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**CANADIAN SPACE AGENCY  
Renewal of water towers**

**Specifications – Electrical**

2021-04-30

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**CANADIAN SPACE AGENCY**  
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**SAINT-HUBERT (QUEBEC)**  
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**RENEWAL OF WATER TOWERS**

**DIVISIONS 01 AND 26**

**Authorized for tender**  
**April 30, 2021**



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**Part 1      General**

**1.1          DEFINITION**

- .1      The terms "Contractor", "General Contractor" and "Supervisor" refer to the person or entity designated as in contract with the Owner or Manager of the works.
- .2      The expressions "section", "sections", "each section", "each related section", "performed by section" and "supplied by section" refers to the firm responsible for the work of that section.
- .3      The terms "Engineer" and "Engineers" mean the firm or the Designated Representative of the engineering firm that issued the engineering section, specifications or plans related to the work covered by these documents.

**1.2          EXAMINATION OF THE SITES**

- .1      Before submitting its bid, each bidder must visit and inspect the site to become familiar with everything that could affect the works in any way. No later claims due to ignorance of local conditions will be considered by the Owner.

**1.3          VERIFICATION OF THE DRAWINGS AND SPECIFICATIONS**

- .1      Only drawings and specifications marked "for tender" should be used for the calculation of bids.
- .2      Check that the copy of the documents is complete: number of drawings, specifications' number of pages.
- .3      Specialties mentioned in the titles of the drawings are to facilitate the work of each section and should not be regarded as restrictive.
- .4      Drawings indicate the approximate placements of equipment. Each section must check the exact emplacements before any installation.
- .5      During bids, each section must study the mechanical and electrical drawings and specifications and compare them with Architectural and structural drawings and specifications and notify the Architect or Engineer at least five working days before submission of his tender of any contradictions, errors or omissions that can be observed.
- .6      During the execution of the works, notify the Architect or Engineer of any inconsistency, error or omission discovered before starting the work.
- .7      The Engineer reserves the right to interpret the contents of mechanical and electrical drawings and specifications.
- .8      No indemnity or compensation will be given for the displacement of ducts, pipes, etc., deemed necessary because of the Architecture, the structure or any other normal consideration.
- .9      In case of contradiction between the English version and the French version of the specification book, the French version will be considered as the official version.



#### 1.4 PRODUCTS USED FOR TENDERS AND EQUIVALENCY

- .1 Each section must prepare an overall price for a tender based only on the products described in the drawings and specifications. The person preparing the tender must not assume that the manufacturers' materials and equipment whose names appear on the "MANUFACTURER LIST" are automatically equivalent. Each section is solely responsible for the verification and validation of equivalence (and, where appropriate, of the special manufacturing requirements for it) of the product that will need to be used from a manufacturer on the list.
- .2 Where an asterisk (\*) is used in the manufacturer list at the request of the Customer, the relevant section must bid with the product from that manufacturer.

All modifications required by the usage of an equivalent material or device to that specified is to be performed at the cost of the division supplying the device, even if it applies to other specialties and if implications are discovered after the acceptance of the substitution request.

#### 1.5 SUBSTITUTION OF MATERIALS

- .1 Equipment and materials from manufacturers other than those mentioned in the manufacturer list may be substituted only after the presenting the tender, provided that they are approved according to the following procedure:
  - .1 Equivalency requests must be made by the relevant section only. They must be submitted within a maximum of fifteen business days following the signing of the contract. They must be accompanied by the following documents:
    - .1 Original tender for the specified products.
    - .2 Tender received for products to be substituted.
    - .3 Justification of the request.
    - .4 Proofs of equivalency.
  - .2 The submission of equivalency requests to periods other than that mentioned above will only be considered for reasons truly exceptional and extraordinary.
- .2 The main points of comparison are construction, performance, capacity, dimensions, weight, encumbrance, technical specifications, parts' availability, maintenance, delivery delays, the evidence of tried and true equipment in service and impact on other specialties.
- .3 Any changes caused by the use of an equivalent equipment or material is to the cost of the section that provided the equipment, even when it applies to other specialties, and even if the implications are made apparent after the substitution request is accepted.
- .4 Any request for substitution will be rejected if it were to impede or delay the execution of the works.

#### 1.6 QUEBEC TENDER OFFICE (BDSQ)

- .1 Each section whose work falls under the jurisdiction of the Submission Code of the Quebec Tender Office must submit a copy of their tender to the Engineer at the same time as their submission to the electronic submission system (TES) of the BDSQ.





### **1.7 IMPORTANT NOTE: SUPPLY AND INSTALL**

- .1 Supply and install all materials and equipment described in this specification and/or shown in the drawings, whether the term "supply and install" is used or not. See also the article "MINOR WORKS".

### **1.8 LAWS, REGULATIONS AND PERMITS**

- .1 All laws and regulations issued by the authorities having jurisdiction relating to the works described herein apply. Each section is required to comply with them without additional compensation.
- .2 Each section must obtain, at its expense, all necessary permits and certificates, pay all costs for drawing approvals and for inspections required by organisations having jurisdiction.
- .3 Submit to the Engineer a copy of the drawings bearing the seal of approval of the relevant inspection services.
- .4 Upon completion of the works, obtain and submit to the Owner, complete with a copy of the mailing slip for the package sent to the Engineer, all permits, approval certificates, and other obtained from the different offices and departments that have jurisdiction over this building.
- .5 Restrictions regarding tobacco usage:
  - .1 It is prohibited to smoke inside the building. Comply with restrictions applying to tobacco usage on the building property.
- .6 Discovery of dangerous materials:
  - .1 If materials applied by spray or trowel, likely to contain asbestos, polychlorinated biphenyls (PCBs), moulds or other designated hazardous materials are discovered during demolition, immediately stop work.
    - .1 Take corrective action and immediately notify the Owner.
    - .2 Do not restart work until written instruction is received.

### **1.9 TAXES**

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

### **1.10 MINOR WORKS**

- .1 Each section is required to provide all the required components and to do all the jobs which, although not specified in the estimate, are necessary for the operation of the equipment and to complete the work included in his contract.

### **1.11 TOOLS AND SCAFFOLDING**

- .1 On the worksite, provide the full range of tools required for the proper execution of the work. Also supply, erect, and remove the scaffolding required to perform the work.



## **1.12 COOPERATION WITH OTHER TRADES**

- .1 Each section must:
  - .1 Cooperate with other trades working in the same building or on the same project.
  - .2 Keep itself informed of additional drawings issued to these other trades.
  - .3 Ensure that these drawings do not come in conflict with its work.
  - .4 Organize its work so as not to interfere in any way with other work done in the building.
  - .5 Collaborate with the other sections to determine the location of accesses in walls and ceilings.
- .2 During the work, if necessary, the relevant section must remove and replace the tiles or access doors to reach its equipment and repair, at its own expense, all the damage it has caused. Protect the furniture and return the premises to a clean condition when the work is completed.

## **1.13 SCHEDULING OF OPERATIONS**

- .1 Plan and execute work in such a way as to minimally disturb the normal use of the building.
- .2 During the tender process of the contract, present a schedule for the work in the form of a bar graph (Gantt diagram), specifying the expected steps in the work until completion, including the project milestones. Once the schedule is reviewed and approved, take necessary action to ensure the project progresses on schedule. Do not modify the calendar without consulting the Engineer and the Owner.
- .3 Perform work during "normal work hours", Monday to Friday between 8 h and 18 h.
- .4 The sequencing of work and interventions must be proposed and validated by the Customer in advance according to the months of operation of the equipment concerned.
- .5 The operations are located in the technical spaces and must be organized to avoid the occupied spaces.

## **1.14 MATERIALS**

- .1 Unless otherwise indicated, use new materials clear of imperfections or defects, in the required quality, bearing the approval labels CSA, ULC, FM, AMCA, ARI and other according to the specialties.

## **1.15 PROTECTION OF WORKS AND MATERIALS**

- .1 Each section must protect its installations against all damage, from any cause, during the execution of works until the work is accepted in a definitive manner.
- .2 All equipment and materials stored on-site must be adequately protected, sheltered from bad weather, or any other possible damage.
- .3 At the end of each workday, seal with a screw cap or a suitable metal cap all openings in conduits of any kind.



## 1.16 WASTE MANAGEMENT

- .1 Perform a "waste audit" in order to determine what waste will be created by demolition and construction activities. Write a "waste reduction plan" and apply the principles of reduction, reuse and recycling of material where possible.
- .2 Provide a "source material triage program" to disassemble and collect, in an orderly manner, among the "general waste" the materials bound for "environmental disposal" listed below:
  - .1 Brick and Portland cement concrete.
  - .2 Corrugated cardboard.
  - .3 Drywall (unfinished).
  - .4 Steel.
  - .5 Wood (except painted, treated or laminated).
- .3 Submit logs of all material removed from site as "general waste" and "environmental disposal" with the following information:
  - .1 Time and date of removal operations.
  - .2 Description of the material and the quantity.
  - .3 Proof that the material was received at an approved waste treatment or disposal facility, as required.

