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CANADIAN SPACE AGENCY
Ventilation of local 2B-100

Specifications – Electrical

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Project: 2020-134-1006

CANADIAN SPACE AGENCY

6767 ROUTE DE L'AÉROPORT

SAINT-HUBERT (QUÉBEC)

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VENTILATION OF LOCAL 2B-100

DIVISIONS 20 AND 26

For tenders
March 18, 2022

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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.

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.

.3 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.

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 be 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.

.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 "VENTILATION – AIR-CONDITIONING" 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 "VENTILATION – AIR-CONDITIONING" 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 Engineering drawings are included or not.

.2 The Division 23 (section "VENTILATION – AIR-CONDITIONING") 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 The placement of sleeves, openings and perforations expected in the walls, floors, beams and columns.

.2 Anchors.

.3 Work on the fire sprinkler and fire prevention.

.4 All ventilation work – air conditioning.

.5 All mechanical and electrical work in mechanical rooms, tunnels, wells, parking lots, and primary and secondary electrical rooms.

.6 All mechanical and electrical work in all places where space is particularly restricted.

.7 Work performed by a section that could have implications on the work of another section.

.8 Places described in sections of the Divisions 21, 22, 23, 25 and 26.

.9 This clause is not restrictive. Coordination drawings may be demanded for places deemed necessary.

.10 For all work on automatic sprinklers, the coordination drawings are the responsibility of the Division 21.

.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 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

1.22 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: fans, filters, controls, alarm panels, lighting fixtures, transformer stations, 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.

1.23 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".

1.24 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.

1.25 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.

1.26 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.

1.27 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.

1.28 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.

1.29 SLEEVES

.1 Unless otherwise indicated, all direct and indirect costs of the supply and installation of the sleeves are the responsibility of the concerned section.

.2 Refer to the prescriptions of the relevant sections of the mechanical and electrical specifications.

1.30 NEW OPENINGS, DRILLING IN WALLS, FLOORS, BEAMS, AND COLUMNS

.1 General:

.1 Unless otherwise indicated, all necessary openings for piping and ventilation and electrical conduits in the form of holes to be made are the responsibility of the General Contractor, including all direct and indirect costs, such as tracking and marking.

.2 The General Contractor is responsible for all damages and repair caused by the openings.

.3 Openings must be shown and located on the coordination drawings, located and identified on the site in a manner accepted by the Contractor and the structural Engineer before drilling.

.4 The openings must be sufficiently large to permit the laying of sleeves and thermal and acoustic insulation.

.5 Any drilling in the structure must be approved by the structural Engineer.

.6 Piercing holes with pneumatic or electric hammers by vibratory action as well as hand drilling and any other process by mechanical impacts are prohibited.

.7 In the concrete, drill the holes using a rotary water drill or any other equipment accepted by the structural Engineer.

.8 In the steel bridging, drill and reinforce openings, according to the guidelines of the structural Engineer.

.9 It is not allowed to drill in capitals and column projections or strips without special permission from the structural Engineer who will decide how to proceed.

.10 The General Contractor is responsible for all formwork required for the installation of rectangular ducts. Instructions related to dimensions, quantity, location, and testing must come from the related section. All additional steel framing and related work are also the responsibility of the General Contractor.

.11 The General Contractor must employ a specialised firm to scan and digitize the existing slabs, with Georadar (GPR) or similar technology, in order to determine the location of buried elements and services such as conduits, pipes, and reinforcements, before making openings in the existing concrete. Unless otherwise indicated, these elements must not be damaged when the opening is made.

.2 Round, square and rectangular openings in concrete:

.1 All new openings of 150 mm (6") or less are the responsibility of the concerned section, under the instructions of the structural Engineer.

.2 All new openings of more than 150 mm (6") must be made by the Contractor, at the expense of the latter, under the direction of the structural Engineer.

.3 Openings in concrete block walls and drywall:

.1 Sealing of openings by the Contractor.

.2 All new openings of 150 mm (6") and less are the responsibility of the section concerned, under the instructions of the structural Engineer.

.3 All new openings over 150 mm (6") must be made by the General Contractor, at his expense, under the directives of the Structural Engineer and the Architect.

.4 Openings to be drilled into the foundation walls and sump:

.1 By the Contractor, under the instructions of the structural Engineer.

.5 Concrete beams and columns:

.1 The drilling of new openings in the concrete beams and columns is prohibited.

.6 Steel beams and columns:

.1 The drilling of new openings in the steel beams and columns is prohibited.

.7 Steel bridging:

.1 All new openings required through the steel bridges for mechanical and electrical work and reinforcements required for this bridging must be done by the general Contractor. However, each mechanical section should locate and give the dimensions of the openings on the site, in a manner acceptable by the Contractor and the structural Engineer.

.8 Firestop and smoke deflector assemblies: complies with the standard CAN/ULC S115-05 – Standard method of fire tests of firestop systems. Place firestops and smoke deflectors around pipes, conduits, cables and other objects passing through firewalls in order to provide the same fire resistance as the neighbouring floors, ceilings and walls.

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 embedded 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.

.3 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 All systems modulated by a variable frequency speed controller must be analyzed over the entire range of operating frequencies.

.3 ANSI S3.29 and ISO 2631-2 standards must be followed for occupant comfort.

.4 If the acceptable values of vibrations are not available from the manufacturer of the equipment, use the RMS values (IRD 1988).

.5 Also refer to the chapter "Sound and Vibration Control" from ASHRAE.

.6 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.

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 TEMPORARY SERVICES

.1 From a mechanical and electrical point of view, temporary services include: electricity, telephone service, fire alarms, lighting, water supply, sanitation and drainage, heating, ventilation, controls, intercom systems, fire protection, refrigeration, and all the systems necessary for the completion of the works.

.2 All temporary services, as well as energy costs, are the responsibility of the general Contractor. Refer to general conditions of contract.

.3 No device that is not part of the permanent installation will be used for temporary services before the building is deemed complete.

.4 The temporary service period ends upon acceptance "with reservation".

1.42 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 outside the occupancy hours of the building. For example: electricity, water, etc.

.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.

1.43 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.

1.44 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.

1.45 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 cm² in order to comply with the NADCA-ACR standards.

.2 Duct cleanliness: see section 23 05 00 – CVCA – Common work results for HVAC.

1.46 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.

1.47 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.

1.48 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.

1.49 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 One line per activity per sector, floor or phase.
.5 Tests and trials.
.6 Preliminary balancing reports (aeraulics and hydraulics).
.7 Final balancing report.
.8 Alignment of equipment (pumps, fans, etc.).
.9 Equipment start-up.
.10 Commissioning of systems.
.11 Seismic measurement compliance report.
.12 Demobilization.
.13 Operation and maintenance manual.
.14 Training.
.15 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

TABLE OF CONTENTS

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
1.1	**Electrical**	
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	Copy of the request for supply/declaration of work (DA / DT).	
1.1.7	Delivery time for the equipment to be supplied.	
1.1.8	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
1.2	**Generalities**	
1.2.1	Detailed schedule for implantation of commissioning.	
1.2.2	Descriptive table of planned training, as prescribed in section 26 05 00.01.	
1.2.3	Detailed schedule of interventions in the existing.	
1.2.4	Systems verification and test certificates.	
1.2.5	All Construction Professional visit reports initialed as corrected when deficiencies have been reported.	
1.3	**Electrical**	
1.3.1	Shop drawings (complete).	
1.3.2	Training programs, as prescribed in section 26 05 00.02.	
1.3.3	Drawings and calculations of seismic protection sealed by an Engineer, as prescribed in section 26 05 49.	
1.3.4	Seismic installations compliance report sealed by an Engineer, as prescribed in section 26 05 49.	
1.3.5	Load balancing reports, as prescribed in section 26 05 00.01.	
1.3.6	Complete verification and commissioning report for each piece of equipment.	
1.3.7	Thermographic inspection reports, as prescribed in section 26 05 00.01.	
1.3.8	WHMIS Material Safety Data Sheets, as prescribed in section 26 05 00.01.	
1.3.9	Table summarizing the tests to be carried out within the framework of the project.	

Description		Transmission dates
1.3.10	Table of contents for operation and maintenance manuals.	
1.3.11	Certificates signed by the Contractor for all tests.	
1.3.12	Certificate of conformity of the entire system requiring fire resistance, end to end, complete with all components, by the cable manufacturer.	
1.3.13	Megohmmeter cable insulation report, as requested in section 26 05 00.01.	
1.3.14	Report of commissioning motor control centers.	
1.3.15	Commissioning Report variable frequency drives.	
1.3.16	Report of the earth resistance of the network.	
1.3.17	Verification sheets, certificates, calculations, erection drawings requested from the different sections of the estimate.	

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
1.4	**General** All the lists of deficiencies of the specialized contractors completed and cross-checked by the foreman of the project. Important Notes : – A signature from the project manager and the foreman will be required to certify that the work is being carried out. – 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.	
1.5	**Electrical**	
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	Equipment thermography report.	
1.5.6	As-built drawings certified "as built".	
1.5.7	List of spare parts and proof of transmission thereof.	
1.5.8	List of training sessions given with date and signature of participants.	
1.5.9	List of special tools.	

Part 2 Product

2.1 NOT USED

.1 Not used.

Part 3 Execution

3.1 NOT USED

.1 Not used.

END OF SECTION

TABLE OF CONTENTS

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 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 the 120/208 V three phases distribution network, normal and emergency.

.3 Modifications to grounding and bonding.

.4 Supply and connection of electric heating appliances, connection only to the coils of the HVAC systems.

.5 Connection of other equipment as outlined in the plans.

.6 All steel structural supports for conductors, cables, devices and equipment.

.7 All specified tests.

.8 Temporary installations required to ensure continuity of services.

.9 Connection of other special equipment.

.10 The networks of conduits and wiring supplying all equipment requiring electricity as well as all other systems.

.11 Duct and wiring networks supplying all equipment requiring electricity as well as all other systems.

.12 Fasteners, supports, seismic protection, as well as all seismic fixings of equipment.

.13 Removal of existing equipment that has become unnecessary and/or not reused.

.14 Ensuring the continuity of all existing services.

.15 Verification and coordination of all existing services with the Owner, utility companies and the services of other specialties concerned.

.16 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.

.17 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 PARASISMIC RESTRICTIONS

.1 The Contractor is responsible for the compliance of the seismic protection systems required by his work.

.2 Refer to section 26 05 49 – Seismic protection systems.

1.6 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.

1.7 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 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.
- .3 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.
- .4 Apply a minimum of one coat of corrosion resistant primer to ferrous metal fasteners, brackets, hangers and site fabricated equipment (CGSB-IGP-140).
- .5 Prime and touch up damaged surfaces to the satisfaction of the Owner.

1.8 EQUIPMENT PROTECTED BY SPRINKLERS

.1 The electrical equipment inside perforated boxes installed in a room protected by sprinklers must be protected by hoods or non-combustible shielding arranged in such a way as to interfere as little as possible with the protection offered by the sprinklers.

