittals in accordance with Section 26 05 00 – Common Work Results - Electrical.
- .2 Product data: submit manufacturer's printed product literature, specifications and datasheets.
 - .1 Submit cable manufacturing data.
- .3 Quality assurance submittals:
 - .1 Test reports: submit certified test reports.
 - .2 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
 - .3 Instructions: submit manufacturer's installation instructions.

PART 2 PRODUCTS**2.1 CONDUITS**

- .1 Electrical metallic tubing (EMT): to CSA C22.2 No. 83, with couplings.
- .2 Rigid PVC conduit: to CSA C22.2 No. 211.2.
- .3 Flexible metal conduit: to CSA C22.2 No. 56, liquid-tight flexible metal.

2.2 CONDUIT FASTENINGS

- .1 One hole steel straps to secure surface conduits 50 mm and smaller.
 - .1 Two hole steel straps for conduits larger than 50 mm.

CONDUITS, CONDUIT FASTENINGS AND CONDUIT FITTINGS

- .2 Beam clamps to secure conduits to exposed steel work.
- .3 Threaded rods, 6mm diameter, to support suspended channels.

2.3 CONDUIT FITTINGS

- .1 Fittings: to CAN/CSA C22.2 No. 18, manufactured for use with conduit specified. Coating: same as conduit.
- .2 Ensure factory "ells" where 90 degrees bends for 25 mm and larger conduits.
- .3 Watertight connectors and couplings for EMT.
 - .1 Set-screws are not acceptable.

2.4 FISH CORD

- .1 Polypropylene.

PART 3 EXECUTION**3.1 MANUFACTURER'S INSTRUCTIONS**

- .1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheets.

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.
- .3 Surface mount conduits.
- .4 Use electrical metallic tubing (EMT) except in cast concrete.
- .5 Use rigid PVC conduit underground in corrosive areas.
- .6 Use flexible metal conduit for connection to motors in dry areas, connection to recessed incandescent fixtures without prewired outlet box, [connection to surface or recessed fluorescent fixtures, work in movable metal partitions.
- .7 Use liquid tight flexible metal conduit for connection to motors or vibrating equipment in damp, wet or corrosive locations.
- .8 Bend conduit cold:
 - .1 Replace conduit if kinked or flattened more than 1/10th of its original diameter.
- .9 Mechanically bend steel conduit over 19 mm diameter.
- .10 Field threads on rigid conduit must be of sufficient length to draw conduits up tight.
- .11 Install fish cord in empty conduits.

CONDUITS, CONDUIT FASTENINGS AND CONDUIT FITTINGS

- .12 Run 2-25 mm spare conduits up to ceiling space and 2-25 mm spare conduits down to ceiling space from each flush panel.
 - .1 Terminate these conduits in 152 x 152 x 102 mm junction boxes in ceiling space or in case of an exposed concrete slab, terminate each conduit in surface type box.
- .13 Dry conduits out before installing wire.

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 and/or 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 CLEANING

- .1 Proceed in accordance with Section 26 05 00 – Common Work Results – Electrical.
- .2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

CABLE TRAYS FOR ELECTRICAL SYSTEMS**PART 1 GENERAL****1.1 REFERENCES**

- .1 Canadian Standards Association (CSA International)
 - .1 CAN/CSA C22.1 No.126.1-09 (R2014), Metal Cable Tray Systems.
- .2 National Electrical Manufacturers Association (NEMA)
 - .1 NEMA VE 1-2009, Metal Cable Tray Systems.
 - .2 NEMA VE 2-2013, Cable Tray Installation Guidelines.

1.2 DOCUMENTS TO BE SUBMITTED

- .1 Submittals: provide submittals in accordance with Section 26 05 00 – Common Work Results – Electrical.
- .2 Product Data: submit manufacturer's product data sheets for cable tray indicating dimensions, materials, and finishes, including classifications and certifications.
- .3 Shop Drawings: submit shop drawings showing materials, finish, dimensions, accessories, layout, and installation details.
- .4 Identify types of cabletroughs used.
- .5 Show actual cabletrough installation details and suspension system.

PART 2 PRODUCTS**2.1 CABLETROUGH**

- .1 Cabletroughs and fittings: to NEMA, VE 1 and CAN/CSA C22.1 No. 126.1.
- .2 Ladder type, Class A to CAN/CSA C22.2 No.126.1.
- .3 Trays: extruded aluminum. 450 mm in width and 75 mm in depth dimensions.
- .4 Fittings: horizontal elbows, end plates, drop outs, vertical risers and drops, tees, wyes, expansion joints and reducers where required, manufactured accessories for cabletrough supplied.
- .5 Ground cable trays with #2 AWG bare copper conductor attached to each tray section in accordance with CEC requirements.
- .6 Provide fire stop material at firewall penetrations.

