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**CANADIAN SPACE AGENCY**  
**Air-conditioning of room 2B-203**

**Specifications – Electrical**

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Project: 2020-134-1024

**CANADIAN SPACE AGENCY**  
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**AIR-CONDITIONING OF ROOM 2B-203**

**DIVISIONS 01 AND 26**

Document signé numériquement / Digitally signed document



**For tender**  
**August 26, 2022**



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3.1 NOT USED



## **Part 1 General**

### **1.1 DEFINITION**

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

### **1.2 EXAMINATION OF THE SITES**

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

### **1.3 VERIFICATION OF THE DRAWINGS AND SPECIFICATIONS**

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



#### **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 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 or English.

## **1.18 COORDINATION DRAWINGS**

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



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

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

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

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

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



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

## 1.21 FRAMES AND ACCESS DOORS

- .1 Unless otherwise specified, recessed frames and access doors in walls and ceilings, other than easily removable ceilings, shall be provided by the relevant section but installed by the company responsible for the construction of walls and ceilings.
- .2 Each mechanical and electrical section shall determine the size and location of doors in such a way as to ensure easy access to all baffles, control devices, fire dampers, valves, vents, cleanouts, siphons, sieves, traps, ventilation units, pull boxes, electrical appliances, etc.
- .3 The doors must be at the same fire resistance specified for the walls and ceilings.
- .4 These frames and doors shall be built-in, constructed of 1.6129 mm (16-gauge) galvanized sheet metal with a layer of sealant. Hidden frames with exposed line with face flush with wall or ceiling, concealed hinge, 150° opening with lock and key (except on fire doors). The door must self-closing.
- .5 The types of frames and doors are as follows:
  - .1 Walls made of brick, concrete block, finished in tile, poured cement blocks covered with gypsum boards or other similar finish: Karp no DSC-214M.
  - .2 Ceilings and walls of plaster or with cement finish or other similar finish: Karp KDW.
  - .3 Firewalls: Karp no KRP150FR, in steel, 16-gauge, with 50 mm (2") of insulation in the door, fire resistance of ULC 1½ h, with self-closing mechanism and without lock/latch.
- .6 All Contractors must coordinate in order to provide the same type of door for all mechanical and electrical sections.





## **1.22 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

## **1.23 OPERATION AND EQUIPMENT MAINTENANCE INSTRUCTION MANUALS**

- .1 Each section must provide the Owner with four copies of manuals with detailed instructions for the operation and maintenance of all equipment and appliances included in his contract. Also provide a USB flash drive.
- .2 These manuals must contain:
  - .1 A list and illustration of all equipment components: pumps, fans, filters, controls, burners, alarm panels, lighting fixtures, transformer stations, generators, fire alarms, etc.
  - .2 A copy of the approved shop drawings, and as executed.
  - .3 The instructions for lubrication published by the manufacturers with the specifications of the oils and greases to be used and the frequency of lubrication.
  - .4 A diagram indicating the identification numbers of each valve, the normal operating position, the location, and flow direction for each of the piping systems.
  - .5 Prepare a properly attached glossary containing the number, location, and function of each valve. This glossary should contain a separate chapter for all shut down (or emergency) valves and main valves. The numbering code must be approved.
  - .6 A diagram of the controls with explanatory text.
  - .7 A list identifying access points to fire shutters and controls in the walls and ceilings.
  - .8 A list of legends of the piping, the piping identification codes, and ventilation systems.
  - .9 A list of the systems' final calibration values, as approved.
  - .10 A list of the different sub-Contractors with names, addresses, and phone numbers.
  - .11 A list of representatives and/or manufacturers of the installed equipment with names, addresses, and phone numbers.
  - .12 These instructions must contain all the graphics, curves, capacities and other data provided by the manufacturers concerning the operation and details of all mechanical and electrical equipment installed in the building.
  - .13 The fan graphics must clearly indicate the specified operating capacities and the required horsepower. These graphics should also indicate the serial number, fan model, and the operating speed.





- .3 The entirety must be written in French or English.
- .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.

#### **1.24 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".

#### **1.25 PLACEMENT OF PIPING AND DUCTS**

- .1 No pipe may be in contact with another. Allow a clearance of at least 15 mm ( $\frac{1}{2}$ ") 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.

## **1.26 MANUFACTURERS' INSTRUCTIONS**

- .1 Install the various pieces of prefabricated materials and equipment, in accordance with the manufacturer's instructions. Obtain all relevant instructions.

## **1.27 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.

## **1.28 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.

### **1.29 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.

### **1.30 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.

### **1.31 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.

### **1.32 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.

### **1.33 INSPECTIONS**

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

### **1.34 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 forty-eight (48) hours notice to the Engineer before the date of the test.
  - .6 Provide equipment, meters, material and staff required to run tests during the project until the acceptance of installations by the Engineer and pay all fees.



- .7 If a piece of equipment or device does not meet the manufacturer's data or the specified performance during a test, immediately replace the defective unit or part and pay all expenses incurred by the replacement. Make adjustments to the system to achieve the desired performance. Cover all costs, including those of new tests and repair.
- .8 Prevent dust, dirt, and other foreign matter from entering the openings of installations and equipment during testing.
- .9 Provide to the Engineer a certificate or letter from the manufacturer confirming that each section of the installation was implemented to their satisfaction.
- .10 Submit the written test results to the Engineer.
- .11 The tests must be performed and accepted prior to the installation of the thermal insulation.
- .12 Do not conceal or embed any piping, conduits, accessories 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.



### 1.35 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 period, and until receipt "with reservation", each section concerned shall carry out normal maintenance, in accordance with the manufacturers' recommendations and the instruction manuals supplied by the Contractor. Maintenance between "qualified" and "unqualified" receptions will be performed by the Owner if all information is provided and training has been completed. Otherwise, the Contractor will have to assume the maintenance.