1.9 LOCATION OF OUTPUTS AND SOCKETS

.1 The location of outlets and outlets may be changed without additional charge or credit, provided that the displacement does not exceed 3000 mm and that notice is given before installation.

.2 Install outlets located back-to-back in a common wall, leaving a horizontal clearance of at least 300 mm between the boxes.

1.10 MOUNTING HEIGHTS

.1 Unless otherwise indicated, measure all heights from the center of the appliances to the level of the finished floor. In rooms where there is a raised floor, measure against the finish of that floor.

.2 In cases where the mounting height is not indicated, check with competent persons before beginning the installation.

.3 Unless otherwise indicated, install equipment at height indicated below.

.1 Wall outlets:

.1 In general: 400 mm

.2 Above a worktop or its backsplash: 1065 mm

.3 In mechanical installation rooms: 1065 mm

1.11 ON-SITE QUALITY CONTROL

.1 Load balancing:

.1 Measure the phase current of the distribution panels under normal loads upon acceptance of the work. Distribute the branch circuit connections so as to obtain the best balance of current between the various phases and note the modifications made to the original connections.

.2 Once the measurements are complete, submit the load balancing report prescribed in article "DOCUMENTS/SAMPLES TO BE SUBMITTED FOR APPROVAL/INFORMATION" of part 1. This report must indicate the operating currents under normal loads recorded on phases and neutrals of distribution panels, dry-type transformers and motor control centers. Specify the time and date each load was measured, as well as the circuit voltage at the time of the measurements.

.2 Perform tests on the following:

.1 Electricity distribution network, including phase, voltage and grounding control, and load balancing.

.2 Circuits from load center panels.

.3 Motors, heaters and associated controls/regulation, including sequential system operation controls if applicable.

.4 Measurement of insulation resistance:

.1 Measure, using a 1000 V megohmmeter, the insulation value of circuits, arteries and devices with a nominal voltage between 350 and 600 V.

.2 Check the value of the earth resistance before energizing.

.3 Provide measuring devices, indicators, devices and personnel required for the execution of the tests during the performance of the work and upon completion of the latter.

1.12 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.

1.13 START-UP OF THE INSTALLATION

.1 Instruct operating personnel in the mode of operation and maintenance methods of the installation, its devices and its components.

.2 Provide these services for a sufficient period of time, allowing the number of visits necessary to start up the equipment and ensure that the operating personnel are familiar with all aspects of their maintenance and operation.

Part 2 Product

2.1 NOT USED

.1 Not used.

Part 3 Execution

3.1 NOT USED

.1 Not used.

END OF SECTION

TABLE OF CONTENTS

Part 1 General

1.1 SUMMARY

.1 This section contains:

.1 This section specifies the specific requirements of the Division 26 project.

1.2 ADDITIONNEL DRAWING AND SPECIFICATION

.1 Note that the Canadian Space Agency section is also an integral part of this Division.

1.3 WORK PROCEDURE AND TIMETABLE

.1 The Contractor shall refer to the documents of the Canadian Space Agency and follow the established construction stages as well as the work procedure.

.2 The Contractor must take into account that the establishment will remain operational during the work.

.3 The Contractor will do all the preparatory work so that the construction stages are followed and he will ensure the continuity of the existing services on either side of the place where there will be work to be done, so that the occupied premises, the equipment, as well as the electrical and mechanical systems are always operational.

.4 The price for the execution of all work following the work procedure must be included in the tender. No additional remuneration will be granted thereafter for this purpose.

.5 Certain work will be carried out outside of normal working hours, namely evenings, nights and weekends. The Contractor shall coordinate this work with the Owner and the Representative of the Canadian space agency.

.6 The price for the execution of all the work in overtime, that is to say the evening, the night, the weekends will be included in the tender. No additional remuneration will be granted thereafter for this purpose.

1.4 INTERRUPTIONS OF SERVICES

.1 For all work that could interfere with the Owner's activities, the Contractor will request written authorization where he will indicate the nature of the work to be done, the time required for its execution and the date on which he must do this work. The Contractor will wait for the Owner's authorization before proceeding.

.2 The Contractor will make the Owner's request for written authorization, at least ten (10) days in advance whenever there are service and power interruptions. More details and conditions are given to the plans dealing with interventions and transfer protocols.

.3 In the event that the Owner has given authorization to proceed and an emergency situation arises, the Contractor must interrupt the work in progress and ensure the continuity of all services immediately.

.4 The operation and initial lockout of circuit breakers or disconnectors supplying existing loads are the exclusive responsibility of the Institutional Representative. Coordinate with the representative of the establishment the maneuvers required for the execution of the work.

1.5 EXISTING SERVICES

.1 The location of certain existing services is indicative only on the plans. Before the start of work, the Contractor will verify and locate all existing services with the Owner.

.2 Before starting the work, the Contractor will check with the Representative of the Canadian Space Agency the existing plans, as well as the structural, mechanical and electrical plans.

.3 Before carrying out demolition, drilling, cellaring and opening work, the Contractor will carry out all the necessary checks so as not to damage the existing hidden services.

1.6 EXISTING HIDDEN SERVICES

.1 The Contractor is responsible for damage to hidden electricity, telecommunications, mechanical or other services, following drilling and concrete cutting required by the present work.

.2 Carry out all the required checks so as not to damage said services. To this end, consult:

- .1 Structural, mechanical and electrical drawings.
- .2 Canadian Space Agency and/or maintenance personnel with local knowledge.
- .3 Public utility companies and specialized companies, having knowledge of the site and its installations.

.3 Carry out all preparatory work for the research. Use an appropriate device to find out whether there are traces of ducts in the areas concerned. In addition, hire specialized firms to search for hidden existing conduits.

.4 If the Contractor neglects to carry out all of the aforementioned verifications, any deterioration in service will be attributable to him and he will be required to pay the cost of repairs to the breakage itself and additional damage caused to the building. In addition, in the event that such deterioration affects the operation of the existing building services, the Owner may claim damages from the Contractor for the damage caused.

.5 If the Contractor performs all the aforementioned verifications and it remains impossible to know if one or more conduits remain hidden, he will not be held responsible for deterioration of service if he provides the Construction Professional the evidence:

- .1 That no details are specified in the drawings and specifications and that the Professional is unable to provide him with the relevant information.
- .2 That the Owner is unable to provide him with details on the route of the conduits at the work site.
- .3 That the companies or their technical department cannot precisely locate the passage of their services.
- .4 That a detection test has been carried out using an appropriate device.
- .5 That a specialized firm was hired to search for existing hidden conduits.

.6 In this case, the chargeable costs will be borne by the Owner and will be the subject of a change order.

1.7 CONTINUITY OF SERVICES

.1 Execute the work so that the continuity of existing services is ensured throughout the duration of the work. The Contractor must provide all the services and all the electrical installations necessary to ensure the continuity of the existing services.

.2 Include in the tender all necessary costs caused by damage to existing services, either by drilling work or any other work. No additional claim will be granted thereafter to this effect.

.3 The Contractor must provide all temporary services necessary when there are modifications to be made to existing installations.

.4 When the establishment's normal service is interrupted for the execution of the work, the Contractor will provide a generator for the required electrical supply of the tools and machinery he needs to carry out the work.

.5 The price for the execution of all work requiring service interruptions and power interruptions during overtime will be included in the tender. The price for temporary connections must be included in the quote. No additional remuneration will be granted thereafter for this purpose.

1.8 WORK INSIDE AND OUTSIDE THE OCCUPIED BUILDING

.1 Perform the work with the least possible disturbance to the occupants, ensuring normal use of the premises. When the means of ensuring safety have been reduced by reason of the work covered by the contract, take the necessary temporary measures to ensure all the safety required. Take into account that the building must remain operational for the duration of the work. The Contractor will be responsible for ensuring the continuity of services.

.2 The Contractor must receive the Owner's authorization before moving the equipment. Report damaged items to the Owner in writing before handling them. Damage caused during the movement of equipment will be repaired at the Contractor's expense.

.3 Install dust screens, tarpaulins, temporary partitions, temporary warning signs in places where renovation and repair work is being carried out adjacent to the sectors that will be operating during this period.

.4 Protect all distribution equipment against electrocution and mechanical damage and make it inaccessible to unauthorized personnel.

.5 If the Contractor moves equipment or furniture to facilitate his work, he must put everything back in place after each work period and ensure that the work areas, equipment and furniture are left clean and operational.

.6 To allow entry and/or exit of equipment, plan to use existing accesses.

1.9 REMOVAL OF EXISTING EQUIPMENT BECOMING UNNECESSARY

.1 In general, unless otherwise indicated, the Contractor must remove all existing equipment that has become unnecessary and/or not reused and ensure the continuity of existing networks and services from end to end. The Contractor will verify all the equipment to be removed and he will remove all the equipment according to the established work procedures and construction stages. The Contractor will provide all the services, the necessary electrical installations and the temporary installations to ensure the continuity of the existing networks for the existing equipment which must remain operational according to the work procedure and the established construction stages. The Contractor shall coordinate with the Owner the removal of existing equipment that has become unnecessary.

.2 The price for the execution of all the work must be included in the Contractor's bid and no additional remuneration will be granted thereafter for this purpose.

1.10 CONSERVED EQUIPMENT

.1 The Contractor shall redo all existing duct and wiring networks in the places where they are kept.

.2 The Contractor must ensure the continuity of the existing networks and end-to-end services for all the equipment retained.

.3 The price for the execution of all the work must be included in the Contractor's bid and no additional remuneration will be granted thereafter for this purpose.

1.11 RECOVERED EQUIPMENT

.1 At the locations indicated on the drawings, the Contractor must remove the existing equipment recovered, handle it and store it at a location determined by the Owner.

.2 The Contractor shall remove conduits, wiring, cables, boxes no longer needed and/or not reused from distribution equipment to the devices and/or devices they supply and ensure the continuity of networks and end-to-end existing services.

.3 The Contractor will replenish all equipment and devices recovered according to the indications on the plans.

1.12 CONCEALED WORKS

.1 Conceal all conduits and boxes.

.2 Conceal all conduits, boxes and wiring, except in mechanical, electrical, telecommunications and technical areas.

1.13 DEMOLITION

.1 Remove and transport off the site, all equipment that has become obsolete as a result of new developments, including wiring, conduits, boxes, outlets, switches, distribution devices, all auxiliary system devices, signaling or communications, all accessories forming part of the electrical installations.

.2 Remove wiring and conduits to the panel or to the last box kept in the network.

.3 Restore power, control, signaling or communications circuits when the continuity of these circuits is broken following the demolition of existing installations.

Part 2 Product

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 1 General

1.1 REFERENCES

.1 CSA International:

.1 CAN/CSA C22.2 no 18 – Outlet Boxes, Conduit Boxes, Fittings, and Associated Hardware.