2.2 SUPPORTS

- .1 Provide splices, supports for a continuously grounded system as required.

CABLE TRAYS FOR ELECTRICAL SYSTEMS

PART 3 EXECUTION

3.1 INSTALLATION

- .1 Install complete cabletrough system in accordance with NEMA VE 2.
- .2 Support cabletrough with seismic supports.
- .3 Remove sharp burrs or projections to prevent damage to cables or injury to personnel.

END OF SECTION

DRY TYPE TRANSFORMERS UP TO 600 V PRIMARY**PART 1 GENERAL****1.1 SECTION INCLUDES**

- .1 Materials and components for dry type transformers up to 600 V primary, equipment identification and transformer installation.

1.2 REFERENCES

- .1 Canadian Standards Association (CSA International)
 - .1 CAN/CSA-C22.2 No.47-13, Air-Cooled Transformers (Dry Type).
 - .2 CSA C9-02(R2011), Dry-Type Transformers.
- .2 National Electrical Manufacturers Association (NEMA)
 - .1 NEMA ST-20 Dry-Type Transformer for General Applications.
- .3 Institute of Electrical and Electronics Engineers (IEEE)
 - .1 IEEE C57.110 Recommended Practice for establishing transformer capability when feeding non-sinusoidal load currents.
- .4 Underwriter's Laboratory (UL)
 - .1 UL 1561 Dry-Type General Purpose and Power Transformers.

1.3 SUBMITALS

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

1.4 STORAGE AND HANDLING

- .1 Storage and handling to be performed in accordance with Section 26 05 00 – Common Work results - Electrical

PART 2 PRODUCTS**2.1 TRANSFORMERS**

- .1 All prescribed transformers must be from the same manufacturer.
- .2 Model:
 - .1 Type: ANN.
 - .2 Three phases, power, primary and secondary voltage as indicated on drawings, 60 Hz.
 - .3 Voltage taps: standard.
 - .4 Insulations: 200 class, rise of temperature 150° Celsius.
 - .5 Neutral: 200 %.
 - .6 Shock resistance voltage: standard.

DRY TYPE TRANSFORMERS UP TO 600 V PRIMARY

- .7 Dielectric: standard.
- .8 Sound level: 60 dB.
- .9 Impedance at 17° Celsius: standard.
- .10 Enclosure: Ventilated, CSA type 2.
- .11 Installation: as indicated on the drawings.
- .12 Enclosure finish : comply with Section 26 05 00 – Électricité - Exigences générales concernant les résultats des travaux.

2.2 EQUIPMENT IDENTIFICATION

- .1 Provide equipment identification in accordance with Section 26 05 00 – Common Work Results - Electrical.
- .2 Label size: 7.

PART 3 EXECUTION**3.1 INSTALLATION**

- .1 The installing contractor shall install the transformer as per the manufacturer's recommended installation practices and comply with all applicable codes.
- .2 Ensure adequate clearance around transformer for ventilation.
- .3 Make sure that the transformer is level.
- .4 Remove shipping supports only after transformer is installed and just before putting into service.
- .5 Loosen isolation pad bolts until no compression is visible.
- .6 Make primary and secondary connections in accordance with wiring diagram.
- .7 Energize transformers after installation is complete.

END OF SECTION

PART 1 GENERAL**1.1 RELATED SECTIONS**

- .1 Section 26 28 16.01 – Air Circuit Breaker.
- .2 Section 26 28 16.02 – Moulded Case Circuit Breaker.
- .3 Section 26 36 23 – Automatic transfer switch

1.2 REFERENCES

- .1 Canadian Standards Association (CSA International)
 - .1 CAN/CSA-C22.2 No.31-14, Switchgear Assemblies.
- .2 Electrical and Electronic Manufacturers' Association of Canada (EEMAC)
 - .1 EEMAC G8-3.3, Metal-Enclosed Interrupter Switchgear Assemblies.

1.3 SHOP DRAWINGS PRODUCT DATA

- .1 Submit shop drawings and product data in accordance with Section 26 05 00 – Common Work Results - Electrical.
- .2 Indicate on shop drawings:
 - .1 Floor anchoring method and foundation template.
 - .2 Dimensioned cable entry and exit locations.
 - .3 Dimensioned position and size of bus.
 - .4 Overall length, height and depth of complete switchgear.
 - .5 Dimensioned layout of internal and front panel mounted components.
- .3 Indicate on product data:
 - .1 Time-current characteristic curves for air circuit breakers.