## 1.17 SHOP DRAWINGS

- .1 Before fabrication or order of any component, submit a PDF copy by email for approval. Each drawing or data sheet should be submitted as a distinct PDF file. The PDF name should include the section, article and name of the article title in the specifications (example: 00\_00\_00\_0.00\_Equipment XYZ.pdf).
- .2 Drawings must include the dimensions, weight, number of attachment points, centre of gravity, seismic requirements, wiring schematics, capacities, controls schematics, curves, space requirements for maintenance and operation, and all other relevant information. If present, clearly indicate the location and dimensions of plumbing, heating, cooling, electrical, etc., connections by device. Each drawing must be verified, coordinated, signed, and dated by the relevant section before being submitted for approval.
- .3 All correspondence and/or document submitted via project management software by the Contractor or a Sub Contractor will not be reviewed and will not be considered as submitted/received.
- .4 Shop drawings must be relevant to the proposed equipment. The sheets from general catalogs are not accepted as shop drawings. Each drawing must be preceded by a title page indicating with the name of the project, the consultant's name, the date and identification tag of the equipment shown in the drawings and specifications. The title page must also include the revision number of the documents as well as the expected delivery date of the product. Drawings must be prepared and signed by the supplier. Drawings pulled from the supplier's website are not accepted.
- .5 Drawings for non-catalogued items must be specifically prepared for the project.



- .6 The verification of shop drawings is general and has the main purpose of avoiding as many errors as possible in manufacturing. This verification does not relieve the relevant section of its liability for errors, omissions, information, dimensions, quantity of equipment, etc., appearing in their drawings.
- .7 The verification of the shop drawings by the Engineers does not diminish the responsibility of the supplier to ensure that the equipment meets all applicable codes and standards, as well as the requirements in this specification.
- .8 When shop drawings are resubmitted or installed, inform the Engineer in writing of changes made, other than those requested by the Engineer.
- .9 When equipment is manufactured before the verification of the shop drawings by the Engineer, the Engineer may refuse the equipment. The Contractor is responsible for any costs associated with the refusal.
- .10 The drawings must be in French.

## **1.18 COORDINATION DRAWINGS**

- .1 General:
  - .1 Coordination drawings, also called composite drawing, are required in all cases where interference between different trades' works need such drawings to illustrate that the work is realizable.
  - .2 Coordination drawings must show clearly and precisely all the work involved, those of the relevant section and those done by others.
  - .3 Communicate with the Architect to procure Architectural base plans.
- .2 Description:
  - .1 Coordination drawings consist of dimensioned plans, to scale, indicating the position of the equipment, ducts, piping, valves and other accessories with cuts and details required, complete with piping and duct dimensions, locations of sleeves, openings, anchorages and supports, relative positions with structure, architectural works, mechanical and electrical work, the positioning of the access doors, the clearances required for the maintenance of equipment and all other disciplines.
  - .2 Each mechanical and electrical section must provide on their coordination drawings the details of their levelling bases and housekeeping pads.
- .3 Preparation:
  - .1 Each relevant section must make their coordination drawings and coordinate them with other disciplines.
  - .2 All drawings must be coordinated by the Contractor in collaboration with all sections.
  - .3 The coordination drawings for each sector must be submitted all at once for verification.



- .4 The section "HEATING – CHILLED WATER " is responsible for coordinating drawings with each section. These sections must provide all the data, diagrams, drawings and diagrams necessary for this coordination work.
  - .5 The section "HEATING – CHILLED WATER" must prepare a drawing with its own work with all data and dimensions necessary and incorporate all the information provided by the other sections.
- .4 Collaboration:
- .1 Close collaboration must exist between the sections in order to determine the location of their respective work and avoid incompatibilities.
- .5 Distribution of coordination drawings:
- .1 Before submitting the drawings to the Engineer for verification, the general Contractor and each of the sections must sign the plans.
  - .2 Submit to the Engineer two paper copies and one emailed digital PDF copy of the scaled coordination drawings signed by the General and Sub Contractors for verification.
  - .3 All correspondence and/or document submitted via project management software by the Contractor or a Sub-Contractor will not be reviewed and will be not be considered as submitted/received.
  - .4 Once commented on, the drawings will be corrected by the relevant section, and, if required, resubmitted.
- .6 Responsibility:
- .1 Each section is directly responsible for the placement and exact dimensions of openings, perforations and sleeves, the location of its equipment, pipes and ducts, whether the structural, Architectural or Engineering drawings are included or not.
  - .2 The Division 23 (section "HEATING – CHILLED WATER") must ensure the full coordination of its work with the coordination drawings.
  - .3 No compensation will be given for the modifications of the work for the purpose of coordination and integration of the electromechanical systems.
  - .4 Notwithstanding the responsibility of coordinating the integration, work cannot be implemented without prior verification of the coordination drawings. Each section must redo, at its expense, all work nonconforming to the coordination drawings without any compensation based on a misinterpretation of the scope and limitations of its work. Such misinterpretations do not relieve the relevant section of its responsibilities and obligations to provide complete and duly proven, ready to operate systems in fully integrated and in perfect condition.
  - .5 Verification of the coordination drawings by the Engineer serves to ensure that the technical requirements appear to be generally met. The Engineer does not check the quality of the coordination carried out by the Contractors.
- .7 Pre-existing work:
- .1 Coordination drawings should account for existing mechanical, electrical, structural and Architectural installations as well as planned work.



- .8 Coordination drawings are required for:
  - .1 Work performed by a section that could have implications on the work of another section.
  - .2 Places described in sections of the Divisions 22, 23, 25 and 26.
  - .3 This clause is not restrictive. Coordination drawings may be demanded for places deemed necessary.
  - .4 Coordination drawings of the heating plant, cooling towers, etc., are the responsibility of the Division 23 (section "HEATING – CHILLED WATER").
- .9 Original coordination drawings:
  - .1 At the end of the work a USB flash drive (containing the "dwg" and "3D Revit model", depending on program used) is to be included with each O&M manual and two paper copies of the as-builts are to be submitted to the Owner, for no additional charge, by each section.

#### **1.19 USING DIGITAL MODELS FOR COORIDNATION**

- .1 DWG plans:
  - .1 Where approved by the Owner Representative, the Engineer may provide to the contractor the digital DWG plans which were used to produce contractual documents.
  - .2 The Contractor must respect the "RESPONSIBILITY WAIVER – DWG PLANS" form included at the end of this section, understanding the limitations of using the digital plans, and complete and sign the form. Submit the duly completed form to the Engineer.
  - .3 The Engineer reserves the right to not provide the design files to the Contractor and/or related sections.
  - .4 The Engineer reserves the right to claim fees for the conversion of design files and specifications issued "for tender" to the format or edition requested by the Contractor and/or related section.

#### **1.20 TECHNICAL REQUESTS FOR INFORMATION**

- .1 The Contractor must submit all requests for information (RFIs) by email.
- .2 All correspondence and/or document submitted via project management software by the Contractor or a Sub Contractor will not be reviewed and will be not be considered as submitted/received.
- .3 Technical Requests for Information:
  - .1 Each question must be submitted using a standardized RFI form.
  - .2 Each PDF RFI form may include only one question.
  - .3 Each question must be assigned a sequential number to facilitate tracking.



- .4 The Contractor is responsible to review questions submitted by other sections to ensure that answers are not present in the contractual documents or previously provided, and to track progress of the RFIs to ensure work is not delayed.
- .5 The RFI form must include, at minimum:
  - .1 Submission date of the question.
  - .2 Name of the sender and recipient.
  - .3 Subject line.
  - .4 Clearly formulated question.
  - .5 Clips of the plans, specifications and photos relating to the question.
  - .6 Proposed solutions.
  - .7 Sufficient space for the engineer to respond to the question on the form.

### **1.21 DIGGING AND BACKFILLING**

- .1 The digging, backfilling and compaction, both inside and outside the building, are the responsibility of the Contractor under the supervision of all relevant mechanical and electrical sections.
- .2 For underground piping install the well tamped stone dust or sand as follows:
  - .1 200 mm (8") deep under the piping.
  - .2 150 mm (6") on each side.
  - .3 300 mm (12") above metal piping.
  - .4 600 mm (24") above the non-metallic piping.
  - .5 Any other thickness if the applicable regulations require more than those above.
  - .6 Or as recommended by the civil and/or structural Engineers.
- .3 The relevant section shall permit backfilling only once the inspection of the work is done and the authorization to proceed is given.

### **1.22 CONCRETE WORKS**

- .1 Consult the documents provided by the structural Engineer.

### **1.23 UP TO DATE DRAWINGS**

- .1 Each section must, at its expense, clearly indicate all changes, additions, etc., on a separate copy of the drawings and specifications, so as to have a complete and accurate copy of the work as executed and materials installed when the contract is completed. In particular, any displacement, even minor, of underground piping must be indicated with precision
- .2 This copy of the drawings must be kept up to date and be available on site.
- .3 Deliver these plans to the Owner at the end of the works.





## 1.24 OPERATION AND EQUIPMENT MAINTENANCE INSTRUCTION MANUALS

- .1 Each section must provide the Owner with four copies of manuals with detailed instructions for the operation and maintenance of all equipment and appliances included in his contract. Also provide a USB flash drive.
- .2 These manuals must contain:
  - .1 A list and illustration of all equipment components: pumps, fans, filters, controls, burners, alarm panels, lighting fixtures, transformer stations, generators, fire alarms, etc.
  - .2 A copy of the approved shop drawings, and as executed.
  - .3 The instructions for lubrication published by the manufacturers with the specifications of the oils and greases to be used and the frequency of lubrication.
  - .4 A diagram indicating the identification numbers of each valve, the normal operating position, the location, and flow direction for each of the piping systems.
  - .5 Prepare a properly attached glossary containing the number, location, and function of each valve. This glossary should contain a separate chapter for all shut down (or emergency) valves and main valves. The numbering code must be approved.
  - .6 A diagram of the controls with explanatory text.
  - .7 A list identifying access points to fire shutters and controls in the walls and ceilings.
  - .8 A list of legends of the piping, the piping identification codes, and ventilation systems.
  - .9 A list of the systems' final calibration values, as approved.
  - .10 A list of the different sub-Contractors with names, addresses, and phone numbers.
  - .11 A list of representatives and/or manufacturers of the installed equipment with names, addresses, and phone numbers.
  - .12 These instructions must contain all the graphics, curves, capacities and other data provided by the manufacturers concerning the operation and details of all mechanical and electrical equipment installed in the building.
  - .13 The fan graphics must clearly indicate the specified operating capacities and the required horsepower. These graphics should also indicate the serial number, fan model, and the operating speed.
- .3 The entirety must be written in French.
- .4 Divide each manual in the sections using blank sheets which have coloured tabs with the necessary identification. For example: "CENTRAL SYSTEM FAN". At the beginning of the manual, insert a table of contents with the title of each section and identification of the corresponding tab.
- .5 Each manual is covered with a black cardboard, allowing the binding of loose sheets with 215 mm x 275 mm (8" x 11") binding strips.
- .6 Submit one PDF copy to the Engineer for comment. Once approved, provide three (3) copies of the manual to the Owner and one to the Engineer.