.2 CAN/CSA C22.2 no 65 – Wire connectors (trinational standard with UL 486A-486B et NMX-J-543-ANCE-03).

.2 Electrical and Electronic Manufacturers' Association of Canada (EEMAC):

.1 EEMAC 1Y-2-1961 – Bushing Stud Connectors and Aluminum Adapters (1 200 A Maximum Rating).

.3 National Electrical Manufacturers Association (NEMA).

1.2 ACTION AND INFORMATION SUBMITTALS

.1 Submit in accordance with section 01 33 00 – Submittal procedures.

.2 Submit documents and samples in accordance with section 26 00 10 –Mechanical and electrical general instructions.

.3 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for [wire and box connectors] and include product characteristics, performance criteria, physical size, finish and limitations.

1.3 CLOSEOUT SUBMITTALS

.1 Submit in accordance with section 20 00 10 –-Mechanical and electrical general instructions.

.2 Operation and maintenance data: submit operation and maintenance data for wire and box connectors for incorporation into manual, E&Es.

Part 2 Product

2.1 MATERIALS

.1 Pressure type wire connectors to CAN/CSA-C22.2 no. 65, with current carrying parts of copper or aluminum alloy sized to fit copper or aluminum conductors as required.

.2 Fixture type splicing connectors to CAN/CSA-C22.2 no. 65, with current carrying parts of copper sized to fit copper conductors 10 AWG or less.

.3 Bushing stud connectors: to EEMAC 1Y-2 and NEMA to consist of:

.1 Connector body and stud clamp for copper conductors.

.2 Clamp for copper conductors.

.3 Stud clamp bolts.

.4 Bolts for copper conductors.

.5 Bolts for aluminum alloy conductors.

.6 Sized for conductors as indicated.

.4 Clamps or connectors for Teck cable as required to: CAN/CSA-C22.2 no. 18.

2.2 WIRE CONNECTORS

.1 Mechanical connectors for conductor size 8 AWG or less, use Scotchlock Electrical Spring Connectors from 3M or Marette from Thomas & Betts.

.2 Mechanical connection for copper-to-copper conductors of size 6 AWG or larger, use type H split bolt connectors from Thomas & Betts.

.3 Mechanical connection for copper-to-Nual conductors of size 6 AWG or larger, use type APS split bolt connectors from Thomas & Betts.

.4 Mechanical connection for Nual-to-Nual conductors of size 6 AWG or larger, use type HPS split bolt connector from Thomas & Betts.

2.3 MULTI-PORT WIRE CONNECTORS

.1 Insulated mechanical connector for wire termination:

.1 Multi port connection block with clamping screw.

.2 Insulation rated to 600 V, 90ºC.

.3 Removable port and screw plugs.

.4 Dual rated for copper or aluminum conductors.

.5 Pre-filled with oxide inhibitor.

2.4 WIRE TERMINATIONS

.1 The contractor is responsible for coordinating the size of the equipment connection lugs with the conductor sized indicated on drawings. Where it is not possible to connect the conductors, the Contractor may use insulated compression reducing connectors.

.2 Insulated Compression Reducer Connector:

.1 Offset connecting stem.

.2 Insulation rated to 600 V, 90ºC.

.3 Dual rated for copper or aluminum conductors.

.4 Pre-filled with oxide inhibitor.

2.5 TERMINAL BLOCKS

.1 All wire connection in junction boxes and panels for fire-alarm, low-voltage lighting control, other low-voltage systems, etc., will be made on terminal blocks in sufficient quantities for each wire connection.

.2 Terminal blocks shall be from Wieland brand, series 9700B, 10 A, 300 V, complete with DIN rail, end plates, identification, extremity flanges and jumpers.

2.6 ACCEPTABLE MANUFACTURERS

.1 Wire connectors:

- .1 3M
- .2 Burndy
- .3 Thomas & Betts
- .4 Or approved equivalent

.2 Multi-port wire connectors:

- .1 Burndy Black Unitap series
- .2 Ilsco PBTD series
- .3 Thomas & Betts AMT series
- .4 Or approved equivalent

.3 Insulated compression reducer connector:

- .1 Burndy AYPO series
- .2 Ilsco ACO series
- .3 Thomas & Betts 619 series
- .4 Or approved equivalent

.4 Terminal blocks:

- .1 Staffel
- .2 Weidmüller
- .3 Wieland
- .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 wire and box connector 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.

3.2 INSTALLATION

.1 Carefully strip the end of the conductors and cables, then, as appropriate, do the following:

- .1 Apply coat of zinc joint compound on aluminum conductors prior to installation of connectors.

.2 Install mechanical pressure type connectors and tighten screws with appropriate compression tool recommended by manufacturer. Installation shall meet secureness tests in accordance with CAN/CSA-C22.2 no. 65.

.3 Install fixture type connectors and tighten to CAN/CSA-C22.2 no. 65. Replace insulating cap.

.4 Install bushing stud connectors in accordance with NEMA.

3.3 WIRE JUNCTIONS

.1 Tape connectors, that do not have their own insulating jacket, with at least two (2) semi-overlapping rows of Scotch 88 vinyl tape from 3M.

.2 The di-electric characteristics of the junction must not be inferior to those of the conductor insulation.

.3 Wire junctions and connectors which do not have a smooth surface should be wrapped with Scotchfil from 3M prior to being taped.

END OF SECTION

TABLE OF CONTENTS

Part 1 General

1.1 SUMMARY

.1 This section includes:

.1 Copper, ACM alloy and aluminum conductor requirements from 0 – 1 000 V and common electrical insulation and covering materials.

1.2 REFERENCES

.1 Canadian Standards Association (CSA)/CSA International:

.1 C22.2 no 38 – Thermoset-Insulated Wires and Cables (Tri-National Standard, with UL 44 and ANCE NMX-J-451-2014).

.2 C22.2 no 131 – Type Teck 90 Cable.

.3 C22.2 no 51 – Armoured Cables.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit the required documents and samples, in accordance with section 20 00 10 - Mechanical and electrical general instructions.

.2 Shop drawings:

.1 Submit a general drawing for each conductor and cable type and indicate all gauges used.

.3 Calculations:

.1 Submit cable pull calculations for materials installed in buried duct banks. Include description of pulling method for installing 600 V conductors.

1.4 CLOSEOUT SUBMITTALS

.1 Submit the required documents, in accordance with section 20 00 10 – General Instructions for mechanical and electrical.

.2 Operation and maintenance data: submit operation and maintenance data for wire and cables for incorporation into manual.

Part 2 Product

2.1 CONDUCTOR WIRE GAUGE

.1 Unless otherwise indicated, the minimum gauge of copper cabling to be:

.1 12 AWG for dedicated circuits in dedicated conduit.

.2 10 AWG for multiple circuits grouped in a common conduit.

.2 Solid wire for size no. 10 conductors and smaller.

.3 Stranded wire for size no. 8 conductor and larger.

.4 Conductor size indicated on drawings represents minimum requirements. If not indicated, provide and install conductor of type and size as required by the applicable electrical code, latest edition, specifically:

.1 Refer to appendices to determine the size of conductors given the routing distance.

.2 Apply correction factors for de-rating of current carrying capacity as required by the electrical code, including but not limited to table 5C when conductors are grouped in a common conduit.

2.2 BUILDING WIRES

.1 All wiring connected to a 600 V system shall have minimum 600 V insulation.

.2 Unless otherwise indicated, provide copper-conductors for circuits rated less than 100 A, size as indicated, with 600 V insulation of cross-linked thermosetting polyethylene material rated RW90 XLPE.

.3 Unless otherwise indicated, provide ACM alloy or aluminum conductors for circuits rated 100 A or greater, size as indicated, with 600 V insulation of cross-linked thermosetting polyethylene material rated RW90 XLPE.

.4 Conductors and cables shall be marked at minimum with manufacturer's name, type of insulation, wire gauge and voltage. Markings shall be permanent and imprinted at regular intervals.

2.3 CONDUCTOR COLOUR

.1 In branch circuits of three-phase systems, the phase colours to be: black, red, blue, etc., and the neutrals to be white.

.2 No. 4/0 gauge and smaller neutral conductors to have white insulation and those of 250MCM gauge and larger to be painted white.

.3 Grounding conductors to be installed in all P.V.C., E.M.T. type conduits, and empty flexible metal conduits. The grounding conductors to have green insulation and to be the sized according to the Electrical Code.

.4 Grounding conductors used for equipment, special outlets, insulated outlets, to have green insulation and to be sized according to the Quebec Electrical Code.

2.4 EQUIPMENT IDENTIFICATION

.1 Identify equipment in accordance with section 26 05 53 – Identification of electrical equipment.

2.5 RECOMMENDED MANUFACTURERS

.1 Conductors:

.1 General Cable
.2 Nexans
.3 Prysmian
.4 SouthWire
.5 Or approved equivalent

.2 Cables AC90 and ACWU90:

.1 General Cable
.2 Nexans
.3 Prysmian
.4 SouthWire
.5 Or approved equivalent

Part 3 Execution

3.1 FIELD QUALITY CONTROL

.1 Perform tests in accordance with section 20 00 10.

.2 Perform tests before energizing electrical system.

.3 Tests shall be completed by competent personnel.

.1 Provide all materials and instruments necessary to complete the tests.

.4 Check the phase of each conductor and identify the phase of each individual conductor for all circuit.

.5 Check continuity of all circuits. Ensure all circuits are free from faults and leakage current.

.1 Ensure resistance to ground of each circuit is not less than 50 megaohms or as recommended by cable manufacturer.

.6 Splice tests:

.1 After laying or pulling cables, but before splicing and connecting, measure the insulation resistance of each phase conductor using a 1000 V megohmmeter.

.2 After the completion of each splice and / or connection, check the insulation resistance to ensure the distribution system is ready for the acceptance test.

.7 Dielectric strength tests:

.1 Ensure all circuit terminations and all ancillary equipment are disconnected.

.2 Ground shields, ground wires, metallic armor and conductors not being tested.

.3 Carry out dielectric strength tests in accordance with Manufacturer's recommendations.

.4 Measure dielectric value of circuits, power cables and equipment with a maximum voltage of 350 V using a 500 V megohmmeter.

.5 Measure dielectric value of circuits, power cables and equipment with a voltage range from 351 V to 600 V using a 1 000 V megohmmeter.

.6 For the above noted test cases, ensure that the value of the grounding resistance prior to energization is not less than the manufacturer's requirements.

.7 Provide a certificate stating that all conductors have been tested and verified, and that all defective conductors have been replaced.

.8 Completely remove and replace the total and complete length of cable which does not meet the test criteria.

3.2 GENERAL CABLE INSTALLATION

4. Cable Colour Coding: to section 26 05 00.01- Common work results for electrical.

.1 Conductor length for parallel feeders to be identical.

.2 Lace or clip groups of feeder cables at distribution centres, pull boxes, and termination points.