1.4 QUALITY ASSURANCE

- .1 Submit 3 copies of certified factory test results.

1.5 CLOSEOUT SUBMITTALS

- .1 Provide maintenance data for secondary switchgear for incorporation into manual in accordance with Section 26 05 00 – Common Work Results - Electrical.
- .2 3 copies maintenance data for complete switchgear assembly including components.

1.6 STORAGE AND PROTECTION

- .1 Store switchgear on site in protected, dry location. Cover with plastic to keep off dust.
- .2 Provide energized strip heater in each cell to maintain dry condition during storage.

LOW VOLTAGE SWITCHGEAR**PART 2 PRODUCTS****2.1 MATERIALS**

- .1 Switchgear assembly: to EEMAC G8-3.3 and CAN/CSA-C22.2 No.31.

2.2 RATING

- .1 Secondary switchgear: indoor, 347/600 V, 1200 A, 3 phases, 4 wire, 60 Hz, minimum short circuit capacity 100 kA (rms symmetrical) or as per the coordination study.

2.3 ENCLOSURE

- .1 Main incoming section to contain:
 - .1 Air circuit breaker sized as indicated.
 - .2 Digital check meter (c/w display) with kilowatt hours and peak demand readings (ammeter, voltmeter), c/w digital selector buttons on meter.
 - .3 Provision for electrical power supply authority metering.
- .2 Automatic transfer switch to contain:
 - .1 See section 26 36 23 - Automatic Transfer Switches for description.
 - .2 Copper bus, from main section to distribution sections including vertical bussing.
- .3 Distribution sections to contain:
 - .1 Moulded case circuit breaker sized as indicated.
 - .2 Copper bus, from main section to distribution sections including vertical bussing.
- .4 Blanked off spaces for future units.
- .5 Metal enclosed, free standing, floor mounted, dead front, indoor, CSA Enclosure 2 cubicle unit.
- .6 Ventilating louvres: vermin, insect and sprinkler proof.
- .7 Access from front.
- .8 Steel channel sills for base mounting in single length common to multi-cubicle switchboard.

2.4 BUSBARS

- .1 Three phase and full capacity neutral bare busbars, continuous current rating 1200 A self-cooled, extending full width of multi-cubicle switch board, suitably supported on insulators.
- .2 Main connections between bus and major switching components to have continuous current rating to match major switching components.
- .3 Busbars and main connections: 99.30%conductivity copper.
- .4 Provision for extension of bus on both sides of unit without need for further drilling or preparation in field.

LOW VOLTAGE SWITCHGEAR

- .5 Silver surfaced joints, secured with non-corrosive bolts and Belleville washers.
- .6 Identify phases of busbars by suitable marking.
- .7 Busbar connectors, when switchboard shipped in more than one section.

2.5 GROUNDING

- .1 Copper ground bus not smaller than 50 x 6 mm extending full width of multi-cubicle switchboard and situated at bottom, or as indicated on drawings.
- .2 Lugs at each end.

2.6 AIR CIRCUIT BREAKER

- .1 Section 26 28 16.01 – Air Circuit Breaker.

2.7 MOULDED CASE CIRCUIT BREAKERS

- .1 Section 26 28 16.02 – Moulded Case Circuit Breaker.

2.8 POWER SUPPLY AUTHORITY METERING

- .1 Separate compartment and metal raceway for exclusive use of power supply authority metering.
- .2 Mounting accessories and wiring for metering supplied by power supply authority:
 - .1 Potential transformers as per Hydro-Quebec standards.
 - .2 Current transformers as per Hydro-Quebec standards.
 - .3 Watthour meter.
 - .4 Demand meter with kW.h register.
 - .5 Ammeter.
 - .6 Voltmeter.
 - .7 Ammeter phase selector switch.
 - .8 Voltmeter phase selector switch.

2.9 FINISHES

- .1 Apply finishes in accordance with Section 26 05 00 – Common Work Results - Electrical.
 - .1 Cubicle exteriors gray.
 - .2 Cubicle interiors gray.

2.10 EQUIPMENT IDENTIFICATION

- .1 Provide equipment identification in accordance with Section 26 05 00 – Common Work Results - Electrical.
- .2 Nameplates:
 - .1 White plate, black letters, size 7.
 - .2 Complete switchgear labelled: As indicated on drawings.