- .7 These manuals should be submitted before final trials. Provide an empty section to later add calibration and commissioning reports.

### **1.25 CONCEALED WORK**

- .1 Do not conceal any work, material, such as pipes, boxes, etc. before the installation has been verified.
- .2 If a section does not comply with this requirement, it will have to pay the cost of all work required to proceed to the examination of the works.
- .3 Unless otherwise indicated, all piping and ducts must be concealed in partitions, walls, between floors, in ceilings, etc. The cost of all necessary leveling shall be borne by the Contractor.
- .4 Reread the articles "COOPERATION WITH OTHER TRADES" and "TESTING".

### **1.26 PLACEMENT OF PIPING AND DUCTS**

- .1 No pipe may be in contact with another. Allow a clearance of at least 15 mm (½") between them. No piping may be in contact with any part of the building. Take special care in the case of piping through a steel beam.
- .2 Take particular care to conserve space in vital areas, including in the case of piping rising along columns.
- .3 Any piping or ducting that may possibly be covered by insulation must be installed at a sufficient distance from walls, ceilings, columns or other piping, ducts, and equipment to facilitate the insulation of the pipe or duct.
- .4 Any piping or ducting placed horizontally must be installed to maximize the headroom of the area. This is of particular importance in rooms where ceilings are suspended, such as in parking lots and warehouses.
- .5 Exposed piping should be straight and generally, parallel to the framework.
- .6 Consider the symmetry with respect to the piping of the apparent equipment. Consult the Departmental Representative if necessary.
- .7 Before installing a pipe or duct, make note of the location of the other mechanical, electrical, Architectural and structural work to avoid interference, otherwise the relevant section will be required to move the pipe or duct at its expense.
- .8 When uninsulated piping passes through a wall or a poured concrete floor, install rigid insulation on the pipe before casting, after the installation of the pipe, so that the concrete does not come into contact with the pipe.

### **1.27 MANUFACTURERS' INSTRUCTIONS**

- .1 Install the various pieces of prefabricated materials and equipment, in accordance with the manufacturer's instructions. Obtain all relevant instructions.
- .2 Ensure the presence of the manufacturers' representative to attest the conformity of the installation.



## 1.28 LAYOUT AND ACCESS TO THE EQUIPMENT

- .1 Install the equipment so that they are easily accessible for maintenance, disassembly, repair, and moving.
- .2 Pay particular attention to the motors, belts, bushings, heat exchangers and boiler tubes, fittings, valves, controls, rotating shafts, etc.
- .3 If necessary, install access doors and accessories, such as extensions for the lubrication of bushings, etc.
- .4 Installation of equipment:
  - .1 Ensure that maintenance and disassembly can be done without having to move the connecting elements of the piping and ducts, by the use of union fittings, flanges or valves, and without the building structural members or other installations being obstacles. Dismantling must be possible without emptying networks and/or stopping the power supply to other equipment.
  - .2 The manufacturer plates and the seals or labels of the equipment standards and approvals organizations must be visible and legible once the equipment is installed.
  - .3 Provide fasteners and metal accessories of the same texture, colour and finish as the support metal to which they are attached. Use non-corrosive fasteners, anchors, and shims to secure the external and internal work.
  - .4 Ensure that the floors or tiles on which the equipment will be installed are level.
  - .5 Check fittings done at the factory and retighten them if necessary to ensure the integrity of the installation.
  - .6 Provide a means to lubricate the equipment, including Lifetime lubricated shaft housings.
  - .7 Connect the equipment's drainage piping to the drains.
  - .8 Align the edges of the pieces of equipment, as well as those of the rectangular identification plaques, and other similar parts with the building walls.
- .5 Future provisions:
  - .1 In any place where a space was left free for future use, ensure that this space remains free and install materials and equipment related to the work so that future connections of the added equipment can be done without needing to redo the floor, walls or ceiling, or even, a portion of the mechanical or electrical facilities.

## 1.29 PAINTING

- .1 Apply a base coat of sealant on any non-galvanized metal equipment or equipment supports. Before leaving the premises, touch up the base coat of all the damaged areas after removing any rust.
- .2 The base coat is a sandable grey coloured water based acrylic, this product can be used as a base layer and to paint cut or perforated sections of galvanized apparatus, equipment or equipment supports, Sierra Performance S30 Griptec from Rust-Oleum or Sierra Performance S71 as an aerosol.



- .3 Apply one coat of metal mordant and one additional coat of black paint to the soldered joints of uninsulated black steel pipes.
- .4 On insulated black steel pipes, apply one layer of metal mordant on the soldered joints.
- .5 Ensure that access doors of all kinds, including the opening convector panels, electrical panels, etc., are painted in the open position to ensure freedom of movement.
- .6 See section 23 05 53.01 – Identification of systems and mechanical equipment.

### **1.30 FRAMES, SUPPORTS, AND BRACKETS**

- .1 Each relevant section must provide and erect all frames and brackets required for the equipment it installs: reservoir tanks, panels, motors, starters, key switches, etc.
- .2 Install equipment at the height shown in the drawings, but never less than 75 mm (3") above the floor.
- .3 Build the supports and brackets out of welded and grinded steel. If necessary, install hooks, rails, eyelets, etc., to facilitate installation and removal of equipment.

### **1.31 SUPERVISOR**

- .1 Each section must retain and pay for the services of a competent and permanent supervisor or superintendent who must remain on site until the works are accepted, and, having full authority to represent the section. All communications, orders, etc. supplied by the Engineer or Contractor are considered as given directly to the company responsible for the work of the section.
- .2 Submit for approval the name, qualifications, and experience of the supervisor or superintendent. Following revisions made at the request by the Owner's representative, a lack of experience and qualifications relevant to the project will result in the mandatory replacement of the Superintendent by one meeting the requirements.
- .3 This supervisor cannot be removed from the work site without a valid reason and prior written approval.
- .4 Facilitate site inspections for the Owner and the Engineer at any time. During these visits, the supervisor must be available to them.

### **1.32 INSPECTIONS**

- .1 It is absolutely necessary before any inspection request to the Engineer, that the testing was previously conducted and successful.

### **1.33 TESTING**

- .1 Each section must cooperate with the other sections, so as to enable them to complete their tests within the time period allowed by the Contractor.
- .2 Once the test is finished, readjust all the equipment used for this test, to permit their proper operation.



- .3 General requirements:
- .1 The Engineer may assist, at any time, in any test they deem necessary.
  - .2 All tests must be performed to the satisfaction of the Engineer.
  - .3 The Engineer may require a test of installations and equipment before accepting them.
  - .4 For temporary trials, obtain written permission to operate and test installations and permanent equipment before being accepted by the Engineer.
  - .5 Give a written 48 h notice to the Engineer before the date of the test.
  - .6 Provide equipment, meters, material and staff required to run tests during the project until the acceptance of installations by the Engineer and pay all fees.
  - .7 If a piece of equipment or device does not meet the manufacturer's data or the specified performance during a test, immediately replace the defective unit or part and pay all expenses incurred by the replacement. Make adjustments to the system to achieve the desired performance. Cover all costs, including those of new tests and repair.
  - .8 Prevent dust, dirt, and other foreign matter from entering the openings of installations and equipment during testing.
  - .9 Provide to the Engineer a certificate or letter from the manufacturer confirming that each section of the installation was implemented to their satisfaction.
  - .10 Submit the written test results to the Engineer.
  - .11 The tests must be performed and accepted prior to the installation of the thermal insulation.
  - .12 Do not conceal or embed piping, conduits, or equipment before the tests are completed and accepted.
  - .13 By submitting the pipe or conduits to the test pressures required in each of the respective sections, take the necessary precautions to prevent the deterioration of equipment and accessories that cannot withstand such pressures.
  - .14 If it is impossible to test the entire installation in a single trial, it can be divided into several zones, each of which will be tested individually. The installation must be tested in several stages.
  - .15 Provide hydraulic pumps, air compressors, fans and other equipment necessary to perform all tests and related temporary work.
  - .16 Correct any leak detected. The defective part must be removed, repaired and the test is redone until the results are satisfactory.
  - .17 Whenever tests are conducted with water, place the pressure gauge at the highest point of the installation.
  - .18 Whenever tests are conducted with compressed air, use soap and water on the piping and apparatus to detect air leaks. The air temperature must be the same in the pressure readings. Install a thermometer for this purpose.
  - .19 For joints with caulking, it is not permitted to repair cracks using other materials.
  - .20 Provide two copies of a written report for each of the tests performed.