.3 Wiring in walls: typically drop or loop vertically from above to better facilitate future renovations. Generally wiring from below and horizontal wiring in walls to be avoided unless indicated.

.4 Branch circuit wiring for surge suppression receptacles and permanently wired computer and electronic equipment to be two (2) wire circuits only, i.e. common neutrals not permitted.

.5 Provide numbered wire collars for control wiring. Numbers to correspond to control shop drawing legend. Obtain wiring diagram for control wiring.

.6 Supply and install wires and cables required for the connection of all electrical equipment and devices to make them fully operational even if the wires or cables are not specifically shown on the drawings.

.7 Install conductors or cables in conduits or metal sheaths as indicated in this section.

.8 Install a neutral conductor bypass circuit at 120 V.

.9 Use only lubricants approved by the manufacturer for cable pulling.

.10 Install cables and leads continuously without joints from their point of origin to the powered device. If necessary, create joints in approved boxes.

.11 Support conductors in vertical conduit with Type M carriers, manufactured by O-Z Products. Space them as follows: conductors of size 1/0 and smaller: supports every 30 m.

.12 Support vertical climbs of armored or Teck-type cables, such as AC90, ACU90, RP90, RC90 or Teck90, according to the requirements of table 21 of Chapter V – Electricity of the Quebec Construction Code, or:

.1 Incorporate 90° elbows in the vertical run at intervals not exceeding the distances indicated in table 21 of Chapter V – Electricity of the Quebec Construction Code.

.2 Use cable specially designed for vertical runs.

3.3 INSTALLATION OF BUILDING WIRES

.1 Provide armored cable with "Liquid-Tight" connections for the final connection to interior motors and transformers from a nearby junction box.

.2 Unless otherwise indicated in the plans or specification, all flexible connections to motors sand other devices inside cleaning rooms or in damp areas and exposed to dripping will be made with "Seal Dry" or " Cab Tire " type 24" minimum length, fitted with suitable watertight fittings, from a threaded galvanized steel conduit.

.3 Unless otherwise indicated in the plans, provide an additional green insulated conductor of the appropriate size to ensure the continuity of the ground in each thin-walled duct (EMT type).

.4 Install the wiring:

.1 In conduit systems in accordance with Section 26 05 34 – Conduits, conduit fastenings and conduit fittings.

.2 In surface pipes and cable trays for lighting fixtures, in accordance with Division 26.

APPENDIX

MAXIMUM LENGTH (IN METERS) OF ONE 120 V VERSUS BYPASS CIRCUIT PRESSURE DROP			
Conductor size AWG	Protection in amperes (A)		
	15	20	30
12	20	15	---
10	30	25	15
8	50	40	25
6	90	65	40

Notes:

– For loads not indicated, follow Chapter V - Electricity of the Quebec Construction Code (Quebec Electricity Code) (table no. D3).

– Distance calculated for copper conductors, at a temperature of 60° C.

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 CSA International:

.1 CSA Z32-09 – Electrical Safety and Critical Electrical Systems in Health Care Facilities.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit the required documents and samples, in accordance with Section 20 00 10 - Mechanical and Electrical General Instructions.

.2 Submit grounding compliance certificate complete with test results.

1.4 DOCUMENTS/ELEMENTS TO BE SUBMITTED ON COMPLETION OF THE WORK

.1 Submit the required documents/elements, in accordance with section 20 00 10 – General mechanical and electrical instructions.

.2 Operation and maintenance sheets (O&M): provide operating and maintenance instructions, which will be incorporated into the O&M manual.

Part 2 Product

2.1 EQUIPMENT

.1 Grounding conductors: bare stranded copper, tinned, soft annealed, size as indicated.

.2 Insulated grounding conductors: green, copper conductors, size as indicated.

.3 All grounding conductors shall be minimum gauge 6 AWG.

2.2 **RECOMMENDED MANUFACTURERS**

.1 Grounding material:

.1 Burndy Corp.
.2 Ilsco
.3 Thomas & Betts
.4 Or approved equivalent

2.3 **EQUIPMENT IDENTIFICATION**

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

2.4 **ACCEPTABLE PRODUCTS**

.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 20 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 Use mechanical connectors for grounding connections to equipment provided with lugs.

.6 Soldered joints not permitted.

.7 Grounding continuity for electrical systems:

.1 Install ground conductor in all PVC conduits.

.2 Bond single conductor, metallic armoured cables to cabinet at supply end, and provide non-metallic entry plate at load end.

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.

END OF SECTION

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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 20 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.

1.4 DOCUMENTS/ELEMENTS TO BE SUBMITTED ON COMPLETION OF THE WORK

.1 Submit the required documents/elements, in accordance with section 20 00 10 – General mechanical and electrical instructions.

.2 Operation and maintenance sheets (O&M): provide operating and maintenance instructions, which will be incorporated into the O&M manual.

Part 2 Product

2.1 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.

.7 Custom-made boxes for communications and security, when necessary, in order to meet the requirements of this specification, including, in particular, the dimensions below:

Maximum dimension of interrupted duct segment by the pull box mm (in)	Dimensions of the pull box			For each segment additional duct interrupted by the box draft, the width must be increased by: mm (in)
	Width mm (po)	Length mm (po)	Dept mm (po)	
21 (¾)	100 (4)	300 (12)	75 (3)	50 (2)
27 (1)	100 (4)	400 (16)	75 (3)	50 (2)
35 (1¼)	150 (6)	500 (20)	75 (3)	75 (3)
41 (1½)	200 (8)	675 (27)	100 (4)	100 (4)
53 (2)	200 (8)	900 (36)	100 (4)	125 (5)
63 (2½)	250 (10)	1 050 (42)	125 (5)	150 (6)
78 (3)	300 (12)	1 200 (48)	125 (5)	150 (6)
91 (3½)	300 (12)	1 350 (54)	150 (6)	150 (6)
103 (4)	375 (15)	1 500 (60)	200 (8)	200 (8)

.8 Custom made electrical boxes shall be 16 gauge painted steel with hinged cover and separators, as required by Code between sources and different voltages.

2.2 ACCEPTABLE MANUFACTURERS

.1 Junction and pull boxes:

.1 Bel Products
.2 Hammond
.3 Hoffman
.4 Iberville
.5 Roger Girard
.6 Or approved equivalent

2.3 EQUIPMENT IDENTIFICATION

.1 Identify equipment as per the requirements of section 26 05 53 – Identification of electrical equipment.

Part 3 Execution

3.1 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 2 m 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

TABLE OF CONTENTS

Part 1 General

1.1 SUMMARY

.1 This section includes:

.1 Rigid and flexible conduits, fasteners and fittings, and related installation methods.

1.2 REFERENCES

.1 Canadian standards association (CSA)/CSA International:

.1 CAN/CSA-C22.2 no. 18 – Outlet Boxes, Conduit Boxes, Fittings and Associated Hardware, A National Standard of Canada.

.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).

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit the required documents and samples, in accordance with section 26 00 10 – Mechanical and electrical general instructions.

.2 Shop drawings:

.1 Electrical metallic tubing (EMT).

.2 Large radius elbows as indicated on drawings.

.3 End caps to sizes as indicated on drawings.

.3 Interference drawings:

.1 Interference drawings indicating placement and dimensions of junction and pull boxes.

Part 2 Product

2.1 CONDUITS

.1 All conduits shall be colour coded in accordance with section 26 05 00 – Common work results for electrical.

.2 Electrical metallic tubing (EMT): to CSA C22.2 no. 83, with couplings, and expanded ends.

.3 Flexible metal conduit: to CSA C22.2 no. 56, liquid-tight flexible metal aluminum.

.4 The size required by Chapter V – Electricity of the Quebec Construction Code (Code d'Électricité du Québec), unless otherwise indicated, is a minimum of 21 mm diameter.

.5 Galvanized steel, rigid, thin-walled, unless otherwise indicated.

.6 Galvanized steel, flexible waterproof kind, between the ductwork and the unit's connections box (± 900 mm in length) for connecting motors and kitchen appliances.

.7 Sealed conduit connectors and fittings for electrical metallic tubing.

2.2 CONDUIT FASTENINGS

.1 One (1) hole, steel straps to secure surface conduits where the diameter is equal to 53 mm or less.

.1 Two (2) hole, steel straps for conduits larger than 53 mm.

.2 Beam clamps to secure conduits to exposed steel work.

.3 Channel type supports for two or more conduits.

.4 Threaded rods, 10 mm diameter, to support suspended channels.

.5 Maximum spacing of conduit fasteners:

.1 All rigid metal conduits of same size shall be securely fastened to supports or suitable surface such that the maximum spacing between the fastening points shall be (OESC Rule 12-1010 (1)):

.1 1.5 m for conduits sized 21 mm in diameter.

.2 2 m for conduits sized 27 to 35 mm in diameter.

.3 3 m for conduits sized 41 mm in diameter or greater.

.2 Grouped mounting of rigid metal conduits of different sizes shall maintain maximum fastener spacing as indicated in item 2.3.5.1 for the smallest conduit size in the grouping (OESC Rule 12-1010 (2)).

.3 Flexible metal conduits shall be secured at intervals not exceeding 1.5 m and shall be secured within 300 mm of a termination to an enclosure or box. In cases where flexible metal conduit is pulled and flexibility is required at the termination, the conduit shall be permitted to be secured within 900 mm in lieu of 300 mm (OESC Rule 12-1010 (3)).

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 (L)" where 90° bends for conduits 27 mm and larger if the space is not practicable for a 90° curve.

.3 Steel screw type fittings and connection sleeves for metal electrical tubing.

2.4 FISH CORD

.1 Polyester pre-stretching rope with integral measurement, equal to Greenlee Measuring Tape N435 or approved equivalent.

.2 For optical fibre and Category 3 multipair cabling, use flat pull cord, 9.525 mm, having a minimum tensile strength of 220 lb. The rope shall include a 22 gauge tracer wire.

2.5 ACCEPTABLE MANUFACTURERS

.1 EMT or rigid metal ducts:

- .1 Columbia-MBF
- .2 RepubliConduit
- .3 Wheatland
- .4 Or approved equivalent

.2 PVC conduits:

- .1 Canron
- .2 Columbia-MBF
- .3 Ipex
- .4 Panduit (Canada) Ltée
- .5 Or approved equivalent

.3 Flexible conduits:

- .1 Anamet Canada
- .2 Columbia-MBF
- .3 Thomas & Betts
- .4 Or approved equivalent

2.6 IDENTIFICATION

.1 Equipment identification to conform with section 26 05 53 – Electrical system identification.

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 GENERAL

.1 Conduits indicated on plans are shown in schematic form only. Place exposed conduit such that the available vertical clearance of the space is not reduced. Before start of work, review location of conduits with Consultant.

.2 Parallel conductor conduit runs shall be of the same length.

.3 Arrange and allow for cutting and drilling of openings and other structural work necessary to install electrical conduits, cables, pull boxes and terminal boxes.