LOW VOLTAGE SWITCHGEAR

- .3 Main cubicle labelled: "Main Draw-Out Breaker".
- .4 Distribution units labelled: As indicated on drawings.

2.11 SOURCE QUALITY CONTROL

- .1 Final factory test reports to be provided to Engineer for approval prior for the work to be done.

PART 3 EXECUTION**3.1 INSTALLATION**

- .1 Locate switchgear assembly as indicated and bolt to padmount.
- .2 Connect main secondary power supply to main breaker.
- .3 Connect load side of breakers in distribution cubicles to distribution feeders.
- .4 Check factory made connections for mechanical security and electrical continuity.
- .5 Run one grounding conductor bare copper in conduit as indicated on drawings.
- .6 Check trip unit settings against co-ordination study to ensure proper working and protection of components.

END OF SECTION

PANELBOARDS BREAKER TYPE**PART 1 GENERAL****1.1 RELATED SECTIONS**

- .1 Section 26 28 16.02 – Moulded Case Circuit Breakers.

1.2 SECTION INCLUDES

- .1 Materials and installation for standard and custom breaker type panelboards.

1.3 REFERENCES

- .1 Canadian Standards Association (CSA International)
 - .1 CSA C22.2No.29-11, Panelboards and enclosed Panelboards.

1.4 SHOP DRAWINGS

- .1 Submit shop drawings in accordance with Section 26 05 00 – Common Work Results - Electrical.
- .2 Drawings to include electrical detail of panel, branch breaker type, quantity, ampacity and enclosure dimension.

PART 2 PRODUCTS**2.1 PANELBOARDS**

- .1 Panelboards: to CSA C22.2 No.29 and product of one manufacturer.
 - .1 Install circuit breakers in panelboards before shipment.
 - .2 In addition to CSA requirements manufacturer's nameplate must show fault current that panel including breakers has been built to withstand.
- .2 208 V panelboards: bus and breakers rated for interrupting capacity as indicated.
- .3 Sequence phase bussing with odd numbered breakers on left and even on right, with each breaker identified by permanent number identification as to circuit number and phase.
- .4 Panelboards: mains, number of circuits, and number and size of branch circuit breakers as indicated.
- .5 Two keys for each panelboard and key panelboards alike.
- .6 Copper bus with neutral of same ampere rating as mains.
- .7 Mains: suitable for bolt-on-breakers.
- .8 Trim with concealed front bolts and hinges.

PANELBOARDS BREAKER TYPE

- .9 Trim and door finish: baked grey enamel.

2.2 BREAKERS

- .1 Breakers: to Section 26 28 16.02 – Moulded Case Circuit Breakers.
- .2 Breakers with thermal and magnetic tripping in panelboards except as indicated otherwise.
- .3 Main breaker: separately mounted on top or bottom of panel to suit cable entry. When mounted vertically, down position should open breaker.
- .4 Lock-on devices for breakers installed as indicated.

2.3 EQUIPMENT IDENTIFICATION

- .1 Provide equipment identification in accordance with Section 26 05 00 – Common Work Results - Electrical.
- .2 Nameplate for each panelboard size 4 engraved as indicated.
- .3 Nameplate for each circuit in distribution panelboards size 2 engraved as indicated.
- .4 Complete circuit directory with typewritten legend showing location and load of each circuit.

PART 3 EXECUTION**3.1 INSTALLATION**

- .1 Locate panelboards as indicated and mount securely, plumb, true and square, to adjoining surfaces.
- .2 Mount panelboards to height specified in Section 26 05 00 – Common Work Results - Electrical or as indicated.
- .3 Connect loads to circuits.
- .4 Connect neutral conductors to common neutral bus with respective neutral identified.

END OF SECTION

AIR CIRCUIT BREAKERS**PART 1 GENERAL****1.1 REFERENCES**

- .1 American National Standards Institute (ANSI)/Institute of Electrical and Electronics Engineers (IEEE)
 - .1 ANSI/IEEE C37.13-2008, Low Voltage AC Power Circuit Breakers Used in Enclosures.
- .2 Canadian Standards Association (CSA International)
 - .1 CSA C22.2 No. 5-13, Moulded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures (Tri-national standard with UL 489, and NMX-J-266-ANCE-2013).

1.2 SHOP DRAWINGS

- .1 Submit shop drawings in accordance with Section 26 05 00 – Common Work Results - Electrical.
- .2 Include time-current phase protection co-ordination characteristic curves for breakers.