- .4 Special requirements:
  - .1 For details about the tests to perform, see the other sections of this specification.
  - .2 The presence of a section can be required in a test conducted by another section.
- .5 Factory tests:
  - .1 The Engineer and the Owner reserve the right to examine the equipment in the factory and attend factory trials described in this specification.
  - .2 Notify the Engineer and the Owner at least one week in advance of the date, time and place where the factory testing will take place.
  - .3 Submit two certified copies of the factory test reports to the Engineer.

### **1.34 "EARLY ACCEPTANCE", "WITH RESERVATION" AND "WITHOUT RESERVATION"**

- .1 Refer to general conditions and additional general conditions of the Client for the definition of "early acceptance", "with reservation " and "without reservation".

### **1.35 FINAL TESTING**

- .1 Each section must include all costs of final testing to the overall price in its tender. When the work is fully completed and settings, calibrations, and preliminary tests are successfully performed, run the final tests. Notify the Departmental Representative early enough to allow him to attend any of the tests judged necessary.
- .2 In order to demonstrate that the work is complete and executed satisfactorily, each piece of equipment must run for a minimum period of fifteen days and that, prior to acceptance "with reservation". During this period, all equipment must operate simultaneously and not consecutively. The operation must be in automatic mode and set on controls as planned in the operating sequences.

During this time, until the acceptance "with reservation", each section must perform the normal maintenance, in compliance with the maintenance manual supplied by the Contractor. The maintenance in the period between the acceptance "with reservation" and "without reservation" will be performed by the Owner if all relevant information has been provided and training has been completed. Otherwise the Contractor is to perform the maintenance.

### **1.36 EQUIPMENT CALIBRATION AND OPERATION**

- .1 General:
  - .1 Vibration tests are required to ensure that:
    - .1 The equipment operates within acceptable levels of vibrations.
    - .2 That vibrations or noises is not transmitted to the building structure.
  - .2 The company in charge of the work of each relevant section must use the services of a firm specialized in vibration analysis to conduct verifications and the work required by this article.



- .3 Before proceeding to any work, have the selection of the specialized firm, which must be retained to perform the analyses, approved. Submit the qualifications of the firm and the methodology to be used to perform the work.
  - .4 The work must be performed by a qualified Engineer or Technician.
  - .5 Provide a list of personnel who will be assigned to the project and a list of equipment and devices that will be used to perform the analyses.
- .2 Analyses:
- .1 Fans with a 1 HP or stronger motor must be analyzed.
  - .2 Pumps with a 3 HP or stronger motor must be analyzed.
  - .3 All systems modulated by a variable frequency speed controller must be analyzed over the entire range of operating frequencies.
  - .4 ANSI S3.29 and ISO 2631-2 standards must be followed for occupant comfort.
  - .5 If the acceptable values of vibrations are not available from the manufacturer of the equipment, use the RMS values (IRD 1988).
  - .6 Also refer to the chapter "Sound and Vibration Control" from ASHRAE.
  - .7 Minimum criteria:
    - .1 The amplitude parameter is the velocity (mm/sec.). The frequency range used must cover 600 cycles/min. (CPM) (10 Hz) to 600 000 cycles/min. (10 000 Hz).
      - .1 Overall value (unfiltered) for the entire frequency band of the device: maximum velocity of vibrations of 4 mm/sec.
      - .2 Filtered value (by frequency band): peak maximum velocity of 2 mm/sec.
- .3 General procedure:
- .1 General:
    - .1 All analyses should be performed only when the system is adjusted, calibrated, and functioning according to design requirements. The analyses can be performed during the running-in period.
    - .2 Provide a coordinated schedule with the Contractor's intervention and the Owner's activities for the testing of each piece of equipment.
    - .3 During the execution of the works, prepare and present to the Contractor and the Engineer preliminary reports for later discussion about the tests.
  - .2 Complete a visual check of all equipment to detect any obvious installation error correctable on-site.
  - .3 Ensure the freedom of movement of vibration isolators and that there are no short circuits caused by any obstruction, whether between the equipment or the anti-vibration equipment base and the structure of the building.
  - .4 Operate the equipment and check by hearing for any apparent malfunction.
  - .5 Check the bearings with a stethoscope. Defective bearings must be replaced immediately to avoid damaging the shaft or any other component.



- .6 Adjust and calibrate the equipment and the system so that the equipment vibration tests are performed at operating conditions.
- .7 Perform vibration tests.
- .4 Vibration testing procedure:
  - .1 The following steps must be followed to ensure that the tests are adequate.
  - .2 Determine the operating speed of the equipment. Using a tachometer or stroboscope, measure the rotational velocity of the driven equipment, as well as that of the motor.
  - .3 Determine and report the acceptable criterion in the report.
  - .4 Ensure the freedom of movement of vibration isolators.
  - .5 Operate the equipment and perform a visual and auditory verification to detect any apparent malfunctioning. Check bearings using a stethoscope. Defective, misaligned, and malfunctioning bearings must be corrected before continuing the test. If corrections are not made, the equipment will be considered unacceptable.
  - .6 Measure and record the bearing vibrations from the driven components as well as of the motors in horizontal, vertical and, if possible axial directions. There must be at least one axial measurement for each rotating equipment.
  - .7 Take a "Spike Energy" reading for each engine to determine its condition.
  - .8 Perform an analysis with respect to time on each engine to detect the probability of an electrical fault.
  - .9 Analyze the results and determine probable causes of the vibration.
  - .10 Proceed to the corrections required for operation within acceptable standards.
  - .11 Perform a new analysis to demonstrate that the equipment is operating within acceptable standards.
- .5 Analyses reports:
  - .1 Submit three (3) copies of the final report.
  - .2 The report should contain, among other things, the following information:
    - .1 For each analyzed system, a diagram identifying the measurement points.
    - .2 The vibration curves generated by the analyzer, indicating the date on it, the measuring range, the multiplier, the filter used, the identification of the analyzed equipment, and the measurement point.
    - .3 A table showing the velocity measurements in inches/s, as well as the "Spike Energy" for each of the reading points of the equipment.
    - .4 Conclusions from the data collected in relation to vibration criteria and the likely causes of the vibrations.
    - .5 Description of corrective actions done on each device.





- .6 Accepted companies:
  - .1 Hydraulique R&O Services Inc.
  - .2 Paul Gilles Vibrations
  - .3 Services Techniques Vibal Enr.
  - .4 Vibra K Consultants
  - .5 Vibro Mec JPB

### **1.37 INSTRUCTIONS TO THE OWNER**

- .1 Give to the representative of the Owner all the details on the operation of the equipment specified and installed under this contract. Provide qualified personnel to operate this equipment until the Owner's representative is adequately qualified to take charge of the operation and maintenance of said equipment.
- .2 This training can be combined with the final testing period provided that the Owner's team is available.
- .3 It is understood that such tests are not an automatic acceptance of equipment by the Owner.
- .4 The Owner has the right to do this test as soon as the work is considered sufficiently complete by the relevant Engineer's section, and considered in accordance with the drawings and specifications

### **1.38 WARRANTY**

- .1 Each section guarantees its work for a period of one year after acceptance "with reservation" of the work by the Owner. It is required to repair or replace, at its expense, any defects that would become apparent during this period and that, within 48 h after having been formally notified.
- .2 Manufacturers must offer a one (1) year warranty from the starting operation date or eighteen (18) months from the date of delivery to the site, as appropriate. The warranty must include the cost of materials and labour, and the replacement of defective parts and/or manufacturing defect. In the case of chillers, a five-year warranty applies if the refrigerant charge is contaminated due to the compressor motor burning.
- .3 The warranty is for a period greater than one (1) year (extended/or special warranties), for the areas indicated in the respective specifications.
- .4 This warranty is fully independent of the article of the Civil Code concerning the five (5) year warranty.
- .5 General conditions:
  - .1 It is expected that several contracts of the same discipline may be executed by different companies, that another company may have adjustments or tests to be executed on its work, that another company may have work to be done which are a subsequent phase of its work, that each company is committed, through this specification, to accept that its work is subject to all conditions listed above without changing the terms of the warranty.





- .6 The use of permanent equipment for temporary purposes does not relieve the relevant section of its responsibilities and obligations with respect to the acceptance and guarantee of its work.
- .7 The Engineer and/or the Owner reserve the right start the equipment and mechanical and electrical works without affecting the section's obligation to see to the full maintenance of its work up to acceptance "with reservation".

### **1.39 OBLIGATIONS DURING THE WARRANTY PERIOD**

- .1 During the warranty period, in addition to the obligations described in the specifications, the relevant section must provide any technical assistance required by the Engineer and/or Owner with respect to the operation of the installations and their improvements or adjustments as required.
- .2 The temporary use or testing with the goal of adjusting equipment or any other purpose, or permanent use by the Owner of the mechanical and electrical works before the final acceptance of the works should not be interpreted as evidence that such works are accepted by the Owner and does not alter the terms of the warranty. During this time period, the relevant section retains responsibility for the maintenance of installation. No claim for damage or failure of any part of the work put into use will be considered by the Owner.

### **1.40 MAINTENANCE DURING THE CONSTRUCTION PERIOD**

- .1 This article applies only in cases where the equipment is used during the construction period.
- .2 In addition to the responsibilities and obligations of each section, as to the temporary or permanent use of its installations and the use of equipment by the Owner or any other section during construction and before final acceptance of the work, the relevant section still remains as responsible for the operation, preventive maintenance, or other, of its equipment during the same period.
- .3 For these purposes, each relevant section should, in general manner, use its own labour and its own equipment and administer the direct supervision of these tasks.
- .4 However, the relevant section does not have the responsibility to provide the staff required for the equipment's operation during the construction period and before final acceptance of work. However, it remains responsible for the equipment during testing, the adjustment period, calibration, and maintenance of this equipment.
- .5 Supply of spare parts, such as filters, pump belts, fans, compressors and others, as well as providing the energy required for the equipment's operation during the construction period, are the Owner's responsibility.