### 1.36 EQUIPMENT CALIBRATION AND OPERATION

- .1 General:
  - .1 Vibration tests are required to ensure that:
    - .1 The equipment operates within acceptable levels of vibrations.
    - .2 That vibrations or noises is not transmitted to the building structure.
  - .2 The company in charge of the work of each relevant section must use the services of a firm specialized in vibration analysis to conduct verifications and the work required by this article.
  - .3 Before proceeding to any work, have the selection of the specialized firm, which must be retained to perform the analyses, approved. Submit the qualifications of the firm and the methodology to be used to perform the work.
  - .4 The work must be performed by a qualified Engineer or Technician.
  - .5 Provide a list of personnel who will be assigned to the project and a list of equipment and devices that will be used to perform the analyses.
- .2 Analyses:
  - .1 Fans with a 1 HP or stronger motor must be analyzed.
  - .2 Pumps with a 3 HP or stronger motor must be analyzed.
  - .3 All systems modulated by a variable frequency speed controller must be analyzed over the entire range of operating frequencies.
  - .4 ANSI S3.29 and ISO 2631-2 standards must be followed for occupant comfort.
  - .5 If the acceptable values of vibrations are not available from the manufacturer of the equipment, use the RMS values (IRD 1988).
  - .6 Also refer to the chapter "Sound and Vibration Control" from ASHRAE.





- .7 Minimum criteria:
  - .1 The amplitude parameter is the velocity (mm/sec.). The frequency range used must cover 600 cycles/min. (CPM) (10 Hz) to 600 000 cycles/min. (10 000 Hz).
    - .1 Overall value (unfiltered) for the entire frequency band of the device: maximum velocity of vibrations of 4 mm/sec.
    - .2 Filtered value (by frequency band): peak maximum velocity of 2 mm/sec.
- .3 General procedure:
  - .1 General:
    - .1 All analyses should be performed only when the system is adjusted, calibrated, and functioning according to design requirements. The analyses can be performed during the running-in period.
    - .2 Provide a coordinated schedule with the Contractor's intervention and the Owner's activities for the testing of each piece of equipment.
    - .3 During the execution of the works, prepare and present to the Contractor and the Engineer preliminary reports for later discussion about the tests.
  - .2 Complete a visual check of all equipment to detect any obvious installation error correctable on-site.
  - .3 Ensure the freedom of movement of vibration isolators and that there are no short circuits caused by any obstruction, whether between the equipment or the anti-vibration equipment base and the structure of the building.
  - .4 Operate the equipment and check by hearing for any apparent malfunction.
  - .5 Check the bearings with a stethoscope. Defective bearings must be replaced immediately to avoid damaging the shaft or any other component.
  - .6 Adjust and calibrate the equipment and the system so that the equipment vibration tests are performed at operating conditions.
  - .7 Perform vibration tests.
- .4 Vibration testing procedure:
  - .1 The following steps must be followed to ensure that the tests are adequate.
  - .2 Determine the operating speed of the equipment. Using a tachometer or stroboscope, measure the rotational velocity of the driven equipment, as well as that of the motor.
  - .3 Determine and report the acceptable criterion in the report.
  - .4 Ensure the freedom of movement of vibration isolators.
  - .5 Operate the equipment and perform a visual and auditory verification to detect any apparent malfunctioning. Check bearings using a stethoscope. Defective, misaligned, and malfunctioning bearings must be corrected before continuing the test. If corrections are not made, the equipment will be considered unacceptable.





- .6 Measure and record the bearing vibrations from the driven components as well as of the motors in horizontal, vertical and, if possible axial directions. There must be at least one axial measurement for each rotating equipment.
- .7 Take a "Spike Energy" reading for each engine to determine its condition.
- .8 Perform an analysis with respect to time on each engine to detect the probability of an electrical fault.
- .9 Analyze the results and determine probable causes of the vibration.
- .10 Proceed to the corrections required for operation within acceptable standards.
- .11 Perform a new analysis to demonstrate that the equipment is operating within acceptable standards.
- .5 Analyses reports:
  - .1 Submit three (3) copies of the final report.
  - .2 The report should contain, among other things, the following information:
    - .1 For each analyzed system, a diagram identifying the measurement points.
    - .2 The vibration curves generated by the analyzer, indicating the date on it, the measuring range, the multiplier, the filter used, the identification of the analyzed equipment, and the measurement point.
    - .3 A table showing the velocity measurements in inches/s, as well as the "Spike Energy" for each of the reading points of the equipment.
    - .4 Conclusions from the data collected in relation to vibration criteria and the likely causes of the vibrations.
    - .5 Description of corrective actions done on each device.
- .6 Accepted companies:
  - .1 Hydraulique R&O Services Inc.
  - .2 Paul Gilles Vibrations
  - .3 Services Techniques Vibal Enr.
  - .4 Vibra K Consultants
  - .5 Vibro Mec JPB

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

- .1 Give to the representative of the Owner all the details on the operation of the equipment specified and installed under this contract. Provide qualified personnel to operate this equipment until the Owner's representative is adequately qualified to take charge of the operation and maintenance of said equipment.
- .2 This training can be combined with the final testing period provided that the Owner's team is available.
- .3 It is understood that such tests are not an automatic acceptance of equipment by the Owner.



- .4 The Owner has the right to do this test as soon as the work is considered sufficiently complete by the relevant Engineer's section, and considered in accordance with the drawings and specifications

### **1.38 WARRANTY**

- .1 Each section guarantees its work for a period of one year after acceptance "with reservation" of the work by the Owner. It is required to repair or replace, at its expense, any defects that would become apparent during this period and that, within forty-eight (48) hours after having been formally notified.
- .2 Manufacturers must offer a one (1) year warranty from the starting operation date or eighteen (18) months from the date of delivery to the site, as appropriate. The warranty must include the cost of materials and labour, and the replacement of defective parts and/or manufacturing defect. In the case of chillers, a five-year warranty applies if the refrigerant charge is contaminated due to the compressor motor burning.
- .3 The warranty is for a period greater than one (1) year (extended/or special warranties), for the areas indicated in the respective specifications.
- .4 This warranty is fully independent of the article of the Civil Code concerning the five (5) year warranty.
- .5 General conditions:
  - .1 It is expected that several contracts of the same discipline may be executed by different companies, that another company may have adjustments or tests to be executed on its work, that another company may have work to be done which are a subsequent phase of its work, that each company is committed, through this specification, to accept that its work is subject to all conditions listed above without changing the terms of the warranty.
- .6 The use of permanent equipment for temporary purposes does not relieve the relevant section of its responsibilities and obligations with respect to the acceptance and guarantee of its work.
- .7 The Engineer and/or the Owner reserve the right start the equipment and mechanical and electrical works without affecting the section's obligation to see to the full maintenance of its work up to acceptance "with reservation".