PART 2 PRODUCTS**2.1 AIR CIRCUIT BREAKER**

- .1 Air circuit breaker to: ANSI/IEEE C37.13 and CSA C22.2 No.5.
- .2 Drawout type, 600 V class.
 - .1 Continuous current rating: 1200 A.
 - .2 Trip rating: 1200 A.
 - .3 Interrupting rating: 100 kA, rms symmetrical or as per the coordination study.
 - .4 Equipped with short instantaneous ground fault function.
- .3 Solid-state tripping system consisting of 1 current sensor per pole, 1 solid-state trip unit and self-powered trip actuator.
- .4 Breakers with normal stored energy, closing mechanism to provide quick-make operation for all ratings.
- .5 Breakers with motor charged, stored energy, quick-make, closing mechanism with emergency manual spring charging handle.
- .6 Breakers with on-off indicator and spring charged/discharged indicator.
- .7 Interlocks to prevent circuit breaker drawout when in closed position and to prevent closing unless fully engaged or in test position.

AIR CIRCUIT BREAKERS

- .8 Current limiting fuses in series and internally mounted up to 2000 A frame size. Provide in parallel to current limiting fuses, anti-single-phasing coils which act on tripper bar to prevent single phasing. Coordinate time current limiting characteristics of fuses with time current tripping characteristics of circuit breaker.

2.2 OPTIONAL FEATURES

- .1 Alarm switch.
- .2 Pilot light.
- .3 Key interlock.
- .4 Lockout devices.
- .5 Padlocking provision.
- .6 Operation counter.

2.3 CONNECTION TO THE EXISTING DELTA SYSTEM

- .1 The air circuit breaker will be connected to the building management system via the BACnet communication protocol. The system will be able to read the following characteristics:
 - .1 Voltage;
 - .2 Amp;
 - .3 Hertz;
 - .4 Power factor.

PART 3 EXECUTION**3.1 INSTALLATION**

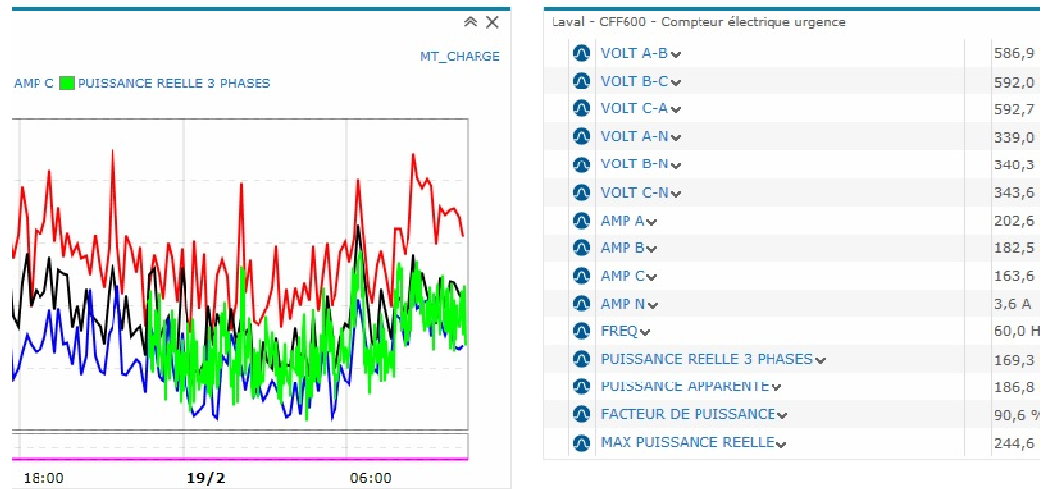
- .1 Install air circuit breakers as indicated.

3.2 enteliWEB INTEGRATION

- .1 All the information concerning the measurement information such as: low oil pressure, high temperature, low temperature, start failure, low fuel level, voltage alarm, short circuit, L-L voltage, L-N voltage, phases amps A-B-C-N, frequency, power factor, Kw, Kw maximum and Kva must be integrated in enteliWEB and be shown in a dashboard showing values. A detailed graphic should display the amperage history of the phases A-B-C-N, KW and the status of the transfer switch.

.2 Exemple de the required dashboard :

- Compteurs électriques



END OF SECTION

PART 1 GENERAL**1.1 RELATED SECTIONS**

Not used.

1.2 REFERENCES

Canadian Standards Association (CSA International).

- .1 CSA-C22.2 No. 5-13, Moulded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures (Tri-national standard with UL 489, and NMX-J-266-ANCE-2013).

1.3 SUBMITTALS

Submit product data in accordance with Section Section 26 05 00 – Common Work Results for Electrical.