## 1.41 RENOVATIONS

- .1 Continuous service:
  - .1 The following services are not to be interrupted without prior agreement with the Owner: telephone, electricity, lighting, intercom, fire alarms, sprinklers, fire protection water, aqueduct water, domestic water, sanitary plumbing, storm drainage, external drainage systems, ventilation – air-conditioning, etc.
  - .2 To ensure the continuity of services at during the hours required by the Owner, each relevant section must do all temporary works required, including labour and equipment.
  - .3 All major service cuts must be performed with the agreement of the Client and his seasonal needs.
- .2 Demolition:
  - .1 All demolition work is the responsibility of each concerned mechanical and electrical section.
- .3 Occupied rooms:
  - .1 The work is being done during the occupancy of rooms in the building, therefore, the work must be performed by stages in the rooms designated by the Owner.
  - .2 Perform work after prior agreement with the Owner and establish an acceptable work schedule with the Owner.
  - .3 Before undertaking work in a given area, ensure the availability of all equipment, tools, and labour required to perform the work without interruption.
  - .4 Follow the Owner's instructions as to the delivery to the worksite of its personnel and equipment.
  - .5 The Owner will indicate which staircase can be used and within what limits it is permitted to circulate in the present corridors.
  - .6 Take all necessary precautions to adequately protect existing installations in these areas.
  - .7 At no time must the traffic and the functioning of the building services be impeded. Follow all of the Owner's instructions.
- .4 Noise:
  - .1 Because of the proximity of the occupied premises, take all necessary measures to reduce the noise from construction and demolition.
- .5 Other restrictions:
  - .1 In order not to impair the function of the building that must remain in operation during construction:
    - .1 No vehicles other than trucks used to transport equipment has access to the site for the duration of the works.
    - .2 The use of all elevators is prohibited for construction purposes.



- .3 The interior circulation outside the boundaries of the services to be renovated must be minimized.
- .4 The access permitted to the various rooms, for demolition and construction purposes, must be determined by the Owner.
- .2 Obey the Owner's rules and directives about signs, announcements, advertisements, smoking, etc.
- .3 Limit equipment/materials to the area delimited set by the Owner for the storage of equipment. They must not congest the area. No part of the construction is to be burdened with a load of equipment that may be hazardous for it.
- .4 Follow the Owner's sterility standards.
- .6 Dismantling of existing piping, materials, and equipment. Unless otherwise instructed:
  - .1 Any removed pipe, fitting, or valve should not be reused.
  - .2 No device should be reused.
  - .3 The dismantling of pipes, materials and existing equipment is the responsibility of each concerned mechanical and electrical section unless indicated otherwise.
  - .4 All existing equipment and material removed and not re-used or not returned to the Owner, as described below, belong to the respective mechanical or electrical section who are to dispose of them as quickly as possible off site.
  - .5 Every concerned mechanical and electrical section must anticipate the cost of transporting waste off site and bear all related costs to dispose of it.
- .7 Reusing removed existing equipment and materials:
  - .1 Any equipment, material, or accessory to be removed and reused should be disassembled and transported carefully by the relevant section, be protected in appropriate packaging, and stored in a suitable location, shielding from weather and moisture.
- .8 Refurbishment of existing materials and equipment:
  - .1 See the article "DISMANTLING OF EXISTING PIPING, MATERIALS AND EQUIPMENT".
  - .2 See each section for a list of equipment.

#### **1.42 EQUIPMENT TO BE HANDED OVER TO THE OWNER**

- .1 Provide the Owner with the following items:
  - .1 Maintenance products and portable equipment indicated in the specification.
  - .2 The replacement materials indicated in the specification.
  - .3 The keys of all supplied equipment with locks.
- .2 Obtain receipts from the Owner for each of the items mentioned above and give them to the Engineer.



### **1.43 CERTIFICATION OF COMPLIANCE**

- .1 At the end of the work, each section must submit to the Engineer a certification of compliance stating that all work was performed following the drawings and specifications, and all applicable standards and codes. Refer to example form at the end of this section.
- .2 Submit the certificate to the Engineer at the same time as the request for an attestation of successful work completion.
- .3 Have an administrator from the company sign this form and affix their seal to it.

### **1.44 CLEANLINESS OF THE SYSTEMS**

- .1 Take every necessary measure and precaution to keep the inside of all of the ventilation systems' components and ducts clean. Otherwise, duct cleaning and sample analysis may be required at the Contractor's expense to ensure that the dust level does not exceed 0.75 mg/100 cm<sup>2</sup> in order to comply with the NADCA-ACR standards.
- .2 Duct cleanliness:
  - .1 See section 23 05 00 – CVCA – Common work results for HVAC.

### **1.45 CLEANING**

- .1 Clean the work area as work progresses. At the end of each workday, or more often if the Owner sees fit, remove the trash, carefully arrange the equipment to be used, and do the work site cleanup.
- .2 Once the work is completed, remove the scaffolding, temporary protective equipment, and surplus materials. Repair any defects observed at this stage.
- .3 Clean and polish glass, mirrors, hardware parts, ceramic tiles, chrome or enamel surfaces, laminated surfaces, aluminum, stainless steel or porcelain-enamel parts, floors and sanitary fixtures. Clean manufactured items in accordance with manufacturer's written instructions.
- .4 Clean the areas used for the execution of works and put them in a state at least equivalent to that which existed before the work began, the cleaning must be approved by the Owner.

### **1.46 SECURITY SCREENING**

- .1 All personnel involved in the execution of the work will be subjected to a security screening. Obtain the required authorisations, as per the requirements, for all personnel who are to be present on site.
- .2 Personnel will be screened every day the beginning of the workday, where they will be provided with a security pass they must carry on their person at all times, to be returned to security at the end of the day.



#### 1.47 SECURITY ESCORT

- .1 All personnel involved in the execution of the work will be required to be accompanied by a security officer when performing work in areas prohibited to the public during normal working hours. They must be accompanied in all areas when working during unoccupied times.
- .2 Submit all requests for escorts at least fourteen (14) days in advance. Where requests are made within the prescribed period, the cost of the security escort will be covered by the Departmental Representative. In the case of late requests, the cost will be the responsibility of the Contractor.
- .3 All requests for escorts may be cancelled, without penalty, if notice is give at least four (4) hours before the time. In the case of late requests, the cost will be the responsibility of the Contractor.

#### 1.48 BREAKDOWN OF COSTS

- .1 Before submitting a request for first payment, provide a detailed breakdown of costs relative to the contract, indicating also the overall price of the contract, as per the Engineer's instructions. Once approved by the Engineer, the breakdown will serve as a reference for payment installment calculations.
- .2 Where applicable, include the following lines, as well as the related amounts, in the monthly statements of each of the specialized Contractors:
  - .1 Mobilization.
  - .2 Insurance and surety bonds.
  - .3 Erection drawings.
  - .4 Hydraulic calculations for fire protection.
  - .5 One line per activity per sector, floor or phase.
  - .6 Tests and trials.
  - .7 Preliminary balancing reports (aeraulics and hydraulics).
  - .8 Final balancing report.
  - .9 Alignment of equipment (pumps, fans, etc.).
  - .10 Equipment start-up.
  - .11 Commissioning of systems.
  - .12 Seismic measurement compliance report.
  - .13 Demobilization.
  - .14 Operation and maintenance manual.
  - .15 Training.
  - .16 Drawings "as annotated by the Contractor".



**Part 2            Product**

- 2.1            NOT USED**
- .1    Not Used.

**Part 3            Execution**

- 3.1            NOT USED**
- .1    Not Used.



**COMPLIANCE CERTIFICATE**

Project: \_\_\_\_\_

Project address: \_\_\_\_\_

Discipline: \_\_\_\_\_

Specification section: \_\_\_\_\_

We certify that all materials and equipment used, as well as all apparent or concealed work that we have completed or that we have ordered completed, are in all aspects, compliant with the plans, specification, addenda, and changes prepared by the Engineers of Bouthillette Parizeau Inc., and with all applicable codes, laws and regulations in effect.

Company name: \_\_\_\_\_

Address: \_\_\_\_\_

Telephone number: \_\_\_\_\_

Signatory name: \_\_\_\_\_

Signature: \_\_\_\_\_

Signatory title: \_\_\_\_\_

**COMPANY SEAL**



**RESPONSIBILITY WAIVER – DWG PLANS**

The \_\_\_\_\_

Mr./Ms. \_\_\_\_\_  
Bouthillette Parizeau  
8580 de l'Esplanade Avenue, office 200  
Montréal (Québec),  
H2P 2R8

Project: \_\_\_\_\_

Subject: \_\_\_\_\_

We, \_\_\_\_\_, relieve Bouthillette Parizeau of any liability resulting from the use of their digital drawings for the development of contractual documents and our coordination, and/or detail drawings, or for any other use related to the project.

We also recognize and agree that:

- That the electronic drawings in question are provided to us for our use only and that they cannot be disseminated without the permission of Bouthillette Parizeau.
- That no assurance is given to us as to the consistency and accuracy of the information contained in it.
- That Bouthillette Parizeau cannot be held responsible should the digital drawings in question contain certain inaccuracies or errors.
- That Bouthillette Parizeau cannot be held responsible for any errors that results from the use of the drawings by us, our subcontractors, or our suppliers.
- That we will remain fully responsible for our submitted drawings or orders, according to contract stipulations.