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

- .1 During the warranty period, in addition to the obligations described in the specifications, the relevant section must provide any technical assistance required by the Engineer and/or Owner with respect to the operation of the installations and their improvements or adjustments as required.



- .2 The temporary use or testing with the goal of adjusting equipment or any other purpose, or permanent use by the Owner of the mechanical and electrical works before the final acceptance of the works should not be interpreted as evidence that such works are accepted by the Owner and does not alter the terms of the warranty. During this time period, the relevant section retains responsibility for the maintenance of installation. No claim for damage or failure of any part of the work put into use will be considered by the Owner.

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

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

#### **1.41 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: medical gas, electricity, water, steam, etc.
- .2 Demolition:
  - .1 All demolition work, including road cuts, utilities, and sealing of disused pipes, are the responsibility of the Contractor.
- .3 Noise:
  - .1 Because of the proximity of the occupied premises, take all necessary measures to reduce the noise from construction and demolition.
- .4 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 cm<sup>2</sup> 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 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**





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- 1.1      REQUIRED DOCUMENTS ON STARTUP OF THE SITE
- 1.2      REQUIRED DOCUMENTS DURING THE SITE UNTIL THE RECEPTION OF  
            ACCEPTANCE "WITH RESERVE"
- 1.3      DOCUMENTS REQUIRED FOR THE "UNRESERVED" ACCEPTANCE OF THE WORKS

### **PART 2      PRODUCT**

- 2.1      NOT USED

### **PART 3      EXECUTION**

- 3.1      NOT USED



## Part 1 General

### 1.1 REQUIRED DOCUMENTS ON STARTUP OF THE SITE

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

Description		Transmission dates
<b>1.1</b>	<b>Electrical</b>	
1.1.1	Licences and qualifications.	
1.1.2	List of subcontractors and their contact details.	
1.1.3	List of suppliers with addresses and contact persons.	
1.1.4	List of staff assigned to the project and their contact details (foreman, estimator, boss/project manager).	
1.1.5	Detailed breakdown of payment requests.	
1.1.6	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
<b>1.2</b>	<b>Generalities</b>	
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.	
<b>1.3</b>	<b>Electrical</b>	
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	Complete verification and commissioning report for each piece of equipment.	
1.3.6	Thermographic inspection reports, as prescribed in section 26 05 00.01.	
1.3.7	WHMIS Material Safety Data Sheets, as prescribed in section 26 05 00.01.	
1.3.8	Table summarizing the tests to be carried out within the framework of the project.	
1.3.9	Table of contents for operation and maintenance manuals.	
1.3.10	Certificates signed by the Contractor for all tests.	



Description		Transmission dates
1.3.11	Certificate of conformity of the entire system requiring fire resistance, end to end, complete with all components, by the cable manufacturer.	
1.3.12	Megohmmeter cable insulation report, as requested in section 26 05 00.01.	
1.3.13	Report of commissioning motor control centers.	
1.3.14	Commissioning Report variable frequency drives.	
1.3.15	Report of the earth resistance of the network.	
1.3.16	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
<b>1.4</b>	<b>General</b> All the lists of deficiencies of the specialized contractors completed and cross-checked by the foreman of the project. Important Notes : <ul style="list-style-type: none"> <li>– A signature from the project manager and the foreman will be required to certify that the work is being carried out.</li> <li>– Once the Company Representative has confirmed that the deficiencies are 100% complete, the Construction Professional will make a final inspection of the work with the latter and the Company. If further visits are required as a result of uncompleted corrections, the Contractor will be responsible for the costs involved.</li> </ul>	
<b>1.5</b>	<b>Electrical</b>	
1.5.1	List of deficiencies 100% completed and initialed by the project manager.	
1.5.2	Letters of guarantee.	
1.5.3	Operation and maintenance manual completed and accepted by the construction professional.	
1.5.4	Certificate of conformity duly signed.	
1.5.5	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**



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**Part 1 General**

**1.1 RELATED REQUIREMENTS**

- .1 All contractual documents.
- .2 Obtain a copy of pertinent documents, read them attentively and determine requirements based on the scope of work.

**1.2 SCOPE OF WORK**

- .1 Work Includes:
  - .1 In general, work consists of the supply of all required materials, workforce, equipment and tools required to complete the electrical installations as described in writing, plans, and specifications. Most notably, work is comprised of:
    - .1 Distribution network of 120/208 V, normal and emergency.
    - .2 Single phase distribution network of 120/240 V, normal and emergency.
    - .3 Electrical and mechanical grounding.
    - .4 Supply and connection of all motors and their controls.
    - .5 Supply and connection of electric heating appliances; connection only to the coils of the HVAC systems.
    - .6 Connection of other equipment as outlined in the plans.
    - .7 All steel structural supports for conductors, cables, devices, and equipment.
    - .8 All specified tests.
    - .9 Relocation of existing equipment.
    - .10 Demolition and removal of equipment deemed obsolete.
    - .11 Installation of temporary equipment to ensure continuity of service.

**1.3 MATERIALS**

- .1 Unless stated to the contrary use new materials, without defect, and of the quality required, bearing the appropriate approval labels by CSA, ULC, FM, according to the specifications.

**1.4 DOCUMENTS/SAMPLES TO SUBMIT FOR APPROVAL/INFORMATION**

- .1 Submit the documents and samples required in accordance with section 26 00 10 – Common work results for electrical.
- .2 Shop Drawings:
  - .1 Wiring diagrams and device installation details must indicate proposed location, proposed layout, control panels, accessories, piping, ducts, and all other elements which must be shown in order to ensure a coordinated construction installation.
  - .2 Wiring diagrams must indicate the terminal ends, internal wiring of each device and in addition interconnections between the different devices.



- .3 Drawings must indicate clearances for operation, maintenance and replacement of operating equipment devices.