PART 2 PRODUCTS**2.1 BREAKERS GENERAL**

Moulded-case circuit breakers and ground-fault circuit-interrupters: to CSA C22.2 No. 5.

Bolt-on moulded case circuit breaker: quick- make, quick-break type, for manual and automatic operation with temperature compensation for 40 degrees C ambient.

Common-trip breakers: with single handle for multi-pole applications.

Magnetic instantaneous trip elements in circuit breakers to operate only when value of current reaches setting.

- .1 Trip settings on breakers with adjustable trips to range from 3-8 times current rating.

Circuit breakers with interchangeable trips as indicated.

Circuit breakers to have the same symmetrical rms interrupting capacity rating as the panel.

2.2 ELECTRONIC BREAKERS

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

2.3 OPTIONAL FEATURES

Include:

- .1 Auxiliary switch.
- .2 Under-voltage release on breakers feeding motors.
- .3 On-off locking device.

2.4 CONNECTION TO THE EXISTING DELTA SYSTEM

The moulded case circuit located in the switchboard will be connected to the building management system via the BACnet communication protocol. The system will be able to read the following characteristics:

- .1 Voltage;
- .2 Amp;
- .3 Hertz;
- .4 Power factor.

PART 3 EXECUTION

3.1 INSTALLATION

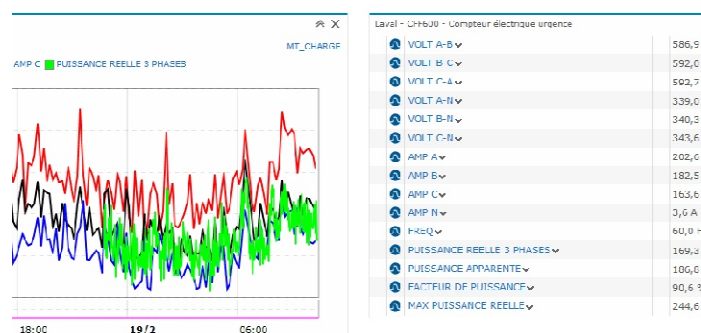
Install circuit breakers as indicated.

3.2 enteliWEB INTEGRATION

All the information concerning the measurement information such as: short circuit, L-L voltage, L-N voltage, phases amps A-B-C-N, frequency, power factor, Kw, Kw maximum and Kva must be integrated in enteliWEB and be shown in a dashboard showing values. A detailed graphic should display the amperage history of the phases A-B-C-N, KW and the status of the transfer switch.

Example of the required dashboard:

· Compteurs électriques



END OF SECTION

**** SEE FRENCH SECTION ****

AUTOMATIC TRANSFER SWITCHES**PART 1 GENERAL****1.1 RELATED SECTIONS**

- .1 Section 26 05 00 - Common Work Results - Electrical.
- .2 Section 26 23 00 – Low voltage switchboard.

1.2 REFERENCES

- .1 Canadian Standards Association (CSA International)
 - .1 CAN3-C13-[M83(R1998)], Instrument Transformers.
 - .2 CSA C22.2No.5-[02], Moulded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures (Tri-national standard with UL 489, tenth edition, and the second edition of NMX-J-266-ANCE).
 - .3 CSA C22.2No.178-[1978(R2001)], Automatic Transfer Switches.
- .2 American National Standards Institute (ANSI)/National Electrical Manufacturers Association (NEMA)
 - .1 ANSI/NEMA ICS 2-[2000], Industrial Control and Systems: Controllers, Contactors, and Overload Relays, Rated Not More Than 2000 Volts AC or 750 Volts DC.

1.3 SYSTEM DESCRIPTION

- .1 Automatic load transfer equipment to:
 - .1 Monitor voltage on phases of normal power supply.
 - .2 Initiate cranking of standby generator unit on normal power failure or abnormal voltage on any one phase below preset adjustable limits for adjustable period of time.
 - .3 Transfer load from normal supply to standby unit.
 - .4 Transfer load from standby unit to normal power supply [when normal power restored, confirmed by sensing of voltage on phases above adjustable pre-set limit for adjustable time period.
 - .5 Shut down standby unit after running unloaded to cool down using adjustable time delay relay.

1.4 SHOP DRAWINGS

- .1 Include:
 - .1 Make, model and type.
 - .2 Single line diagram showing controls and relays.
 - .3 Description of equipment operation including:
 - .1 Automatic starting and transfer to standby unit and back to normal power.
 - .2 Test control.
 - .3 Manual control.
 - .4 Automatic shutdown.