In addition, we will undertake to verify in site the accuracy of the dimensions and information contained within the digital drawings, as if we had created them ourselves.

Signature: \_\_\_\_\_

Name (in print): \_\_\_\_\_

Address: \_\_\_\_\_

Telephone: \_\_\_\_\_

Email: \_\_\_\_\_

**END OF SECTION**





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- 1.3 DOCUMENTS REQUIRED FOR THE "UNRESERVED" ACCEPTANCE OF THE WORKS

### **PART 2 PRODUCTS**

- 2.1 NOT USED

### **PART 3 EXECUTION**

- 3.1 NOT USED



**Part 1 General**

**1.1 REQUIRED DOCUMENTS ON STARTUP OF THE SITE**

- .1 Those requirements must be completed before the first request for payment.

Description		Transmission dates
<b>1.1</b>	<b>Electrical</b>	
1.1.1	Licences and qualifications.	
1.1.2	List of subcontractors and their contact details.	
1.1.3	List of suppliers with addresses and contact persons.	
1.1.4	List of staff assigned to the project and their contact details (foreman, estimator, boss/project manager).	
1.1.5	Detailed breakdown of payment requests.	
1.1.6	Insurance proof	

**1.2 REQUIRED DOCUMENTS DURING THE SITE UNTIL THE RECEPTION OF ACCEPTANCE "WITH RESERVE"**

- .1 These requirements must be completed before the request for reception "with reserve" of the work (prior to obtaining it) in order to receive the work "with reservation".

Description		Transmission dates
<b>1.2</b>	<b>Generalities</b>	
1.2.1	Detailed schedule for implantation of commissioning.	
1.2.2	Detailed schedule of interventions in the existing.	
1.2.3	Systems verification and test certificates.	
1.2.4	All Construction Professional visit reports initialed as corrected when deficiencies have been reported.	
<b>1.3</b>	<b>Electrical</b>	
1.3.1	Complete verification and commissioning report for each piece of equipment.	
1.3.2	Certificates signed by the Contractor for all tests.	
1.3.3	Megohmmeter cable insulation report, as requested in section 26 05 00.01.	



**1.3 DOCUMENTS REQUIRED FOR THE "UNRESERVED" ACCEPTANCE OF THE WORKS**

.1 These requirements must be completed for the "unreserved" acceptance of the work

Description		Transmission dates
<b>1.4</b>	<p><b>General</b></p> <p>All the lists of deficiencies of the specialized contractors completed and cross-checked by the foreman of the project.</p> <p>Important Notes :</p> <ul style="list-style-type: none"> <li>- A signature from the project manager and the foreman will be required to certify that the work is being carried out.</li> <li>- Once the Company Representative has confirmed that the deficiencies are 100% complete, the Construction Professional will make a final inspection of the work with the latter and the Company. If further visits are required as a result of uncompleted corrections, the Contractor will be responsible for the costs involved.</li> </ul>	
<b>1.5</b>	<b>Electrical</b>	
1.5.1	List of deficiencies 100% completed and initialed by the project manager.	
1.5.2	Letters of guarantee.	
1.5.3	Operation and maintenance manual completed and accepted by the construction professional.	
1.5.4	Certificate of conformity duly signed.	
1.5.5	As-built drawings certified "as built".	

**Part 2 Products**

**2.1 NOT USED**

.1 Not used.

**Part 3 Execution**

**3.1 NOT USED**

.1 Not used.

**END OF SECTION**



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### **PART 2 PRODUCTS**

- 2.1 NOT USED

### **PART 3 EXECUTION**

- 3.1 STARTING THE MOTORS



## **Part 1            General**

### **1.1                SUMMARY**

- .1        This section contains:
  - .1        The precise requirements for Division 26.

### **1.2                ELECTRICAL PLANS AND SPECIFICATIONS**

- .1        Electrical plans show the approximate location of devices and conduits; the exact location to be determined by the Contractor on site. In addition, the Contractor is to verify the space available on site before installing the devices and conduits and coordinate the work and spaces available with other Divisions.
- .2        Do not dimension structural elements from the electrical plans.
- .3        No additional remuneration will be granted for the relocation of conduits and devices which are deemed necessary due to structure or any other normal consideration.
- .4        Detailed plans that are to be provided to the Contractor during the construction period will also form part of the contractual documents. If the Contractor needs detailed plans, he must ask the Consultant, in writing, at least fifteen (15) working days in advance.

### **1.3                SCOPE OF WORK**

- .1        Provide all materials, labor, connection, start-up, tools and appliances necessary for the complete performance of all work described in the specifications and/or shown on the plans.
- .2        This list is not exhaustive and any work described herein will be part of the project. The list of works will include, among others, but not limited to:
  - .1        Modifications to the 347/600 V three phase distribution network, normal and emergency.
  - .2        Modifications to grounding and bonding.
  - .3        Supply and connection of all motors and their controls.
  - .4        Connection of other equipment as outlined in the plans.
  - .5        All steel structural supports for conductors, cables, devices, and equipment.
  - .6        All specified tests.
  - .7        Connection of other special equipment.
  - .8        The networks of conduits and wiring supplying all equipment requiring electricity as well as all other systems.
  - .9        Removal of existing equipment that has become unnecessary and/or not reused.
  - .10       Demolition and removal of equipment deemed obsolete.
  - .11       Ensuring the continuity of all existing services.
  - .12       Return to the Owner the equipment described in the specifications, as well as any other equipment that the Owner wishes to recover. The Contractor shall clear the site of all items not collected by the Owner.



- .13 Unless otherwise indicated, the description of the work includes the supply, installation and connection of equipment and materials with all the accessories necessary for a complete installation.

#### **1.4 RESPONSIBILITY FOR WORK**

- .1 Any change made to the plans and specifications, without the written authorization of the Consultant, will render the Contractor concerned solely responsible for the malfunction of the systems. He will be responsible for any defect that may arise within a year after the final acceptance of the work.

#### **1.5 COORDINATION BETWEEN CONTRACTORS**

- .1 In order to ensure full coordination of all work by the building mechanical and electrical trades, in relation to the structure, coordination meetings will be held before any work is carried out on the site by the electrical division. In the event of adjustments made necessary by a lack of coordination on the part of one of the contractors, the one who caused the situation will be responsible vis-à-vis the other divisions.
- .2 The heating and plumbing contractor has priority over other contractors to run conduits first. However, the Consultant has the right to intervene if it is judged that the heating and plumbing contractor has not taken into account the requirements of others or delays the work.
- .3 Before proceeding with the purchase and installation of the electrical equipment required to connect any motors, the electrical contractor is responsible for verifying and validating with mechanical contractors the quantity, the supply rating and the type of control required for each of the motors. Any discrepancies between the information on the plans and specifications and that obtained from other contractors must be reported to the Consultant in order to establish the mitigation strategy required to meet the requirements for the electrical connection of the mechanical systems.
- .4 The above-mentioned coordination and verification is to be done by the various contractors before ordering each device, as well as before starting to perform any work. If an issue arises, the Contractor must submit the case to Consultant before starting any work. If this verification is not made by the Contractor and a difficulty arises, and the Contractor must incur additional costs to overcome it, these costs will be borne by the Contractor concerned.
- .5 Unless otherwise specified, the Contractor shall provide the necessary accessories to complete the installation of the elements he has manufactured on site.
- .6 No compensation will be awarded for the relocation of conduits, boxes, equipment, etc.
- .7 Each Contractor will coordinate their own openings, anchors, supports and other arrangements required for the installation of their works and will obtain the required information in time so as not to delay the execution of the project.



## 1.6 EQUIPMENT AND MATERIAL

- .1 Unless otherwise prescribed, use products from a single manufacturer in the case of materials and equipment of the same type or class. The equipment supplied will be from the same manufacturer to obtain maximum interchangeability between elements, among others for distribution panels, disconnectors, starters, and lighting devices of the same type.
- .2 In special locations, use appropriate products; thus, in humid, dusty, etc. places, the equipment must be impervious to water, dust, etc. Also, the ends of conduits entering boxes, switchboards and similar equipment must be sealed with a special compound for this purpose.
- .3 Installation and finishing:
  - .1 All installations must be carried out in such a way to facilitate inspections, repairs and maintenance.
  - .2 Contractor to install all exposed electrical installations in a symmetrical and straight manner. Also, where ceilings have acoustic tiles or panels of any kind, the Contractor must coordinate his work with that of other trades so that lighting fixtures, etc. occupy the space of a tile or row of tiles or are centered in relation to them.
  - .3 Unless otherwise indicated, where a device is mentioned this implies its supply along with its accessories, as well as the labor to install, connect and start it up.
  - .4 Carry out all minor work, whether or not specified in the plans and specifications, but which is customary and necessary for the completion of the contract.
  - .5 Apply a minimum of one coat of corrosion resistant primer to ferrous metal fasteners, brackets, hangers and site fabricated equipment (CGSB-IGP-140).
  - .6 Prime and touch up damaged surfaces to the satisfaction of the Owner.

## 1.7 QUALITY CONTROL

- .1 Perform tests for the following elements:
  - .1 Insulation resistance test:
    - .1 Measure, using a 1,000 V megohmmeter, the insulation value of circuits, distribution cables and devices with a nominal voltage between 350 and 600 V.
    - .2 Check the value of the resistance to ground before applying voltage.

## 1.8 TESTING

- .1 The electrical contractor must collaborate with other trades so as to enable them to carry out their tests within the time limits required by the project manager.
- .2 Once a test is completed, adjust all the devices relating to the test, so as to allow their correct operation.
- .3 General requirements:
  - .1 All tests must be done in the presence of the Engineer and to his satisfaction.