## **Part 2 Products**

### **2.1 DESIGN REQUIREMENTS**

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

### **2.2 MATERIALS AND EQUIPMENT**

- .1 Material to be CSA certified. Where CSA certified material is not available, obtain special approval from authority having jurisdiction before delivery to site and submit such approval as described in part 1 "ACTION AND INFORMATIONAL SUBMITTALS".

### **2.3 WIRING TERMINATIONS**

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

### **2.4 EQUIPMENT PROTECTED BY SPRINKLERS**

- .1 Any electrical equipment which is enclosed in a perforated cover/box/container and that is installed in a sprinkler-protected area must be protected by a hood or non-combustible cover that is arranged in such a way that it does not impede the proper functioning of the sprinkler system.

### **2.5 EQUIPMENT IDENTIFICATION**

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

NAMEPLATE SIZES			
Size 1	10 mm x 50 mm	One line	3 mm high letters
Size 2	12 mm x 70 mm	One line	5 mm high letters
Size 3	12 mm x 70 mm	Two lines	3 mm high letters





NAMEPLATE SIZES			
Size 4	20 mm x 90 mm	One line	8 mm high letters
Size 5	20 mm x 90 mm	Two lines	5 mm high letters
Size 6	25 mm x 100 mm	One line	12 mm high letters
Size 7	25 mm x 100 mm	Two lines	6 mm high letters

- .2 Labels: embossed plastic labels with 6 mm high letters unless specified otherwise.
- .3 Wording on nameplates to be approved by Consultant prior to manufacture.
- .4 Allow for minimum of twenty-five (25) letters per nameplate and per label.
- .5 Nameplates for terminal cabinets and junction boxes to indicate system and/or voltage characteristics.
- .6 Identify equipment with Size 3 labels engraved "ASSET INVENTORY NO. [\_\_\_\_]" as directed by Consultant.
- .7 Disconnects, starters and contactors: indicate equipment being controlled and voltage.
- .8 Terminal cabinets and pull boxes: indicate system and voltage.
- .9 Transformers: indicate capacity, primary and secondary voltages.
- .10 Devices:
  - .1 Identify all electrical equipment with visible safety labels on the device cover, the door of the device, or on the device frame.
  - .2 Use the same device code as indicated on drawings.
  - .3 Provide a list of all device identification for approval prior to the manufacturing.
  - .4 Assure that all device identifications are affixed to the equipment and that they are in French.
  - .5 List of equipment to identify:
    - .1 High voltage cells at transformer entry points, in addition to disconnectors, switches under load, breakers, and transformers.
    - .2 Cells of the main low-voltage switchboard in addition to the breakers and fused-disconnects.
    - .3 Distribution panel, secondary panel, and motor control centre.
    - .4 Disconnects, starters, contacts, relays, relay box, live components, inverter cabinets.
    - .5 All specific elements identified in plans or in each section of the specifications.

## 2.6 WIRING IDENTIFICATION

- .1 Identify wiring with permanent indelible identifying markings, numbered, on both ends of phase conductors of feeders and branch circuit wiring.
- .2 Maintain phase sequence and colour coding throughout.
- .3 Use colour coded wires in communication cables, matched throughout system.



.4 Phases:

- .1 Identify with letters of size 5 cm in height, each phase A, B, C, N, on the inside of each transformer entry point, each low-voltage switchboard, and each motor control centre on all live components.
- .2 Identify components and assigned phases using the colour codes outlined below:

Identification	120/208 V	120/240 V	347/600 V
Phase A	Red	Red	Red with stripe
Phase B	Black	Black	Black with stripe
Phase C	Blue	---	Blue with stripe
Neutral	White	White	White
Grounding or mass continuity	Green	Green	Green

- .3 Use yellow coloured wiring for lighting return switches and orange coloured wiring for driver deflecting switches and inverters.
- .4 For phase conductors only, use coloured tape placed at a distance of 150 mm from each end of the conductors to identify drivers. Use coloured tape on each end of the conductors inside junction and pull boxes.
- .5 For neutral, grounding and bonding conductors, use heat-shrink tubing or paint provided for this purpose, at each end of each conductor, to identify all large conductors that do not provide choice of colors.

.5 Drivers:

- .1 Identify in each panel, in each pull and junction box each wire with the use of identification tags of the E-Z-Code brand, model WB from Thomas & Betts.
- .2 Indicate on the tag: the circuit number, zone number, and function, in a way that each wire can be easily identified.

## 2.7 CONDUIT AND CABLE IDENTIFICATION

- .1 Colour code conduits, boxes and metallic sheathed cables.
- .2 Unless otherwise specified, use thin-walled metal ducts painted along the entire length by the manufacturer.
- .3 Colours: 25 mm wide prime colour and 20 mm wide auxiliary colour.

Description	Prime	Auxiliary
Up to 250 V	Yellow	
Up to 600 V	Yellow	Green
Other communication networks, general call, etc.	Green	Blue
Emergency communications	Red	Blue
Other safety and auxiliary networks	Red	Yellow



- .4 Conduits:
  - .1 Colour code conduits, boxes and metallic sheathed cables.
  - .2 Code with plastic tape or paint at points where conduit or cable enters wall, ceiling, or floor, and at 15 m intervals.
  - .3 Paint all junction and pull boxes.

## **2.8 CIRCUIT IDENTIFICATION**

- .1 Secondary panels at 120/208 V and 347/600 V:
  - .1 Identify in type each of the circuits in the secondary panel on a protected plastic tab inserted in the panel box door. Use the same circuit number that appears in the plans. Be sure to describe succinctly the load.
- .2 Distribution panel at 120/208 V, 347/600 V and 600 V:
  - .1 Identify each circuit in the panel with a visible safety label and place the label near each disconnect and breaker.

## **2.9 FINISHES**

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

## **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 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 Do complete installation in accordance with CSA C22.1 except where specified otherwise.
- .2 Do overhead and underground systems in accordance with CAN/CSA-C22.3 no. 1 except where specified otherwise.

### **3.3 NAMEPLATES AND LABELS**

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



### **3.4 CONDUIT AND CABLE INSTALLATION**

- .1 If plastic sleeves are used in fire rated walls or floors, remove before conduit installation.
- .2 Install cables, conduits and fittings embedded or plastered over, close to building structure so furring can be kept to minimum.