AUTOMATIC TRANSFER SWITCHES**1.5 CLOSEOUT SUBMITTALS**

- .1 Provide operation and maintenance data for automatic load transfer equipment for incorporation into manual specified in Section 26 05 00 - Common Work Results - Electrical.
- .2 Detailed instructions to permit effective operation, maintenance and repair.
- .3 Technical data:
 - .1 Schematic diagram of components, controls and relays.
 - .2 Illustrated parts lists with parts catalogue numbers.
 - .3 Certified copy of factory test results.

PART 2 PRODUCTS**2.1 MATERIALS**

- .1 Instrument transformers: to CAN3-C13.
- .2 Contactors: to ANSI/NEMA ICS2.

2.2 CIRCUIT BREAKER TYPE TRANSFER EQUIPMENT

- .1 Circuit Breaker Type Transfer Equipment: to CSA C22.2No.5.
- .2 Rated: 347/600 V, 60Hz, 1200 A, 4 wires, solid neutral.
 - .1 Fault withstand rating: kA symmetrical for 3 cycles with maximum peak value of 100 kA or as per the coordination study.
 - .2 One normal-three phases molded-case circuit breaker with thermal magnetic, mounted on common base, designed for double throw action, motor operated, mechanically held and interlocked, mounted CSA enclosure.
 - .3 One emergency – three phases moulded-case circuit breaker with thermal magnetic trip, motor operated, and interlocked.
 - .4 Circuit breakers:
 - .1 Trip free in closed position.
 - .2 Interrupting rating: 1200 A symmetrical.
 - .5 Dead front construction with access to relays and controls for inspection and maintenance, and manual operating lever for transfer switch.
 - .6 Auxiliary contact: to initiate emergency generator start-up on failure of normal power.
 - .7 Solid neutral bar, rated: 1200 A.
 - .8 Overlapping neutral contacts on contractor type transfer equipment.
 - .9 Switchable neutral pole on circuit breaker type equipment.

2.3 CONTROLS

- .1 Selector switch four position "Test", "Auto", "Manual", "Engine start".

AUTOMATIC TRANSFER SWITCHES

- .1 Test position - Normal power failure simulated. Engine starts and transfer takes place. Return switch to "Auto" to stop engine.
- .2 Auto position - Normal operation of transfer switch on failure of normal power; retransfers on return of normal voltage and shuts down engine.
- .3 Manual position - Transfer switch may be operated by manual handle but transfer switch will not operate automatically and engine will not start.
- .4 Engine start position - Engine starts but unit will not transfer unless normal power supply fails. Switch must be returned to "Auto" to stop engine.
- .2 Control transformers: dry type with 120V secondary to isolate control circuits from:
 - .1 Normal power supply.
 - .2 Emergency power supply.
- .3 Relays: continuous duty, industrial control type, with wiping action contacts rated 10 A minimum:
 - .1 Voltage sensing: 3 phase for normal power and on one phase only for emergency, solid state type, adjustable drop out and pick up, close differential, and over voltage protection.
 - .2 Time delay: normal power to standby, adjustable solid state, 0 to 60s.
 - .3 Time delay on engine starting to override momentary power outages or dips, adjustable..
 - .4 Time delay on retransfer from standby to normal power, adjustable 0 to 60s.
 - .5 Time delay for engine cool-off to permit standby set to run unloaded after retransfer to normal power, adjustable, 0 to 60s.
 - .6 Time delay during transfer to stop transfer action in neutral position to prevent fast transfer, adjustable, 5s intervals to 180s.
 - .7 Frequency sensing, to prevent transfer from normal power supply until frequency of standby unit reaches preset adjustable values.
- .4 Solid state electronic in-phase monitor.

2.4 ACCESSORIES

- .1 Pilot lights to indicate power availability normal and standby, switch position, green for normal, red for standby, mounted [in panel] [remote].
- .2 Plant exerciser: 168h timer to start standby unit once each week for selected interval but does not transfer load from normal supply. Timer adjustable 0-168h in 15 min intervals.
- .3 Auxiliary relay to provide N.O. and N.C. contacts for remote alarms.
- .4 Instruments:
 - .1 Digital true rms, indicating type accuracy, flush panel mounting:
 - .1 Voltmeter: ac, scale 0 to 750 V.
 - .2 Ammeter: ac, scale 0 to 2000 A.
 - .3 Frequency meter: scale 55 to 65 Hz.