.4 Openings in concrete beams, walls and floors shall be approved by the Structural Engineering Consultant.

3.3 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 and in unfinished areas.

.3 Unless otherwise indicated, use galvanized, rigid, thin-walled steel conduits.

.4 Unless otherwise indicated, use galvanized and threaded rigid conduits:

- .1 Indoors in areas exposed to mechanical damage.
- .2 Indoors in explosion proof areas.
- .3 Indoors for installations with voltage greater than 750 V.

.5 Unless otherwise indicated, use rigid aluminum threaded conduits:

- .1 Outside, protruding.
- .2 Indoors for areas exposed to moisture, water and weather.

.6 Unless otherwise indicated, use galvanized steel conduits, flexible type, waterproof, with a maximum length of 900 mm between the conduit network and the unit's junction box for connecting motors.

.7 AC90 (BX) or TECK90 flexible ducts are not acceptable. Flexible and watertight metal conduits must bear the identification "FT 4" and must not exceed 1500 mm in length.

.8 For PVC conduits 103 mm in diameter and over, provide long radius PVC elbows.

.9 Use explosion-proof flexible couplings for explosion-proof motor connections.

.10 Bend cold conduit.

- .1 Replace conduit if kinked or flattened more than 1/10th of its original diameter.

.11 Mechanically bend steel conduit over 21 mm diameter.

.12 The thread of rigid conduits, carried out on the site, must be of sufficient length to allow tight joints.

.13 Provide and install a pre-draw wire with indication of the length in all empty conduits of all systems, in all empty conduits for future planning in order to facilitate the pulling of wires and / or cables.

.14 From each panel installed flush, bring up to the ceiling void, two (2) reserve conduits of 41 mm.

.1 The conduits must terminate in 305 mm x 305 mm x 102 mm junction boxes housed in the ceiling.

.15 Remove and replace blocked conduit sections.

.16 Do not use liquids to clean out conduits.

.17 Dry conduits out before installing wire.

.18 Under no circumstances should conduits touch sheath insulation or mechanical equipment or be buried in insulation or flame retardant materials. A minimum free space of 75 mm must be maintained between the ducts and any insulated steam pipe.

.19 No drilling is to be done through the beams for the passage of conduits.

.20 Unless otherwise indicated, conceal all conduits in walls, floors, ceilings and suspended ceilings.

.21 Maintain grounding continuity throughout the installation, taking care to make solid connections between the conduits and the equipment. A green ground wire must be added in each flexible conduit connecting a device liable to vibrate such as motors and in all conduits installed in concrete.

.22 The inner radius of curvature of the ducts is at least six times the internal diameter of the pipe. When a group of ducts run side by side, the bending radii are concentric.

.23 The internal radius of curvature of communications and security conduits must be at least six (6) times their internal diameter for conduits of 53 mm and less.

.24 The internal radius of curvature of communications and safety conduits must be equal to at least ten (10) times their internal diameter for conduits over 53 mm.

.25 Connect threaded conduits to boxes and devices using two (2) nuts and a threaded and insulated steel sleeve.

.26 Ream ends of rigid threaded conduits to remove metal burr. Carefully cut the threads and coat the joints with minium or an equivalent product to ensure waterproofing. Keep the thread length to the minimum necessary for connections to boxes or other accessories.

.27 During construction, equip ducts with plugs to prevent foreign bodies from entering.

.28 Conduit raceways between two outputs, pull boxes or sliding sleeves must not have more than three 90° elbows or equivalent or be more than 60 m in length, except the external telephone network, where indicated in the plans.

.29 Attach conduits as follows:

.1 Supply and install all the necessary supports galvanized for electrical work.

.2 Conduits:

.1 When the insulated conduits are in contact with a surface of concrete or masonry, affix them using cast iron or steel straps.

.2 Where a group of passages (four or more) flows in parallel, affix them to the steel supports by anchoring them directly to the frame or by means of threaded rods or other supports.

.3 The size of the rods, supports, and spacing of supports are based on weight bearing as required by the code. When conduits of various sizes are grouped, the spacing of the supports is determined by the smallest conduit of the group.

.3 Install cross braces spaced up to 12 m center-to-center and longitudinal braces on all horizontal runs of suspended conduits to 300 mm of the ceiling tile. This requirement may be omitted if the maximum diameter is less than 65 mm for a conduit or if conduits of an individual group has a total weight less than 15 lb/m.

.30 Continuous threads are not permitted. When in some cases it is not possible to install regular fittings, use Erikson type fittings.

.31 Support conduits suspended using galvanized brackets, as described elsewhere in this book.

.32 Use liquid tight waterproof conduit for connections to equipment in damp, wet or corrosive locations.

.33 The spacing of supports and fasteners must be in accordance with the latest edition of the Electrical Code of Québec.

.34 Support vertical conduits at floor level and use intermediate supports required by the Code.

.35 In suspended ceilings, support the metal sheath cables to the frame and not the ceiling structure.

3.4 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 Where possible, group conduits in U-shaped suspension brackets mounted on surface.

.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.

3.5 CONCEALED CONDUITS

.1 Run parallel or perpendicular to building lines.

.2 Do not install horizontal runs in masonry walls.

.3 Do not install conduits in terrazzo or concrete toppings or in concrete slabs.

3.6 PULL CORDS

.1 Contractor to supply a flat tracking cord to ensure correct placement when installing fiber optic cables in new conduits or when pulling fiber optic cables and category 3 multipair cables in existing conduits.

.2 The pull cord must be installed inside the fiber conduit at the same time as the cable pull. When a conduit enters pull box or an access shaft, the Contractor shall enter the rope and leave a minimum length of 2 m inside the shaft and secure it near the cover.

.3 Provide a fish cord in empty conduits.

APPENDIX

MAXIMUM NUMBER OF CATEGORY 6 AND 6A CABLES PER CONDUIT									
Cables	Duct size in mm								
	16	21	27	35	41	53	63	78	103
Category 6 FT4	---	3	6	10	14	23	34	52	90
Category 6A FT4	---	2	3	6	8	14	20	30	53
Note: for dimensions not indicated, follow chapter V – Electricity of the Quebec Construction Code (Quebec Electricity Code).									

END OF SECTION

TABLE OF CONTENTS

Part 1 General

1.1 SUMMARY

.1 Section contents:

.1 Systems and devices to protect against shock loads due to earthquakes, technical equipment static assistive devices and technical equipment bracketing elastic, that is to say isolated against vibration, including all appliances, devices electrical lighting, transformers, motor control centers, interruptible power systems, diesel generators, emergency power systems and protection systems against fire and telecommunication systems.

1.2 SCOPE OF WORK

.2 Work includes:

.1 The work includes general calculation, supply, supervision and the responsibility of all materials and equipment necessary for seismic measurements for electrical work:

.1 Calculations and installation details of seismic mechanisms to meet the required standards. A signed and sealed engineering report is required by a seismic engineer for any new construction. This report also demonstrates compliance with various codes. The report is also required for retrofit projects, whose works include the installation of new equipment.

.2 Provision of seismic mechanisms and delivery of the equipment on site, as required, are requirements outlined in Division 26.

.3 Monitoring the installation of all the mechanisms used for seismic measurements and the presentation of a compliance report issued by the Seismic engineer attesting the compliance of systems with the requirements set out in its report and those dictated by the Construction code of Québec. A certificate of compliance will be issued prior to the acceptance of the work.

.4 Seismic mechanisms include, but are not limited to:

.1 Bracing and stiffening the supports (if required) of the carriers of electricity conduit and cables shelves.

.2 Adequate anchorage to the structure if not fitted with vibration isolator devices (anchored directly to the frame).

.3 Seismic mechanisms of all conduits and devices with vibration isolators and those simply placed or secured.

.4 Adequate anchorage of all channels and devices with vibration isolators to the structure.

.5 Adequate anchoring of fixtures taking into account weight and dimensions.

1.3 SEISMIC STANDARDS

.3 Unless otherwise indicated, the seismic action should be designed and selected to meet the requirements of the latest edition of:

- .1 Building Code of Québec.
- .2 CSA S86, S832.
- .3 FEMA-450rl (for existing buildings, and for reference).
- .4 Rules of art are also detailed in ASHRAE (Handbook and Practical Guide to Seismic Restraint) and SMACNA (Seismic Restraint - Manual Guidelines for Mechanical Systems).
- .5 FEMA -172 standards and FEMA -365 must be used for the seismic rehabilitation of existing buildings.

.4 Seismic zone as follows: Brossard: Sa(0.2) = 0.58.

.5 The acceleration factor of the location, F, to be considered in the calculations from the data transmitted by the engineering structure which is related to the soil profile (spot category). As part of this project: the location category is E.

.6 Seismic risk coefficient, I_E:

- .1 Electrical conduits anchored directly (rigid fasteners) to the frame: emergency preparedness: I_E = 1.5.

.7 If the value Sa(0.2) is less than 0.12, the seismic measurements can be omitted.

.8 For buildings other than those for civil protection, if the IE product * F * Sa(0.2) is less than 0.35, seismic measurements may be omitted.

.9 Other coefficients (Cp, Ar, Ax, Rp) according to the Building Code of Québec.

.10 For non-ductile assemblies, adhesives or compressive cartridge fixings, Rp value is 1.0.

.11 Superficial anchors, chemicals, epoxy resin or anchors embedded, the Rp value is 1.5 if the embedding length / diameter ratio is less than 8.

.12 Cartridge fasteners and simply placed anchors should not be used as an anchor to resist pull loads.

.13 Electrical conduits connected to generator systems, ASSC, communications, security systems, etc. I = 1.5.

.14 Electrical conduits supported by vibration isolators (flexible mountings): I = 1.5.

.15 Equipment and devices anchored directly (rigid attachments) or vibration isolators (flexible fasteners) to the frame : I = 1.5.

.16 I_E = 1.0: during or after the earthquake, the attached equipment does not have to remain in working order, as in normal use. The mandatory requirements are that the seismic measures prevent systems and electrical equipment and related systems from causing injury to persons and to prevent equipment from moving from its normal position during an earthquake.

.17 For I_E = 1.5: the following systems shall remain operational during and after an earthquake:

.1 Communications systems.

.2 Static, uninterruptible power supply.

.3 Emergency generator.

.4 Fire detection and alarm system.

.5 Elevators.

.6 Those identified by the owner.

.18 Presenting a complete dynamic analysis of systems and equipment referred to above, provide details of the maximum forces applied to the material and make recommendations for changes or additions to support structures to maintain the equipment in good operating condition.