### **3.5 MOUNTING HEIGHTS**

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

### **3.6 COORDINATION OF PROTECTIVE DEVICES**

- .1 Ensure circuit protective devices such as overcurrent trips, relays and fuses are installed to required values and settings.
- .2 Ensure circuit protective devices such as overcurrent trips, relays and fuses match the required capacity values according to their labels.

### **3.7 FIELD QUALITY CONTROL**

- .1 Load Balance:
  - .1 Measure phase current to panel boards with normal loads operating at time of acceptance; adjust branch circuit connections as required to obtain best balance of current between phases and record changes.
  - .2 Measure phase voltages at loads and adjust transformer taps to within 2% of rated voltage of equipment.
  - .3 Provide upon completion of work, load balance report as directed in part 1 "ACTION AND INFORMATIONAL SUBMITTALS", phase and neutral currents on panel boards, dry-core transformers and motor control centres, operating under normal load, as well as hour and date on which each load was measured, and voltage at time of test.
- .2 Conduct following tests:
  - .1 Motors, heaters and associated control equipment including sequenced operation of systems where applicable.
  - .2 Insulation resistance testing:
    - .1 Megger circuits, feeders and equipment up to 350 V with a 500 V instrument.
    - .2 Check resistance to ground before energizing.
- .3 Carry out tests in presence of Consultant.
- .4 Provide instruments, meters, equipment and personnel required to conduct tests during and at conclusion of project.



### **3.8 PERFORMANCE**

- .1 Electrical contractor to collaborate with other trades in such a way that the performance of equipment can be tested in a timely fashion.
- .2 Once testing of equipment is complete, devices can be adjusted in such a way to obtain maximum efficiency.
- .3 General Requirements:
  - .1 All testing must be completed in the presence of the engineer and to their satisfaction.
  - .2 The engineer may require their own testing prior to accepting the results.
  - .3 For temporary testing, obtain written permission to perform the tests.
  - .4 A written warning giving a notice of 48 hours to the engineer is required prior to testing.
  - .5 Provide the necessary devices, equipment, meters, materials, and personnel required for the execution of testing throughout the project until such a time as the engineer accepts the performance.
  - .6 If a piece of equipment or a device does not operate as per the manufacturer's guarantee or the results of a test do not yield the desired results, the faulty piece of equipment must be replaced without delay and payment shall be deferred until the new piece of equipment is installed and desired operating results are obtained.
  - .7 Prevent dust, dirt, and other foreign materials from penetrating the openings in installations and devices during the testing phase.
  - .8 Provide the engineer with a certificate or a manufacturer's letter confirming that the power supply to the device has been installed to their satisfaction.
  - .9 Provide written confirmation of the results obtained from testing.
  - .10 Testing trials must be completed and accepted prior to the installation of thermal insulation.
  - .11 Do not hide or recess any outlets, accessories, or devices until testing is complete and results have been accepted.
- .4 Special Requirements:
  - .1 The presence of the electrical contractor may be required for a test conducted by another trade.

### **3.9 SYSTEM STARTUP**

- .1 Instruct operating personnel in operation, care and maintenance of systems, system equipment and components.
- .2 Provide these services for such period, and for as many visits as necessary to put equipment in operation, and ensure that operating personnel are conversant with aspects of its care and operation.



### **3.10 DEMOLITION**

- .1 Remove and transport off-site all demolished equipment including the following: conduits, boxes, outlets, switches, lighting devices, power distribution devices, auxiliary systems, safety/warning communications systems, and all accessories.
- .2 Remove wiring and conduits back to the panel, or to the last remaining box.
- .3 Seal all openings left in accordance with the requirements contained in article "FIREPROOFING".
- .4 Repair any power circuits, control wiring or communications wiring that may have been damaged during demolition work.

### **3.11 REMOVAL AND RE-INSTALLATION OF EXISTING EQUIPMENT**

- .1 Remove and install all electrical devices, conduits and required conductors to allow for the completion of architectural, mechanical, and structural work as outlined in the drawings and specifications. Consult the drawings and specifications of other disciplines as required.

**END OF SECTION**



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## **Part 1 General**

### **1.1 REFERENCES**

- .1 Electrical and Electronic Manufacturers' Association of Canada (EEMAC):
  - .1 EEMAC 1Y-2-1961 – Bushing Stud Connectors and Aluminum Adapters (1 200 A Maximum Rating).
- .2 National Electrical Manufacturers Association (NEMA).

### **1.2 ACTION AND INFORMATION SUBMITTALS**

- .1 Submit required documents and samples in accordance with Section 01 00 10 – General Instructions.
- .2 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 01 00 10 - 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 sized to fit copper 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 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 conductors.
  - .6 Sized for conductors as indicated.

### **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 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, model 9700B, 10 A, 300 V, complete with DIN rail, end plates, identification, extremity flanges and jumpers.

## **2.4 ACCEPTABLE MANUFACTURERS**

- .1 Wire connectors:
  - .1 3M
  - .2 Burndy
  - .3 Thomas & Betts
- .2 Terminal Blocks:
  - .1 Staffel
  - .2 Weidmüller
  - .3 Wieland

## **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 Remove insulation carefully from ends of conductors cables and:
  - .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**



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## **Part 1 General**

### **1.1 RELATED REQUIREMENTS**

- .1 Unless indicated otherwise, circuits at 15 A, 120 V will be of size as indicated in annex II of this section.

### **1.2 PRODUCT DATA**

- .1 Submit required documents and samples in accordance with Section 01 00 10 – General Instructions.
- .2 Shop Drawings:
  - .1 The wiring diagrams and details of the installation of the devices must indicate the location, layout, layout and proposed layout, control panels, accessories, piping, conduits and all other elements which must be shown in order to achieve a coordinated installation.
  - .2 The wiring diagrams must indicate the terminal terminals, the internal wiring of each device as well as the interconnections between the various devices.
  - .3 The drawings must indicate the clearances necessary for the operation, maintenance and replacement of the devices.
  - .4 Submit two copies of drawings, minimum 600 mm x 600 mm, and data sheets, to authority having jurisdiction.