AUTOMATIC TRANSFER SWITCHES

- .5 Voltmeter selector switch: rotary, maintained contacts, panel mounting type, round notched handle, four position, labelled "OFF-Phase A-Phase B-Phase C".
- .6 Ammeter selector switch: rotary, maintained contacts, panel mounting type, designed to prevent opening of current circuits, round notched handle, four position labelled "OFF - Phase A - Phase B - Phase C".

2.5 EQUIPMENT IDENTIFICATION

- .1 Provide equipment identification in accordance with Section 26 05 00 - Common Work Results - Electrical.
- .2 Control panel:
 - .1 For selector switch and manual switch: size 4 nameplates.
 - .2 For meters, indicating lights, minor controls: size 2 nameplates.

2.6 SOURCE QUALITY CONTROL

- .1 Complete equipment, including transfer mechanism, controls, relays and accessories factory assembled and tested.
- .2 Notify Consultant 7 days in advance of date of factory test.
- .3 Tests:
 - .1 Operate equipment both mechanically and electrically to ensure proper performance.
 - .2 Check selector switch, in modes of operation Test, Auto, Manual, Engine Start and record results.
 - .3 Check voltage sensing and time delay relay settings.
 - .4 Check:
 - .1 Automatic starting and transfer of load on failure of normal power.
 - .2 Retransfer of load when normal power supply resumed.
 - .3 Automatic shutdown.

PART 3 EXECUTION**3.1 INSTALLATION**

- .1 Locate, install and connect transfer equipment.
- .2 Check relays and solid-state monitors and adjust as required.

3.2 FIELD QUALITY CONTROL

- .1 Perform tests in accordance with Section 26 05 00 - Common Work Results – Electrical.
- .2 Energize transfer equipment from normal power supply.

AUTOMATIC TRANSFER SWITCHES

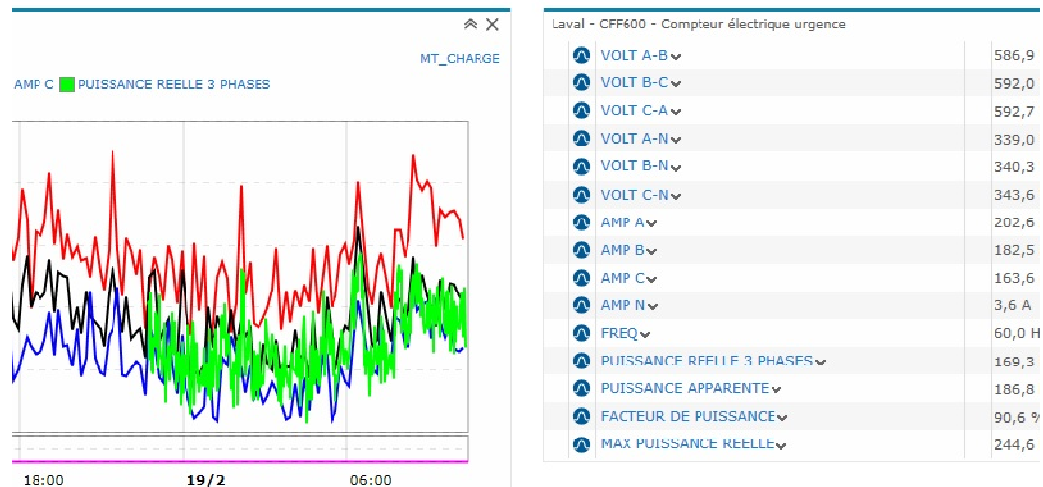
- .3 Set selector switch in "Test" position to ensure proper standby start, running, transfer, retransfer. Return selector switch to "Auto" position to ensure standby shuts down.
- .4 Set selector switch in "Manual" position and check to ensure proper performance.
- .5 Set selector switch in "Engine start" position and check to ensure proper performance. Return switch to "Auto" to stop engine.
- .6 Set selector switch in "Auto" position and open normal power supply disconnect. Standby should start, come up to rated voltage and frequency, and then load should transfer to standby. Allow to operate for 20 min, then close main power supply disconnect. Load should transfer back to normal power supply and standby should shutdown.
- .7 Repeat, at 1h intervals, 3 times, complete test with selector switch in each position, for each test.

3.3

enteliWEB INTEGRATION

- .1 All the information concerning the measurement information such as: short circuit, L-L voltage, L-N voltage, phases amps A-B-C-N, frequency, power factor, Kw, Kw maximum and Kva must be integrated in enteliWEB and be shown in a dashboard showing values. A detailed graphic should display the amperage history of the phases A-B-C-N, KW and the status of the transfer switch.
- .2 Exemple of the required dashboard:

- Compteurs électriques



END OF SECTION