.19 In general:

.1 Montreal:

.1 For I_E = 1.5

Description	Location Category	Lateral Force (g)		
		Ground Level	Mid-height	Roof
Electric cable paths, busbar ducts, conduits (CCQ-2010, No. 17 Table 4.1.8.18).	A	0.11	0.22	0.33
Rigid components with ductile materials or non-ductile assemblies (CCQ-2010, No. 19 Table 4.1.8.18).	A	0.22	0.44	0.65
Machinery, accessories, equipment, conduits and reservoirs (with contents) (rigid, rigid and flexible assembly, flexible assembly) (CCQ-2010, Table No. 11 4.1.8.18).	A	0.22	0.44	0.65
Electric cable paths, busbar ducts, conduits (CCQ-2010, No. 17 Table 4.1.8.18).	B	0.12	0.25	0.37
Rigid components with ductile materials or non-ductile assemblies (CCQ-2010, No. 19 Table 4.1.8.18).	B	0.25	0.49	0.74
Machinery, accessories, equipment, conduits and reservoirs (with contents) (rigid, rigid and flexible assembly, flexible assembly) (CCQ-2010, Table No. 11 4.1.8.18).	B	0.25	0.49	0.74
Electric cable paths, busbar ducts, conduits (CCQ-2010, No. 17 Table 4.1.8.18).	C	0.14	0.29	0.43
Rigid components with ductile materials or non-ductile assemblies (CCQ-2010, No. 19 Table 4.1.8.18).	C	0.29	0.58	0.86
Machinery, accessories, equipment, conduits and reservoirs (with contents) (rigid, rigid and flexible assembly, flexible assembly) (CCQ-2010, Table No. 11 4.1.8.18).	C	0.29	0.58	0.86
Paths of electric cables, busbar duct, conduits (CCQ-2010No. 17 Table 4.1.8.18).	D	0.16	0.33	0.49
Rigid components with ductile materials or non-ductile assemblies (CCQ-2010, No. 19 Table 4.1.8.18).	D	0.33	0.66	0.99

Description	Location Category	Lateral Force (g)		
		Ground Level	Mid-height	Roof
Machinery, accessories, equipment, conduits and reservoirs (with contents) (rigid, rigid and flexible assembly, flexible assembly) (CCQ-2010, Table No. 11 4.1.8.18).	D	0.33	0.66	0.99
Paths of electric cables, busbar ducts, conduits (CCQ-2010, No. 17 Table 4.1.8.18).	E	0.16	0.33	0.49
Rigid components with ductile materials or non-ductile assemblies (CCQ-2010, No. 19 Table 4.1.8.18).	E	0.33	0.66	0.99
Machinery, accessories, equipment, conduits and reservoirs (with contents) (rigid, rigid and flexible assembly, flexible assembly) (CCQ-2010, Table No. 11 4.1.8.18).	E	0.33	0.66	0.99

1.4 CALCULATIONS

.1 The consultant specializing in seismic measurements must obtain the section relating to electricity, all information relating to equipment, including electrical conduits required for the calculation of seismic measurements (weight, number, race, spacing between supports, on groupings trapezoidal supports).

.2 The consultant specializing in seismic measurements must obtain from each device manufacturer, the characteristics required in article "SHOP DRAWINGS" in section 26 00 10 (weight, location of the center of gravity, number of fixing points, the center of gravity location of fixing points, speed, seismic fragility of the internal components, etc.).

.3 Calculation parameters, calculations and installation details of the anchor bolts and earthquake resistant measures, should be checked by an engineer specializing in seismic design.

.4 For vertical loads or the risk of reversal of equipment, use the detailed equations in FEMA standard 450-1.

.5 Provide for information the earthquake engineering design report, the parameters or values used in compliance with the Building Code of Québec, the bases of calculations, data equipment or networks analyzed, calculations for seismic braces and inversion, overturning moments, anchor calculations, recommendations, measures and installation details for each network, piece of equipment, and device installed. Provide plans locating measurements and sketches for each device, along with product specifications.

.6 In the event that the weight of equipment/tank and its contents have a mass greater than 10% of the mass of the floor, seismic forces will be subject to rational analysis.

.7 Confirm by calculations that if rigid braces are installed, no undue force will be applied to the supports.

.8 See the article "SEISMIC STANDARDS".

1.5 DESCRIPTION

.9 Seismic protection systems must be perfectly integrated and compatible with the following:

- .1 Acoustic and vibration of prescribed devices.
- .2 Building design features, as well as electrical and mechanical installations.

.10 It is not necessary that the hardware and operating systems remain protected during and after an earthquake, except those listed in the article "SEISMIC STANDARDS", which must remain on during and after a disaster. During an earthquake, seismic protection devices and systems used to prevent materials and equipment from moving, falling or tipping over, which could injure the occupants.

.11 The design of seismic protection devices and systems should be done by an engineer specialized in the field of earthquake engineering and recognized in the province of Quebec.

1.6 INFORMATION/DOCUMENTS/SAMPLE SUBMITTALS

.1 Submit documents and samples required in accordance with section 01 33 00 - Documents and samples to be submitted.

.2 Shop Drawings: the submitted shop drawings stamped and signed by professional engineer registered or licensed in Canada, in the province of Quebec.

.3 Submit calculations outlined below:

- .1 A detailed version of the calculation criteria.
- .2 The construction drawings (of the same quality and same format as part drawings) submitting tender documents, lists of materials and equipment, schematic and detailed specifications for the elements of each seismic protection device and systems planned.
- .3 Calculation documents (worksheets and tables), including the calculation of the stresses due to seismic forces, according to the Building Code of Québec.
- .4 Separate shop drawings for each device or seismic protection system and for each of their elements.
- .5 A document specifying the location of these devices and systems.
- .6 List the different types of seismic protection devices, systems, and related materials.
- .7 A document showing or giving details of the anchoring and fixing devices, the anchor loads, and methods of frame bonding.
- .8 A document detailing the instructions and installation methods.
- .9 Documents outlining the calculations including the calculation of the stresses due to seismic forces.
- .10 Worksheets/work and detailed tables. Worksheets/work and simplified tables. Cautious hypotheses or simplifying assumptions may be accepted.
- .11 The detailed design documentation, including construction drawings, lists of materials and equipment, calculations, schematic diagrams and specifications.

.4 Submit to the Engineer frame for review, bonding points of devices and seismic protection systems to the structure of the building; to this end, submit to the engineer shop drawings and technical data sheets.

.5 Quality assurance submittals: submit the following documents in accordance with section 01 33 00 – Submittal procedures and documents.

.1 Consultant specializing in seismic measurements must present complete documents 100% prepared in accordance with the quality standard, and construction documents, as well as the dimensions that constitute the tender documents. These must contain the full working drawings, material list, design calculations, drawings and specifications that are used to the detailed design of earthquake-resistant fastenings.

.2 Consultant specializing in seismic measures must provide a written and countersigned by the section certifying that the plans, specifications, shop drawings, and products provided, as well as installation, have been audited by an earthquake design engineer, and are adequate and compatible with the entire building while respecting the seismic standards. The earthquake design engineer must also submit a compliance report.

.3 Instructions: submit installation instructions provided by the manufacturer.

.1 Departmental Representative, the DCC Representative, The Consultant will provide the personnel affected, one (1) copy of the installation instructions prepared by the system supplier.

.6 Documents/items to submit upon completion:

.1 Provide maintenance data, which should include instructions on how to control devices and seismic protection systems for incorporation into manual, specified in section 01 78 00 – Items to submit upon completion.

.2 The certificate renouncing all claims of ownership and copyright to the models, drawings, working drawings, details, and specifications in the owner's favor.

1.7 QUALITY ASSURANCE

.1 Health and Safety:

.1 Take the necessary measures for health and safety in the area of construction in accordance with section 01 35 29.06 – Health and safety.

Part 2 Product

2.1 GENERAL

.1 All seismic measures must be fully integrated and compatible with the noise reduction requirements and anti-vibration systems of electrical equipment and related systems, as specified in the documents.

.2 Seismic measures must be compatible with the electrical and structural design of the building. They must not impede the normal operation of mechanical systems and electricity. They must be designed and installed to withstand acceleration forces.

.3 In the attached building, seismic measures must be designed to accept a multiplicative factor of two times the movement of the expansion joints as predicted by the structural Engineer.

.4 Seismic protection devices must not be anchored to two different structures such as walls and ceilings. They are also not to be anchored to each other.

.5 A distribution network, or equipment braced or not required to be braced, must not cause harm to an essential type of distribution network.

.6 Seismic measures should be able, in an earthquake, to prevent all permanent shifts in all directions caused by the lateral movement of ascent or rocking.

.7 Consultant specializing in seismic measures must validate vibration isolators, integrated and separated seismic dampers, the cable fastening and fixing systems from other manufacturers that regularly produce the same material, in agreement with the proposed installation of the relevant section.

.8 Seismic protection systems must be able to oppose the forces in all directions.

.9 Fasteners and fixing joints must withstand the same maximum loads of seismic protection devices.

.10 For longitudinal braces, the conduit must be attached to the duct.

.11 Seismic bracing must be located near the supports (maximum distance of 100 mm (4")) for piping systems, ventilation pipes or electrical conduit.

.12 Depending on the type of service and its manufacturing material, positioning and number of bracing must consider the shift length, maximum permissible ("offset") according to the forces involved throughout the course of the distribution.

.13 Seismic fasteners installed in duct systems and cable racks must be compatible with the requirements of anchors and guides of the duct systems and cable racks.

.14 Do not add seismic measurements for rigid type to existing holders of electrical conduits without checking the ability of these materials to withstand the increased forces.

.15 Mechanical anchor expansion of resistance must be used to secure seismic measures to concrete structures. Cartridge fasteners and anchors simply placed must not be used for tension loads. The use of anchors and fasteners by nail gun is prohibited.

.16 The use of cast iron supports or those made of threaded pipes or other brittle materials is prohibited.

.17 Seismic protection devices installed on networks of conduits and related fasteners attached to the equipment must be compatible with the vibratory and anti-seismic devices for these components.

.18 Seismic protection devices must not interfere with the operation of fire devices or compromise their integrity.

.19 Vertical supports, including vibration isolators, should in no way develop (reverse forces) during normal operation of the network or equipment.

.20 Mounted services and those contained in wells must include seismic measures and follow the recommendations contained in this discipline.

.21 When required, to prevent buckling, stiffeners on suspension rods will be added.

.22 For buildings I_E = 1.3 and 1.5: accessories such as diffusers and lighting fixtures installed in suspended ceilings, must be stabilized everywhere, including the exit corridors.

2.2 CONDUITS AND ELECTRICAL CABLE SHELVES

.1 Electrical conduit supports must withstand all static and dynamic conditions, including:

.1 The weight of the conduit, accessories, and internal wires.

.2 Inclement weather, such as ice, wind, and seismic forces.

.2 Conduit shall be provided with longitudinal and transverse bracing. They can be rigid or flexible types (cable). At the same bracing, always use identical spacers (do not use a spacer with a stiff wire), as per the installation diagrams in SMACNA.