## **Part 2 Products**

### **2.1 BUILDING WIRES**

- .1 Conductors: stranded for 8 AWG and larger. Minimum size: 12 AWG.
- .2 Unless indicated otherwise, copper conductors: size as indicated, with 600 V insulation of cross-linked thermosetting polyethylene material rated RW90 XLPE, Jacketed.
- .3 Conductors in low-voltage system (25 V or less), of size 18 AWG minimum, integrated into multi-conductor cables, with PVC insulation.
- .4 Conductors and cables must bear the manufacturer's label, insulation type, size and voltage rating at regular intervals on the outer conductor or cable with permanent markings.

### **2.2 MINERAL-INSULATED CABLES**

- .1 Conductors: solid bare soft-annealed copper, size as indicated.
- .2 Insulation: compressed powdered magnesium oxide or silicon dioxide to form compact homogeneous mass throughout entire length of cable.
- .3 Outer covering: annealed seamless copper, stainless steel, sheath, type M1 rated 600 V, 250°C.
- .4 Two hours fire rating.
- .5 Connectors: watertight, explosion-proof, field installed approved for MI cable.



- .6 Termination kits: field installed, factory installed, approved for MI cable.

## **2.3 APPROVED MANUFACTURERS**

- .1 Conductors:
  - .1 Alcan (General Cable)
  - .2 Nexans
  - .3 Phillips
  - .4 Pirelli
- .2 Cables with two (2) hours fire-protection:
  - .1 Pyrotenax
- .3 AC90 and ACWU90 cables:
  - .1 Alcan (General Cable)
  - .2 Nexans
  - .3 Phillips
  - .4 Pirelli

## **Part 3 Execution**

### **3.1 FIELD QUALITY CONTROL**

- .1 Perform tests in accordance with Section 26 05 00.01 – Common Work Results for Electrical.
- .2 Perform tests using method appropriate to site conditions and to approval of Consultant and local authority having jurisdiction over installation.
- .3 Perform tests before energizing electrical system.

### **3.2 GENERAL CABLE INSTALLATION**

- .1 Terminate cables in accordance with Section 26 05 20 – Wire and Box Connectors – 0 – 1 000 V.
- .2 Cable Colour Coding: to Section 26 05 53 – Identification of electrical systems.
- .3 Conductor length for parallel feeders to be identical.
- .4 Lace or clip groups of feeder cables at distribution centres, pull boxes, and termination points.
- .5 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.
- .6 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.



- .7 Provide numbered wire collars for control wiring. Numbers to correspond to control shop drawing legend. Obtain wiring diagram for control wiring.
- .8 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.
- .9 Install conductors or cables in conduits or metal sheaths as indicated in this section.
- .10 Install a neutral conductor bypass circuit at 120 V.
- .11 Use only lubricants approved by the manufacturer for cable pulling.
- .12 Install cables and leads continuously without joints from their point of origin to the powered device. If necessary, create joints in approved boxes.
- .13 Support conductors in vertical conduit with Type M carriers, manufactured by O-Z Products. Space them as follows:
  - .1 Conductors of size 1/0 and smaller: supports every 30 m.
- .14 Refer to table 1 at the end of this section to determine the maximum number of conductors/conduits.

### **3.3 INSTALLATION OF BUILDING WIRES**

- .1 Install wiring as follows:
  - .1 In conduit systems in accordance with Section 26 05 34 – Conduits, Conduit Fastenings and Conduit Fittings.
  - .2 In underfloor distribution system in accordance with Section 21.

### **3.4 INSTALLATION OF MINERAL-INSULATED CABLES**

- .1 Install exposed and concealed cable securely supported by staples, straps, hangers.
- .2 Support two (2) hours fire rated cables at 1 m intervals.
- .3 Make cable terminations by using factory-made kits.
- .4 Cable terminations: use thermoplastic sleeves over bare conductors.
- .5 Where cables are buried in cast concrete or masonry, sleeve for entry and exit of cables.
- .6 Do not splice cables unless indicated.

### **3.5 INSTALLATION OF ARMoured CABLES**

- .1 Group cables wherever possible on U channels.
- .2 Secure cables directly to the frame at a distance of 300 mm from each side of the outputs and at 1500 mm maximum on all lines.
- .3 Cut the metal casing of the cables with a suitable tool and provide insulating sleeves at the ends.
- .4 Installation of armored cables in walls and partitions is only permitted for vertical installations.



### **3.6            INSTALLATION OF CONTROL CABLES**

- .1      Install control cables in conduit.
- .2      Ground control cable shield.

### **3.7            TESTING RESISTANCE IN INSULATION**

- .1      Measure the di-electric value of circuits, power cables, and equipment with a maximum voltage of 350 V and a 500 V megger.
- .2      Measure the di-electric value of circuits, power cables, and equipment with a maximum voltage of 350 V and 600 using a meg-ohmmeter of 1 000 V.
- .3      In either case, ensure that the value of the resistance to ground, before power is applied, is not less than the requirement as set forth by the manufacturer.
- .4      Provide certification that all drivers have been checked and that any defective conductors have been replaced.



## APPENDIX I

MAXIMUM NUMBER OF RW-90 CONDUCTORS PER CONDUIT						
Conductor Size AWG	Size of Conduit in mm					
	16	21	27	35	41	53
14	7	14	22	40	55	90
12	4	10	16	30	40	66
10	4	6	12	20	30	50
8	---	3	6	10	16	26
6	---	---	3	8	9	18
4	---	---	---	3	6	12
3	---	---	---	3	6	12
2	---	---	---	---	6	9
1	---	---	---	---	4	6
1/0	---	---	---	---	---	6
<b>Note:</b> For dimensions not listed, refer to Chapter V – Electrical to Construction Code of Quebec (Quebec Electrical Code).						





## APPENDIX II

<b>MAXIMUM LENGTH (IN METERS) OF A BRANCH CIRCUIT AT 120 V VERSUS VOLTAGE DROP</b>			
Conductor Size AWG	Rating in Amps (A)		
	15	20	30
12	20	15	---
10	30	25	15
8	50	40	25
6	90	65	40
<b>Notes :</b> – For non-specified loads, refer to Chapter V – Electrical to Construction Code of Quebec (Quebec Electrical 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 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-F04 – Electrical Safety and Essential Electrical Systems in Health Care Facilities.