- .2 The Engineer may require tests of the installations and devices before accepting them.
  - .3 For temporary testing, obtain written permission to start up and test permanent installations and devices, prior to their acceptance by the Engineer.
  - .4 Give forty-eight (48) hours written notice to Engineer before date of testing.
  - .5 Provide the devices, meters, equipment and personnel required for the execution of the tests during the project until the installations are accepted by the Engineer and pay all the costs thereof.
  - .6 If a piece of equipment or a device does not meet the manufacturer's data or the performance specified during a test, replace without delay the defective unit or part and pay all costs incurred by this replacement. Make adjustments to the system to obtain the desired performance. Pay all costs, including re-testing and overhaul.
  - .7 Prevent dust, dirt and other foreign matter from entering openings of facilities and equipment during testing.
  - .8 Provide the Engineer with a certificate or letter from the manufacturers confirming that each system or part of the entire installation has been put in place to their satisfaction.
  - .9 Send the results of the tests in writing to the Consultant.
  - .10 The tests must be carried out and accepted before the installation of any thermal insulation.
  - .11 Do not hide or embed any conduit, accessory or device before the tests have been carried out and accepted.
- .4 Special requirements:
- .1 The presence of the electrical contractor may be required during tests carried out by another trade body.

## **Part 2 Products**

### **2.1 NOT USED**

- .1 Not used.

## **Part 3 Execution**

### **3.1 STARTING THE MOTORS**

- .1 Before starting motors for the first time, the electrical contractor must:
  - .1 Ensure the presence of the section that supplied the motor.
  - .2 Check the direction of rotation of the motors. If the rotation is wrong, make corrections and new connections on the engine and not in the starter, in order to respect the color code of the wiring.





- .3 Ensure free movement of layer shaft of any pump with mechanical seal before starting the engine.
  - .4 Check overload and overcurrent protections to ensure they are adequate.
  - .5 Check the insulation at "megger".
  - .6 Measure the voltage of the electric motor supply circuit.
  - .7 Check the voltage (volt) and current (amps) of each motor when at start-up and normal operation on each phase.
  - .8 Verify proper operation of control stations and selectors.
- .2 Under no circumstances shall motors be started unless the above-mentioned requirements having been carried out.

**END OF SECTION**



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## **Part 1        General**

### **1.1            SUMMARY**

- .1        This section includes:
  - .1        This section is about equipment, material, accessories and specific prescriptions for appropriate for the installation of grounding and bonding of electrical system and continuous grounded system.

### **1.2            REFERENCES**

- .1        American National Standards Institute /Institute of Electrical and Electronics Engineers (ANSI/IEEE):
  - .1        ANSI/IEEE 837-02 – IEEE Standard for Qualifying Permanent Connections Used in Substation Grounding.
- .2        Building Industry Consulting Service International (BICSI):
  - .1        Telecommunications Distribution Methods Manual (TDMM), 13<sup>th</sup> Edition.
- .3        American National Standards Institute/Telecommunications Industry Association:
  - .1        ANSI/TIA-606-B – Administration Standard for Telecommunications Infrastructure.
  - .2        ANSI/TIA-607-B – Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises.

### **1.3            ACTION AND INFORMATIONAL SUBMITTALS**

- .1        Submit the required documents and samples, in accordance with Section 01 00 10 - Mechanical and Electrical General Instructions.
- .2        Submit grounding compliance certificate complete with test results.

## **Part 2        Products**

### **2.1            EQUIPMENT**

- .1        Clamps for grounding of conductor: size as required to electrically conductive underground water pipe.
- .2        Insulated grounding conductors: green, copper conductors, size as indicated.
- .3        All grounding conductors shall be minimum gauge 6 AWG.
- .4        High-conductivity wrought copper compression lug, electro-tin plated, 600 V certified, for copper conductors:
  - .1        One (1) hole for conductors smaller than 1/0AWG.
  - .2        Two (2) hole long barrel for 1/0 AWG conductors or larger.
  - .3        Silicone bronze bolts.



- .5 Non-corroding accessories necessary for grounding system, type, size, material as indicated, including, but not necessarily limited to:
  - .1 Grounding and bonding bushings.
  - .2 Protective type clamps.
  - .3 Bolted type conductor connectors.
  - .4 Thermite welded type conductor connectors.
  - .5 Bonding jumpers, straps.
  - .6 Pressure wire connectors.
  - .7 Silicone bronze bolts.

## **2.2 EQUIPMENT IDENTIFICATION**

- .1 Identify grounding equipment in conformance with Section 26 05 53 – Identification of Electrical Equipment

## **2.3 RECOMMENDED MANUFACTURERS**

- .1 Grounding material:
  - .1 Burndy Corp
  - .2 IlSCO
  - .3 Thomas & Betts
  - .4 Or approved equivalent

## **Part 3 Execution**

### **3.1 EXAMINATION**

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for grounding equipment installation in accordance with manufacturer's written instructions.
  - .1 Visually inspect substrate in presence of Consultant.
  - .2 Inform Consultant of unacceptable conditions immediately upon discovery.
  - .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Consultant.
- .2 Perform tests in accordance with Section 01 00 10 – General Instructions for Electrical and Mechanical.
- .3 Measure and verify resistance to ground for all conductors to earth. Measure at ground bar using methods appropriate to local conditions. Resistance to ground must not exceed 5 ohms.
- .4 Perform all tests prior to energizing electrical system.



- .5 During testing, make all pertinent disconnections, such as a ground leakage indicator.

### 3.2 INSTALLATION

- .1 Install complete permanent, continuous grounding system including, electrodes, conductors, connectors, accessories as outlined in Chapter V – Electrical Code of Construction of Québec.
- .2 Arrange the grounding conductors in radial form and route all connections directly to a single common point grounding. Avoid loop connections.
- .3 Install connectors in accordance with manufacturer's instructions.
- .4 Protect exposed grounding conductors from mechanical injury.
- .5 Conduct by thermite welding with the help of permanent mechanical connectors or compressed connectors in wrought copper as per the ANSI/IEEE 837 standard, buried connections, connections to the electrodes and connections to conduct groundwater with good conductivity.
- .6 Use mechanical connectors for grounding connections to equipment provided with lugs.
- .7 Soldered joints not permitted.
- .8 Install flexible ground straps for bus duct enclosure joints, where such bonding is not inherently provided with equipment.
- .9 Grounding continuity for electrical systems:
  - .1 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.
  - .2 Install a ground conductor in concrete encased metallic conduits installed in slab on grade.
  - .3 Install ground conductor in all PVC conduits.
  - .4 Bond single conductor, metallic armoured cables to cabinet at supply end, and provide non-metallic entry plate at load end.
- .10 Grounding continuity:
  - .1 Ground secondary service pedestals, sanitary piping, rainwater piping and gas piping.
  - .2 Ensure conductive continuity across any electrically insulated part of a metallic domestic water distribution system. Conductive continuity across backflow preventers, water meters, pumps or other equipment shall be assured using bonding conductors.
  - .3 Connect building structural steel and metal siding to ground by welding copper to steel.
  - .4 Fuel piping and fuel tanks.



### **3.3 SYSTEM AND CIRCUIT GROUNDING**

- .1 Install system and circuit grounding connections to neutral at secondary side of service.

### **3.4 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, alternators, elevators and escalators, distribution panels, outdoor lighting, cable trays.
- .2 Ground motor frames or other vibrating equipment by installing a separate green insulated ground conductor in the flexible conduit servicing the equipment. Terminate the green insulated conductor to a rigid surface at each end of the flexible conduit.

### **3.5 LAY-IN MECHANICAL GROUND CONNECTOR**

- .1 Make connections using clamps as recommended by the manufacturer.
- .2 Use clamps or suitable size for size and type of mechanical piping.

**END OF SECTION**



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### **PART 3 EXECUTION**

- 3.1 SPLITTER INSTALLATION
- 3.2 JUNCTION, PULL BOXES AND CABINET INSTALLATION



**Part 1           General**

**1.1               SUMMARY**

- .1       This section includes:
  - .1       General and specific requirements for junction, pull boxes and cabinets.

**1.2               REFERENCES**

- .1       CSA Group (CSA):
  - .1       CSA C22.2 No. 40, Junction and Pull Boxes.
  - .2       CSA C22.2 No. 76, Splitters.

**1.3               ACTION AND INFORMATIONAL SUBMITTALS**

- .1       Provide shop drawings: for splitters, pull boxes, and cabinets in accordance with Section 01 00 10 – Mechanical and Electrical General Instructions.
- .2       Coordination drawings:
  - .1       Coordination drawings showing the location and dimensions of junction, pull boxes with identified circuits and distribution cables.

**Part 2           Products**

**2.1               SPLITTERS**

- .1       Construction: sheet metal enclosure, welded corners and formed hinged cover suitable for locking in closed position, of 14 gauge.
- .2       Terminations: connection blocks to match required size and number of incoming and outgoing conductors as indicated.
- .3       Spare Terminals: minimum three (3) spare terminals on each connection or lug block sized less than 400 A.
- .4       Continuous copper bars, complete with soldered terminals, capacity indicated in the plans.

**2.2               JUNCTION AND PULL BOXES**

- .1       Construction: 14 gauge minimum steel, welded steel cans, painted with a coat of paint applied with an electrostatic process, dimensions as indicated.
- .2       Covers Flush Mounted: 25 mm minimum extension all around.