.3 Seismic measures will be based on the recommendations of Sheet Metal and Air Conditioning Contractors National Association (SMACNA):

.1 Seismic Restraint Manual Guidelines for Mechanical Systems – SMACNA

.2 Appendix E – Seismic Restraint Manual Guidelines for Mechanical Systems – Addendum SMACNA.

.4 Use one or more of the following methods depending on the scene conditions:

.1 Fasten conduits securely to the frame.

.2 Strengthen conduit in all directions.

.3 Strengthen attachment points to the conduit frame.

.4 Fasten conduit with bracing. Fixing of conduits by bracing prevents oscillation in the horizontal plane, swinging in the vertical plane, and the sliding and buckling in the axial direction.

.5 Seismic bracing may be omitted:

.1 Electrical conduits individually suspended, the length between the top of the conduit and the anchorage is 300 mm (12") or less. If the installation is made on a trapeze, the permissible length of 300 mm (12") is located between the bottom of the trapezoid and the anchor.

.2 Electrical conduits less than 65 mm (2½") in diameter. If electrical conduits of 65 mm are installed on the trapezoids and the total weight is less than the weight of the pipe or the equivalent of 14.9 kg/m (10 lb/in).

.6 Maximum spacing between seismic bracing shall be as follows, unless otherwise specified in the various tables (see Tables of SMACNA):

Description	Electrical Conduit	
	Transversal	Longitudinal
0.25 g	15.2 m (50')	24.4 m (80')
0.5 g	12.2 m (40')	24.4 m (80')
1.0 g	12.2 m (40')	24.4 m (80')
2.0 g	6.1 m (20')	12.2 m (40')

.7 Cross bracing must be installed at each end if the conduit length is less than the allowed distance. Cross bracing must be installed at each elbow and at each end of a segment. The minimum number is two per length of conduit.

.8 When conduits pass through a seismic joint or a building expansion joint or the pipeline is connected to a device based on vibration isolators, flexible joints must be installed multi-directionally.

.9 A rigid conduit must not be anchored to a structure or part of the building that responds differently to earthquakes.

.10 Raised pipes must be supported laterally at each floor (see details SMACNA).

2.3 EQUIPMENT WITHOUT VIBRATION INSULATORS

.1 Surfaces must withstand all static and dynamic conditions, including:

.1 Their weight with accessories, insulation and internal fluids.

.2 Forces imposed by the effect of thermal expansion and contraction.

.3 Reactions during starts and stops.

.4 Vibration.

.5 Other occasional influences, such as ice, wind and seismic forces.

.2 Coordinate with the structural engineer, the weight of equipment, and the weight of their contents. If it turns out that this mass is greater than 10% of the mass of the floor that supports the whole, rational analysis must be undertaken to consider these and lateral forces.

.3 Devices or equipment must be securely anchored or held in the building framework to prevent them from sliding, tilting or oscillating. Provide support (suspension brackets) in sufficient quantity and of adequate strength to withstand the shear forces to avoid movement. Avoid a breakdown voltage as supports or compression or excessive rotation is imposed on the foundation (frame).

.4 Devices resting on the floor (tile), firmly anchored to the floor or held to a structural wall with metal belts, etc. For devices with a high center of gravity (from the floor) to avoid tipping, which provide rigid support from the top of the equipment and diagonal can be installed either on the ceiling, floor or still in a structural wall.

.5 For equipment not fitted with attachment points, provide for the addition of these anchor points, by welding or other method of attachment or install the fixing belt.

.6 By law, center motor controls (CCM), electrical inputs, etc., using the locations indicated, external structural steel cabinets anchored to the floor (or ceiling if possible).

.7 Seismic measurements may be omitted for equipment or components in operation that weigh less than 9.1 kg (20 lb).

.8 The minimum number of anchors is four (4) and they must include a neoprene lining.

.9 Suspended devices:

.1 With appropriate metal belts and braces:

.1 Lighting:

.1 Attached to the structural slab with gauge cables size 12, length, such that no part of the luminaire falls lower than 2 m above the floor to at least two opposite corners. The cable has a PVC protective covering (cladding). The luminaire must be able to oscillate through an angle of 45° without risk of encountering a component. Bracing must be capable of supporting twice the weight of the suspended element.

.2 The following luminaires:

.1 Fluorescent devices installed in a suspended ceiling or an inverted ceiling, gypsum tees (minimum two fasteners per unit).

.2 Light emitting diode equipment (LED).

.3 Incandescent lighting fixtures.

.4 Compact fluorescent lighting equipment.

.3 High intensity discharge lighting equipment.

2.4 DEVICES WITH VIBRATION INSULATORS

.1 Surfaces must withstand all static and dynamic conditions, including:

.1 Their weight with accessories, insulation and internal fluids.

.2 Forces imposed by the thermal stress of expansion and contraction.

.3 Reactions during starts and stops.

.4 Vibration.

.5 In general, other occasional conditions, such as ice, wind and seismic forces.

.2 These devices must be securely anchored to the building structure to prevent tipping or sliding:

.1 Apply one or more methods, depending on the location conditions.

.2 Use anti-vibration devices with integrated damping systems.

.3 Use dampers separated into more anti-vibration devices.

.4 Use a damping system made of a compound of structural elements and an elastomeric material, with the approval of the engineer.

.3 Damping effect exerted due to an elastomeric material or other means must be smooth and regular so as to prevent high impact loads.

.4 Seismic measures should not interfere with vibration isolators. They must not operate in case of earthquake and will not cause any overturning.

.5 Each device must have at least four seismic dampers installed as close as possible near the corners of the device.

.6 Each type of seismic shock must have the following characteristics:

.1 The impact surface must be high quality, un-cemented, elastomeric, in place for ease of replacement.

.2 Resilient material must be easily accessible for inspection and replacement in the case of damage.

.3 The assembly must reduce movement in all directions.

.4 Dampers must be tested by independent laboratories and certified by a registered engineer in this discipline.

.5 In general, a maximum spacing of 6 mm (¼") between the unit and the seismic shock.

.7 Piping, conduit, and devices supported with vibration isolators:

.1 To avoid transmitting the vibrations normally by rigid bracing, these components have suspended cables relaxed, galvanized steel or stainless steel, see F-type seismic dampers.

.2 Seismic equipment fasteners must have the characteristics described for pipes and ventilation ducts without vibration isolators.

.8 Types of seismic shock:

.1 In general, seismic shock absorbers will be integrated with vibration isolators. When seismic forces are too high or when vibration isolators are existing, they must be separate.

.2 Description:

Type A Separate omnidirectional absorber consisting of a molded element replaceable neoprene 3/16" minimum thickness, maximum capacity of 1 000 lb/in² minimum clearance of ⅛", minimum of two bolts, similar to the model No. Z 1225 by Mason.

Type B Separate omnidirectional absorber consisting of a molded member replaceable neoprene ¾" minimum thickness, maximum capacity of 1 000 lb/in², clear ⅛" to ¼" maximum, minimum number of two bolts, similar to model no. Z-1011 by Mason.

Type C Integrated omnidirectional absorber comprised of one or more springs shock with neoprene linings, placed inside of a housing ductile iron (gray cast iron housings cast are not accepted), minimum clearance ¼" minimum number of two bolts, similar to SLR models SSLFH by Mason.

Type D Integrated damper omnidirectional composed of two molded elements replaceable neoprene placed inside a housing ductile iron minimum number of six bolts, similar to BR model by Mason.

Type E Omnidirectional integrated damper for guiding or anchoring the riser pipes consisting of two steel tubes separated by ½" 60 durometer neoprene, load capacity of 500 lb/in², anchor plate to the base using two bolts, similar to the model ADAH by Mason.

Type F	Aviation type, pre-stressed cable in galvanized steel or stainless steel, complete with the appropriate hardware (fasteners at the ends, assembly lugs, etc.), similar to the SCR model Vibron Mountings & Controls. Use a multiplication factor of 2 if it is of SCR model.
Type G	Hoses, rubber, spherical expansion with several layers of nylon, capable of withstanding 250 lb/in² at 170°F and 165 lb/in² at 250°F, fitting similar right to MFTNC model and 90° fitting similar to MFNEC model by Mason.
Type H	Steel platform suspended with steel frame, able to withstand seismic forces imposed by the weight of the equipment.
Type K	Separate shock absorber composed of frame elements and neoprene cushions, minimum number of two bolts, similar to Kinetics (Vibro Acoustics) KSS model.
Type L	Separate shock absorber consisting of two neoprene sleeves and two steel washers, allowing the bolt to anchor the surface metal panels to a wall, similar to Mason PB model.

2.5 LIST OF MANUFACTURERS

.1 List of manufacturers, section 26 05 49.01:

.1 Stiffeners on suspension rods:

.1 B-Line (Cooper Industries)

.2 Mason Industries Inc. (Tecoustics Ltd, Oakville, Ontario)

.3 Power-Strut by Grinnell

.4 Unistrut (Routleco Inc.)

.5 Vibro-Acoustics, Vibration Mountings & Controls Inc. Korfund Dynamics Co. Inc. (Racan).

.6 Vibron Ltd, Kinetics Noise Control (Patrick Garneau & Associates Inc.)

.2 Supports mechanical pipes and electrical conduits without vibration isolators:

.1 B-Line (Cooper Industries)

.2 Mason Industries Inc. (Tecoustics Ltd, Oakville, Ontario)

.3 Power-Strut by Grinnell

.4 Unistrut (Routleco Inc.)

.5 Vibro-Acoustics, Vibration Mountings & Controls Inc. Korfund Dynamics Co. Inc. (Racan).

.6 Vibron Ltd, Kinetics Noise Control (Patrick Garneau & Associates Inc.)

.3 Seismic dampers:

.1 B-Line (Cooper Industries)

.2 Mason Industries Inc. (Tecoustics Ltd, Oakville, Ontario)

.3 Novibra

.4 Vibro-Acoustics, Vibration Mountings & Controls Inc. Korfund Dynamics Co. Inc. (Racan).

.5 Vibron Ltd, Kinetics Noise Control (Patrick Garneau & Associates Inc.)

.4 Steel Structures external to certain equipment cabinets:

.1 B-Line (Cooper Industries)

.2 Power-Strut by Grinnell

.3 Unistrut (Routleco Inc.)

Part 3 Execution

3.1 MANUFACTURER INSTRUCTIONS

.1 Compliance: comply with requirements, recommendations and manufacturer's written data, including product technical bulletins, instructions for handling, storage and product installation, and technical information sheets.

3.2 INSTALLATION

.1 Fastening devices and bonding points:

.1 Ensure that the bonding points and fixing devices can withstand the same maximum loads of devices and seismic protection systems in all directions.

.2 Retaining cables:

.1 Linking retaining wire to suspended fixtures so that their axial impact corresponds to the center of gravity of the equipment.

.2 Use wire passes, spades and other appropriate hardware parts to ensure alignment of seismic devices and systems and to prevent the cables from bending in points bonding.

.3 In the case of piping systems, install the transversal retaining cables at intervals of not more than 10 m and the longitudinal wires at intervals not exceeding 20 m or according to the limits imposed by their performance characteristics or those of the anchors.