### **1.2 DOCUMENTS/SAMPLES TO BE SUBMITTED FOR APPROVAL/INFORMATION**

- .1 Submit required documents and samples in accordance with Section 01 00 10 – General Instructions.

## **Part 2 Products**

### **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.

### **2.2 RECOMMENDED MANUFACTURERS**

- .1 Burndy Corp.
- .2 McGraw-Edison (Canada) Ltd.
- .3 Thomas & Betts

## **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.

### **3.2 INSTALLATION – GENERAL**

- .1 Install complete permanent, continuous grounding system including, electrodes, conductors, connectors, accessories as outlined in Chapter V – Electrical Code of Construction of Québec.
- .2 Install connectors in accordance with manufacturer's instructions.
- .3 Protect exposed grounding conductors from mechanical injury.



- .4 Conduct by thermite welding, buried connections, connections to the electrodes and connections to conduct groundwater with good conductivity.
- .5 Use mechanical connectors for grounding connections to equipment provided with lugs.
- .6 Soldered joints not permitted.
- .7 Flexible ducts, providing a bonding wire connected at each end to a ground terminal.
- .8 Install flexible ground straps for bus duct enclosure joints, where such bonding is not inherently provided with equipment.
- .9 Ensure the grounding of all electrical equipment provided in another section, is fueled by that division.
- .10 Ground the steel frame of the building, and metal coating by welding copper to steel.
- .11 Arrange the grounding conductors in radial form and route all connections directly to a single common point grounding. Avoid loop connections

### **3.3 EQUIPMENT GROUNDING**

- .1 Make required continuity grounding connections for all equipment, including: service equipment, transformers, switchgear, raceways, motor frames, motor control centers, starters, switchboards, etc. controls, cable trays, armored bars, structural steel, generators, alternators, elevators and escalators, distribution boards, outdoor lighting network, overhead cranes, swimming pool and spa equipment, cranes and hoists.
- .2 Linking built engines or other devices transmitting vibrations with a separate conductor, green, to a grounding terminal in the junction box or connection placed between the rigid pipe and the flexible conduit connecting the device.

### **3.4 FIELD QUALITY CONTROL**

- .1 Perform tests in accordance with Section 26 05 00.01 - Common Work Results for Electrical.
- .2 Perform tests before energizing electrical system.
- .3 Disconnect ground fault indicator during tests.
- .4 Assemble the apparatus shown in figure 2 CSA Z32-04 standard for conducting voltage drop tests for grounding networks. Provide all measuring devices required.

**END OF SECTION**



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**Part 1 General**

**1.1 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submit required documents and samples in accordance with Section 01 00 10 – General Instructions.
- .2 Product data:
  - .1 Submit manufacturer's printed product literature, specifications and datasheets.
  - .2 Submit cable manufacturing data.

**Part 2 Products**

**2.1 CONDUITS**

- .1 Rigid metal conduit: to CSA C22.2 no. 45, galvanized steel threaded.
- .2 Epoxy coated conduit: to CSA C22.2 no. 45, with zinc coating and corrosion resistant epoxy finish inside and outside.
- .3 Electrical metallic tubing (EMT): to CSA C22.2 no. 83, with couplings, and expanded ends.
- .4 Rigid PVC conduit: to CSA C22.2 no. 211.2.
- .5 Flexible metal conduit: to CSA C22.2 no. 56, liquid-tight flexible metal steel.
- .6 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.
- .7 Galvanized steel, rigid, thin-walled, unless otherwise indicated.
- .8 Galvanized steel, flexible waterproof kind, between the ductwork and the unit's connections box ( $\pm$  900 mm in length) for connecting motors and kitchen appliances.
- .9 Connectors and conduit fittings, thin-walled steel, screw type.
- .10 Non-plasticized, rigid PVC, when installed in ventilation plenums or cold rooms.
- .11 See Section 26 05 43.01 – Cable Installation in Trench and Duct.

**2.2 CONDUIT FASTENINGS**

- .1 One hole, steel straps to secure surface conduits where the diameter is equal to 50 mm or less.
  - .1 Two hole, steel straps for conduits larger than 50 mm.
- .2 Beam clamps to secure conduits to exposed steel work.
- .3 Channel type supports for two or more conduits.
- .4 Threaded rods, 6 mm diameter, to support suspended channels.



## **2.3 CONDUIT FITTINGS**

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

## **2.4 EXPANSION FITTINGS FOR RIGID CONDUIT**

- .1 Weatherproof expansion fittings with internal bonding assembly suitable for 200 mm linear expansion.
- .2 Watertight expansion fittings with integral bonding jumper suitable for linear expansion and 19 mm deflection.
- .3 Weatherproof expansion fittings for linear expansion at entry to panel.

## **2.5 FISH CORD**

- .1 Polypropylene.

## **2.6 ACCEPTABLE MANUFACTURERS**

- .1 EMT or rigid metal ducts:
  - .1 Columbia International Ltd.
  - .2 Siezfried Kreser Industries Ltd.
- .2 PVC conduits:
  - .1 Canron
  - .2 Columbia International Ltd.
  - .3 Ipex
  - .4 Panduit (Canada) Ltd.
- .3 Flexible conduit:
  - .1 Nexans
  - .2 Columbia International Ltd.
- .4 Expanding joints:
  - .1 Crouse-Hinds