- .3 Covers Surface Mounted: screw-on flat covers.
  - .1 General use and dimensions less than 400 mm with screw on flat covers.
  - .2 With terminals or the dimensions more than 400 mm with flat covers on hinges.
- .4 Without knockouts.
- .5 When apparent, TC type with frame, covered/concealed hinges, lock, no visible screws.
- .6 Boxes with large dimensions as 600 mm x 600 mm equipped with steel angle frame to form a rigid assembly, easily removable lids.

### **2.3 EQUIPMENT IDENTIFICATION**

- .1 Identify equipment as per the requirements of Section 26 05 53 – Identification of Electrical Equipment

### **2.4 ACCEPTABLE MANUFACTURERS**

- .1 Junction and pull boxes:
  - .1 Bel Products.
  - .2 Hammond.
  - .3 Hoffman.
  - .4 Iberville.
  - .5 Roger Girard.
  - .6 Or approved equivalent.

## **Part 3 Execution**

### **3.1 SPLITTER INSTALLATION**

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

### **3.2 JUNCTION, PULL BOXES AND CABINET INSTALLATION**

- .1 Install pull boxes in inconspicuous but accessible locations.
- .2 Mount cabinets with top not higher than 2 m above finished floor except where indicated otherwise.
- .3 Unless otherwise indicated, install cabinet with the top at 2m maximum from the finished floor.



- .4 Only main junction and pull boxes are indicated. The dimensions and locations are for information. The contractor is the only responsible to locate and size the junction and pull boxes. Install additional pull boxes as required by CSA C22.1.
- .5 Install all junction and pull boxes as indicated in the plans or where necessary.

**END OF SECTION**



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- 3.7 CONDUIT, BOX AND CABLE DESIGNATIONS



**Part 1 General**

**1.1 SUMMARY**

- .1 This section includes:
  - .1 The general requirements for the identification of electrical equipment.

**1.2 LABELS AND NAMEPLATES**

- .1 Use the identifications for devices as indicated on plans.

**1.3 ACTION AND INFORMATION SUBMITTALS**

- .1 Submit the required documents and samples, in accordance with Section 01 00 10 - Mechanical and Electrical General Instructions.
- .2 Shop Drawings: Nameplates for electrical equipment.

**Part 2 Products**

**2.1 EQUIPMENT IDENTIFICATION**

- .1 Fabrication:
  - .1 General characteristics: 3 mm thick plastic lamicoids, with square corners, lettering accurately aligned and machine engraved into core.
- .2 Sizes as follows:

Nameplate Sizes	Dimensions (L x H)	Dimensions: lettering height in mm or Arial font sizing			
		First Line	Second Line	Third Line	Fourth Line
1	300 mm x 100 mm	8 (30)	22 (80)	10 (36)	---
2	150 mm x 50 mm	6.5 (24)	13 (50)	6.5 (24)	---
3	100 mm x 30 mm	4.5 (16)	8 (30)	4.5 (16)	---
4	100 mm x 40 mm	4.5 (16)	8 (30)	5.5 (20)	4.5 (16)
5	75 mm x 35 mm	3 (12)	6 (22)	3 (12)	---
6	75 mm x 20 mm	6 (24)	3 (12)	---	---
7	50 mm x 10 mm	3 (12)	---	---	---

- .3 Colours:

Type	Lettering	Background
Normal "N "	Black	White
Conditional Emergency Power	White	Red
Emergency – Personal security	Red	White
Emergency - Delay	Blue	Yellow
UPS Power	White	Blue



## 2.2 OUTLET AND SWITCH IDENTIFICATION

- .1 Materials:
  - .1 Normal power: "P-Touch" type labels or approved equivalent. Size 9mm with black lettering on white tape.
  - .2 Emergency power: "P-Touch" type labels or approved equivalent. Size 9mm with red lettering on white tape.

## 2.3 EMERGENCY LIGHTING IDENTIFICATION

- .1 Materials:
  - .1 Identify all emergency lighting devices with a round red sticker 6 mm in diameter with a plasticized finish resistant to cleaning.

## 2.4 ELECTRICAL EQUIPMENT IDENTIFICATION

- .1 Materials:
  - .1 Normal power: "P-Touch" type labels or approved equivalent. Size 12mm with black lettering on white tape.
  - .2 Emergency power: "P-Touch" type labels or approved equivalent. Size 12mm with red lettering on white tape.
  - .3 UPS power: "P-Touch" type labels or approved equivalent. Size 12mm with blue lettering on white tape.

## 2.5 FIRE ALARM SYSTEM IDENTIFICATION

- .1 Materials:
  - .1 "P-Touch" type labels or approved equivalent. Size 9mm with black lettering on clear tape.

## 2.6 UNILINGUAL IDENTIFICATION

- .1 The labels used to identify the systems and elements must be written in French.

## Part 3 Execution

### 3.1 GENERAL REQUIREMENTS

- .1 Ensure manufacturer's nameplates, ULC and/or CSA labels and identification nameplates are visible and legible after equipment is installed.
- .2 The procedure for identifying equipment numbers is provided in the legend.
- .3 Circuit identification must be installed from each device and / or outlet, up to the supply power source.
- .4 Circuit numbers must be marked on all junction box covers using a black felt-tip pen.



### 3.2 NAMEPLATE LOCATIONS

- .1 Nameplates must clearly identify devices and must be located such that they will be visible and legible from the work floor.
- .2 Do not apply paint or heat insulation to nameplates.

### 3.3 OUTLETS, SWITCHES, AND ELECTRICAL DEVICES

- .1 Provide identification labels on all receptacle plates, switches and other similar devices.
- .2 Install tape across the width of the plate and turn the tape to the inside on each side of the plate.
- .3 Write circuit numbers on the inside of all outlet boxes and switches. Use white tape and secure it to the wiring inside the box.
- .4 The circuit number must be identified in full and include the distribution panel number followed by the circuit number (example: PS-1, 22).
- .5 For "hospital" grade outlets, install a size 7 lamicoïd plate above the outlet cover.

### 3.4 ELECTRICAL EQUIPMENT

- .1 Information to include on nameplates:

Equipment	Format	First Line	Second Line	Third Line	Fourth Line
Substation or Service Entrance	2	Source (room)*	Equipment number	Capacité/Tension	---
Départ	6	No d'équipement alimenté	Room	---	---
Panneau de distribution (PD)	3	Source (room)*	Equipment number	Voltage, upstream protection	---
Starter	6	Supplied equipment number	(If TX, supplied panel), (room)	---	---
Motor Control Centre (MCC)	3	Source (room) (*)	Equipment number	Voltage/Room number	---
Starter	5	Protection /HP	Supplied equipment number	Room number if different	---
Interlock (starter)	3	Supplied equipment number	Interlocked with	Panel number of alternate source	
Transfer switch (TS) and equipment supplied from two (s) sources	4		Equipment number	Voltage/Upstream protection	Supplied equipment number
Source 1	6	Source (room) (*)			
Source 2	6	Source (room) (*)			
Transformer (TR)	4	Source (room) (*)	Equipment number	kVA-Voltage	Supplied equipment number
Supply panel (P)	3	Source (room) (*)	Equipment number		---



Equipment	Format	First Line	Second Line	Third Line	Fourth Line
Non-fused safety switch (IT)	5	Source	Equipment number	(room), S.F. amps	---
Fused safety switch (IT)	5	Source	Equipment number	Fuse size	---
Individual Starter/contacteur (DEM)	5	Source	Equipment number	Protection/HP	---
Z32 Outlet	7	CCT (panel.)	---	---	---
(*) Only if the source is not in the same room.					

### 3.5 EXISTING SYSTEMS

- .1 With a black marker, write circuit numbers on all junction boxes of existing circuits to be kept or relocated.
- .2 When circuit wiring is removed up to a junction box, write on the box the number of the circuit with the inscription "RESERVED".

### 3.6 WIRING DESIGNATIONS

- .1 Conductors to be identified by the CSA C22.10-2007 colour codes.
- .2 In each fire alarm panel and in all junction boxes, each conductor will be identified by the circuit and loop number and an Electrovert Type Z identifier or approved equivalent suitable for the size of the wire; or by a sticker made from a printer designed for this purpose.

### 3.7 CONDUIT, BOX AND CABLE DESIGNATIONS

- .1 Colour coding of metallic conduits: Apply colour marks (paint or plastic tape) to cables or conduits every 15 m and at the points where they penetrate a wall, ceiling or floor.

System	Conduit colour
Emergency 480/600 V	Black
Emergency 120/208 V, 120/240 V	Orange
Normal 480/600 V	Green
Normal 120/208 V, 120/240V	Violet
25 kV in rigid threaded steel conduit	Galvanized steel
Fire Alarm	Red
Telecommunications	Blue
Security	Yellow
Guard call	White
Building controls, GBM, Ground	Natural Galvanized Steel



- .2 Add to the colour mark of the metal conduits a secondary colour marked with a 19 mm plastic tape coloured according to the colour codes indicated in the following table:

<b>Secondary colour</b>	
Mechanical	---
Medical	White
Building services (GBM)	Black
Ground	Green
Isolated ground	Green and yellow

- .1 Apply color markings (plastic tape) to cables or conduits at the points where they enter a wall, ceiling or floor, electrical / mechanical room, and at each box and piece of equipment.
- .3 Permanently and indelibly mark with colored plastic tape the conductors for each power circuit. The Contractor must identify the phases according to the colour codes indicated in the following table:

<b>Building conductor colour codes</b>	
Phase A	Red
Phase B	Black
Phase C	Blue
Neutral	White
Ground	Green
Isolated ground	Green and Yellow

- .1 On the visible face of box covers, indicate the circuit numbers and the name of the panel, or its function. Use a "P-Touch" type sticker or approved equivalent.

**END OF SECTION**