.4 For purposes of seismic protection, small diameter pipes may be subject to larger diameter pipes; however, the opposite practice is not permitted.

.5 In the case of equipment hanging from the ceiling, ensure angle of 90° in the restraint cables relative to each other (in the plane), and attach them to the building frame at a 45° angle.

.6 Adjust the tension of the cables so they do not appear loose but ensure they do not impede the normal operation of anti-vibration devices.

.7 Tighten the cables in order to reduce the slack, 40 mm under thumb pressure. Under normal operating conditions, the cables must not support the weight of the retained material.

.3 Install seismic devices and systems at least 25 mm from any machinery or any utility line.

.4 Uninsulated Miscellaneous equipment against vibration:

.1 Bolt the equipment to the mounting base and then to the building frame with the aid of through anchor bolts.

.5 Coordinate operations with the other trades involved.

3.3 INSPECTION

.1 After installing all rigid and flexible bindings and ensured their proper functioning in normal conditions, carry out inspections and repairs as per seismic measures.

.2 A consultant specializing in seismic measures will inspect the entire installation and remark and provide seismic measures it has calculated. Submit a written report signed by the same engineer who produced the design report including, among others:

.1 Installation errors with corrective actions required.

.2 Improperly selected seismic dampers.

.3 Other deficiencies that could affect the operation of seismic measurements with corrective actions required.

.4 Steps to correct installations.

.5 The certificate of conformity signed by the electromechanical system to the standards listed previously issued once all defects or errors have been corrected. This report must be submitted to the project donor or his representative before the acceptance of work.

3.4 FREE SPACING

.1 All seismic measurements should be verified after the mechanical and electrical systems have been switched on to ensure that the recommended free spacings are obtained. No more than recommended, as the fragility of the unit may be affected. Make adjustments where required. Be sure that the seismic shocks do not cause short circuits with vibration isolators.

.2 A minimum clearance of 25 mm (1") must be provided between the seismic protection devices, other equipment, and service elements.

3.5 CLEANING

.1 Perform cleaning in accordance with section 01 74 11 – Cleaning.

.2 Once the installation work and performance assessment have been completed, remove surplus materials, rubbish, tools and equipment.

END OF SECTION

TABLE OF CONTENTS

Partie 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 20 00 10 – Mechanical and electrical general instructions.

.2 Shop drawings: nameplates for electrical equipment.

1.4 DOCUMENTS/ELEMENTS TO BE SUBMITTED ON COMPLETION OF THE WORK

.1 Submit the required documents/elements, in accordance with section 20 00 10 - General mechanical and electrical instructions.

Partie 2 Product

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:

Types	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 9 mm with black lettering on white tape.

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

2.3 ELECTRICAL EQUIPMENT IDENTIFICATION

.1 Materials:

.1 Normal power: "P-Touch" type labels or approved equivalent. Size 12 mm with black lettering on white tape.

.2 Emergency power: "P-Touch" type labels or approved equivalent. Size 12 mm with red lettering on white tape.

.3 UPS power: "P-Touch" type labels or approved equivalent. Size 12 mm with blue lettering on white tape.

2.4 UNILINGUAL IDENTIFICATION

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

Partie 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 lamicoid plate above the outlet cover.

3.4 ELECTRICAL EQUIPMENT

.1 Information to include on nameplates:

Equipments	Formats	First Line	Second Line	Third Line	Fourth Line
Starter	6	No. of powered equipment	Room	---	---
Starter	6	Supplied equipment number	(If TX, supplied panel), (room)	---	---
(*) 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.

Systems	Conduit colours
Normal 480/600 V	Green
Normal 120/208 V, 120/240 V	Violet

.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:

Secondary colours	
Mechanical	---
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:

Building conductor colour codes	
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

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Part 1 General

1.1 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit the required documents and samples, in accordance with section 26 00 10 – Mechanical and electrical general instructions.

.2 Product data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for motor control centres and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop drawings:

.1 Indicate on drawings: schematic and wiring diagrams.

Part 2 Product

2.1 SUPPLY CHARACTERISTICS

.1 Supply power as indicated.

2.2 GENERAL DESCRIPTION

.1 Drawings of starter and channel controls affixed inside the door. Identification compatible with the control plans.

2.3 MOTOR STARTERS AND DEVICES

.1 Overload relay:

.1 The overload relays will be of the electronic sensor type (Solid State).

.2 Phase loss protection.

.3 Manual reset.

.4 Trip current adjustment.

.5 Select the relay class according to the characteristics of the motor, minimum class 20 required.

Part 3 Execution

3.1 INSPECTION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other sections or contracts are acceptable for motor control centres 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 the Consultant.

3.2 INSTALLATION

.1 Set and secure motor control centre in place on channel bases, rigid, balanced, and square to building floor and wall.

.2 Make field power and control connections as indicated.

.3 Ensure correct overload heater elements are installed.

.4 Bolt the floor, the motor control centers, by means of four bolts 9 mm diameter x 40 mm and of length 1 m, installed in the center when the cells are mounted in a continuous row, and at least the four corners when the cells have less than 1 m in width.

3.3 FIELD QUALITY CONTROL

.1 Ensure moving and working parts are lubricated where required.

.2 Operate starters, in sequence, to prove satisfactory performance of motor control centre during a period of one hour.

END OF SECTION

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Part 1 General

1.1 NOT USED

.1 Not Used.

Part 2 Product

2.1 MATERIALS

.1 Starters: to IEC 947-4 with AC4 utilization category.

.2 In general, starters and push buttons are part of the electrical contractor contract unless specified otherwise.

.3 All engines must be equipped with manual or magnetic starter types, test sprinklers with or without push button, depending on the individual device description. All starters must be of the same brand in order to facilitate maintenance. They must meet the NEMA standard.

.4 Magnetic starters serving prolonged acceleration engines must be equipped with thermal relays to protect against slow tripping overloads.

.5 Every mechanical section involved must ensure that there are formal and preliminary agreements between the manufacturer and the starter-motor based on the mutual acceptance of their products. The section that provides the engine is solely responsible for the choice of overload and overcurrent relays.

.6 In places where the cases are waterproof (NEMA-4), paint the outside of the boxes with a layer of epoxy paint.

.7 Each starter must be provided with a function display, a three-phase thermal protection with melted (welded) or special bimetallic alloy engines type T carcass and class B. Insulation starters must be calibrated for carcass engines type T and type B.

.8 All connections inside the starters should be made on screw terminals, type 9700B mounted on rail with warning plates and end plates, by Wieland. To that end, provide a terminal identified with a minimum of four air terminals.

.9 Starter motor 20 HP and above with trip relays for thermistor similar to the model no. 3UN8 Siemens with fault indicator on the front of the starter. Install the relay in a CEMA-1 case if it cannot be integrated into the factory made starter.

.10 Unless otherwise specified for each magnetic starter, provide both N.O. and N.C. auxiliary contacts.

2.2 MANUAL MOTOR STARTERS

.1 Single or three phase manual motor starters of size, type, rating, and enclosure type as indicated, with components as follows:

.1 Switching mechanism, quick make and break.

.2 One (1) or three (3) overload heaters, manual reset, trip indicating handle.

.2 Accessories:

.1 Push button toggle key switch: labelled as indicated.

.2 Indicating light: type and colour as indicated.

.3 Locking tab to permit padlocking in "on" or "off" position.

.3 Acceptable manufacturers:

.1 For motors of 1 HP and at least 115/230 V/1/60: model 2510 by Schneider Group (Square D), switch.

2.3 FULL VOLTAGE MAGNETIC STARTERS

.1 Magnetic, combination magnetic starters of size, type, rating and enclosure type as indicated with components as follows:

.1 Contactor solenoid operated, rapid action type.

.2 Motor overload protective device in each phase, manually reset from outside enclosure.

.3 Wiring and schematic diagram inside starter enclosure in visible location.

.4 Identify each wire and terminal for external connections, within starter, with permanent number marking identical to diagram.

.2 Combination type starters to include fused disconnect switch with operating lever on outside of enclosure to control and provision for:

.1 Locking in "off" position with up to one (1), two 2) or three (3) padlocks.

.2 Independent locking of enclosure door.

.3 Provision for preventing switching to "on" position while enclosure door open.

.3 Accessories:

.1 Pushbuttons, selector switches: standard, heavy duty, labelled as indicated.

.2 Indicating lights: standard, heavy duty, type and color as indicated.

.3 Two (2) N.O. and two (2) N.C. spare auxiliary contacts unless otherwise indicated.

.4 Acceptable Manufacturers:

.1 Combined type with motor circuit breaker no. 8539 Schneider Group (Square D), control relays provided by the manufacturer.

2.4 ACCEPTABLE MANUFACTURERS

.1 Cutler-Hammer

.2 General Electric

.3 Schneider Group

.4 Klockner-Moeller

.5 Siemens

.6 Télémécanique

Part 3 Execution

3.1 INSTALLATION

.1 Install starters and control devices in accordance with manufacturer's instructions.

.2 Install and wire starters and controls as indicated.

.3 Ensure correct fuses installed.

.4 Confirm motor nameplate and adjust overload device to suit.

.5 Make the motor and equipment connections provided under other divisions and under the supervision of the suppliers/manufacturers of these devices.

.6 Ensure that the voltage and number of phases of the power supply circuits and equipment are compatible.

.7 Ensure overload relays are suitable for the engines they protect. To this end, approval of the caliber of these relays by the supplier/manufacturer of each engine is required.

.8 Install jumpers on the terminals provided for the control connection, so you can try each starter, even if the command circuits are not relayed.

.9 Check the thermal protection of each engine starter. Make a list of the results and return it to the Consultant.

3.2 FIELD QUALITY CONTROL

.1 Operate switches and contactors to verify correct functioning.

.2 Perform starting and stopping sequences of contactors and relays.

.3 Check that sequence controls, interlocking with other separate related starters, equipment, control devices, operate as indicated.

.4 Before operating the engine for the first time, the electrical contractor must:

- .1 Ensure the presence of the section that refers to the engine.
- .2 Check the direction of rotation of motors. If rotation is wrong, make corrections and new fittings on the engine and not in the ignition, in order to respect the color coding of the wiring.
- .3 Before starting the engine, ensure the free movement of any layer of shaft mechanical seal pump.
- .4 Check protection overload and overcurrent to ensure they are adequate.
- .5 Check the “megger” insulation.
- .6 Measure the voltage of the electric circuit powering the motor.
- .7 Check voltage (volt) and current (ampere) of each of the motors upon starting and at normal operation on each phase.
- .8 Check the operation positions of the controls and switches.

.5 Ensure the presence of the manufacturer of the engine and/or the device.

.6 At all costs, the engines should not be started unless the requirements mentioned above have been executed.

.7 Engine manufacturers must provide the start-up curves of their engines.

END OF SECTION