**Part 3            Execution**

**3.1                MANUFACTURER'S INSTRUCTIONS**

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

**3.2                INSTALLATION**

- .1        Install conduits to conserve headroom in exposed locations and cause minimum interference in spaces through which they pass.
- .2        Conceal conduits except in unfinished areas.
- .3        Use rigid galvanized steel threaded conduit except where specified otherwise.
- .4        Use electrical metallic tubing (EMT) above 2.4 m not subject to mechanical injury.
- .5        Use flexible metal conduit for connection to motors in dry areas.
- .6        Use liquid tight flexible metal conduit for connection to motors or vibrating equipment in damp, wet or corrosive locations.
- .7        Use explosion proof flexible connection for connection to explosion proof motors.
- .8        Minimum conduit size for lighting and power circuits: 19 mm.
- .9        Install rigid metal EMT conduit from branch circuit panel to outlet boxes located in sub floor.
- .10       Bend cold conduit. Replace conduit if kinked or flattened more than 1/10th of its original diameter.
- .11       Mechanically bend steel conduit over 19 mm diameter.
- .12       Field threads on rigid conduit must be of sufficient length to draw conduits up tight.
- .13       Install fish cord in empty conduits.
- .14       Remove and replace blocked conduit sections. Do not use liquids to clean out conduits.
- .15       Dry conduits out before installing wire.
- .16       Unless otherwise indicated, all ducts are to be concealed in walls, floors, ceilings and suspended ceilings.
- .17       Install protruding ducts in parallel with structural lines and so as not to harm the equipment of other trades.
- .18       No drilling is to be done through the beams for the passage of conduits.
- .19       Maintaining the continuity of the grounding throughout the facility, taking care to make solid connections between the conduits and equipment. A green wire grounding must be added to each flexible conduit connecting a device capable of vibrating, such as, motors and all ducts are to be installed in concrete.





- .20 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.
- .21 Connect the threaded conduit liners and devices using two nuts and a threaded sleeve, and insulated steel. Merge conduit with thin-walled steel type connectors screw.
- .22 Ream ends of threaded rigid conduit to remove metal burrs. Carefully cut fillets and coat gaskets or use an equivalent product to seal. Maintain the length of fillets to the minimum necessary for the connections to the boxes.
- .23 During construction, equip ducts with plugs to prevent foreign bodies from entering.
- .24 Leave a nylon cord at least 3 mm in diameter in each empty conduit where the installation of cables is part of another section.
- .25 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.
- .26 Attach conduits as follows:
  - .1 Supply and install all the necessary supports galvanized steel 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.
- .27 Continuous nets are not allowed. In some cases it is impossible to install ordinary fittings, in these circumstances use Erikson type fittings.
- .28 Support conduits suspended using galvanized brackets, as described elsewhere in this book.
- .29 Ducts emerging from sprinkler-proof boxes must be fitted with liquid-tight fittings.
- .30 The spacing of supports and fasteners must be in accordance with the latest edition of the Electrical Code of Québec.
- .31 Support vertical conduits at floor level and use intermediate supports required by the code.
- .32 In suspended ceilings, support the metal sheath cables to the frame and not the ceiling structure.



- .33 The conduits should not touch the conduit insulation, mechanical equipment, or be buried in the insulation or fireproofing materials.
- .34 Join conduits, in explosion-proof areas, threaded EYS connections or similar type, filled with a suitable compound.
- .35 Seal all conduits installed in cold rooms or a fan plenum, at the crossing point of the wall, by means of an EYS connection filled with a suitable compound.
- .36 When a recessed panel is located in a room with a suspended ceiling, install three empty conduits of 21 mm diameter between the panel and the interior of the suspended ceiling and three upper pipes 21 mm between the panel and the suspended ceiling of the lower stage. These conduits must be easily accessible for future work/maintenance.

### **3.3 SURFACE CONDUITS**

- .1 Run parallel or perpendicular to building lines.
- .2 Locate conduits behind infrared or gas fired heaters with 1.5 m clearance.
- .3 Run conduits in flanged portion of structural steel.
- .4 Group conduits wherever possible on suspended surface channels.
- .5 Do not pass conduits through structural members except as indicated.
- .6 Do not locate conduits less than 75 mm parallel to steam or hot water lines with minimum of 25 mm at crossovers.

### **3.4 CONCEALED CONDUITS**

- .1 Run parallel or perpendicular to building lines.
- .2 Do not install horizontal runs in masonry walls.
- .3 Do not install conduits in terrazzo or concrete toppings.
- .4 No conduit is to be installed in concrete slabs.

### **3.5 CLEANING**

- .1 Proceed in accordance with Section 01 00 10 – General instructions.
- .2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

**END OF SECTION**



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## **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 01 00 10 – 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 01 00 10 –General 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

## 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.

## 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 lamicaid 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
Panel (P)	3	Source (room) (*)	Equipment number		---
Starter	5	No. of powered equipment	Room	---	---
Starter	5	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
Emergency 120/208 V, 120/240 V	Orange
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 NOT USED**

- .1 Not Used.

**Part 2 Products**

**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 Identify all starters with a white plastic plate with black lettering, screwed and glued to the starter. Provide an ID list for approval. Use the starter type manual reset. Those with automatic reset are to be rejected.
- .10 Unless otherwise specified for each magnetic starter, provide both N.O. and N.C. auxiliary contacts.

**2.2 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.

## 2.3 ACCESSORIES

- .1 Pushbutton: heavy duty, oil tight as required.
- .2 Selector switches: heavy duty, oil tight as required.
- .3 Indicating lights: heavy duty, oil tight, type and colour as indicated.
- .4 All push-buttons and indicator lights, selectors "manual-off-auto", unless otherwise specified, must be oil tight, class No. 9001 by Schneider Group (Square D).
- .5 In the category of oil tight: the stop buttons inside ventilation plenums for humidifiers are of water-sealed type.
- .6 Buttons made for intensive use, installed in a recessed housing, with face plate of stainless steel in all finished areas.
- .7 Sufficient number of buttons complete with contact blocks, as shown on the plans. These contact blocks are manufactured to be able to add, change, or remove contacts without difficulty. The contacts are silver alloy, double opening type or double closure, as applicable, and self-rubbing.
- .8 Every button or lamp will be provided with a nameplate in French, abbreviation is not accepted.
- .9 Push buttons of different colors for each function:
  - .1 Start: green
  - .2 Stop: red
  - .3 Low-speed: green
  - .4 High-speed: amber or yellow
  - .5 Reverse, high-speed: blue



- .10 Overload relays:
  - .1 The overload relay will be an electronic sensor type (Solid State), class 20 minimum, and according to the type of engine protection required.
  - .2 Phase loss protection.
  - .3 Manual reset.
  - .4 Trip current adjustment.
  - .5 Select the relay class based on motor data.

## **2.4 ACCEPTABLE MANUFACTURERS**

- .1 Cutler-Hammer.
- .2 General Electric.
- .3 Schneider Group.
- .4 Klockner-Moeller.
- .5 Siemens.
- .6 Telemechanic.

## **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**

