advanced building solutions

HEALTH CANADA
Addition of a nuclear magnetic resonance equipment – Room 161

Specifications – Mechanical

2019-12-10
Project: 3019-044

HEALTH CANADA

1001 SAINT-LAURENT WEST STREET

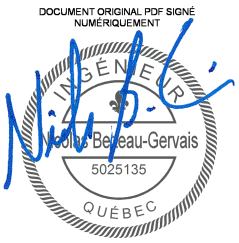
LONGUEUIL (QUÉBEC)

J4K 1C7

ADDITION OF A NUCLEAR MAGNETIC

RESONANCE EQUIPEMENT – ROOM 161

DIVISIONS 20, 21, 22, 23 AND 25



For tender
December 10, 2019

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Part 1 General

1.1 DEFINITION

.1 The terms "Contractor", "General Contractor" and "Supervisor" refer to the person or entity designated as in contract with the Owner or Manager of the works.

.2 The expressions "section", "sections", "each section", "each related section", "performed by section" and "supplied by section" refers to the firm responsible for the work of that section.

.3 The terms "Engineer" and "Engineers" mean the firm or the Designated Representative of the engineering firm that issued the engineering section, specifications or plans related to the work covered by these documents.

1.2 EXAMINATION OF THE SITES

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

1.3 VERIFICATION OF THE DRAWINGS AND SPECIFICATIONS

.1 Only drawings and specifications marked "for tender" should be used for the calculation of bids.

.2 Check that the copy of the documents is complete: number of drawings, specifications' number of pages.

.3 Specialties mentioned in the titles of the drawings are to facilitate the work of each section and should not be regarded as restrictive.

.4 Drawings indicate the approximate placements of equipment. Each section must check the exact emplacements before any installation.

.5 During bids, each section must study the mechanical and electrical drawings and specifications and compare them with Architectural and structural drawings and specifications and notify the Architect or Engineer at least five working days before submission of his tender of any contradictions, errors or omissions that can be observed.

.6 During the execution of the works, notify the Architect or Engineer of any inconsistency, error or omission discovered before starting the work.

.7 The Engineer reserves the right to interpret the contents of mechanical and electrical drawings and specifications.

.8 No indemnity or compensation will be given for the displacement of ducts, pipes, etc., deemed necessary because of the Architecture, the structure or any other normal consideration.

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.

.3 The work must be completed in seven (7) weeks following the signing of the contract.

.4 Perform the following work during the day as well as on evenings, Saturdays and Sundays.

.5 Notify the Engineer and the Owner 48 h before performing work during periods of inoccupation.

1.14 MATERIALS

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

1.15 PROTECTION OF WORKS AND MATERIALS

.1 Each section must protect its installations against all damage, from any cause, during the execution of works until the work is accepted in a definitive manner.

.2 All equipment and materials stored on-site must be adequately protected, sheltered from bad weather, or any other possible damage.

.3 At the end of each workday, seal with a screw cap or a suitable metal cap all openings in conduits of any kind.

1.16 WASTE MANAGEMENT

.1 Perform a "waste audit" in order to determine what waste will be created by demolition and construction activities. Write a "waste reduction plan" and apply the principles of reduction, reuse and recycling of material where possible.

.2 Provide a "source material triage program" to disassemble and collect, in an orderly manner, among the "general waste" the materials bound for "environmental disposal" listed below:

.1 Brick and Portland cement concrete.

.2 Corrugated cardboard.

.3 Drywall (unfinished).

.4 Steel.

.5 Wood (except painted, treated or laminated).

.3 Submit logs of all material removed from site as "general waste" and "environmental disposal" with the following information:

.1 Time and date of removal operations.

.2 Description of the material and the quantity.

.3 Proof that the material was received at an approved waste treatment or disposal facility, as required.

1.17 SHOP DRAWINGS

.1 Before fabrication or order of any component, submit a PDF copy by email for approval. Each drawing or data sheet should be submitted as a distinct PDF file. The PDF name should include the section, article and name of the article title in the specifications (example: 00_00_00_0.00_Equipment XYZ.pdf).

.2 Drawings must include the dimensions, weight, number of attachment points, centre of gravity, seismic requirements, wiring schematics, capacities, controls schematics, curves, space requirements for maintenance and operation, and all other relevant information. If present, clearly indicate the location and dimensions of plumbing, heating, cooling, electrical, etc., connections by device. Each drawing must be verified, coordinated, signed, and dated by the relevant section before being submitted for approval.

.3 All correspondence and/or document submitted via project management software by the Contractor or a Sub Contractor will not be reviewed and will be not be considered as submitted/received.

.4 Shop drawings must be relevant to the proposed equipment. The sheets from general catalogs are not accepted as shop drawings. Each drawing must be preceded by a title page indicating with the name of the project, the consultant's name, the date and identification tag of the equipment shown in the drawings and specifications. The title page must also include the revision number of the documents as well as the expected delivery date of the product. Drawings must be prepared and signed by the supplier. Drawings pulled from the supplier’s website are not accepted.

.5 Drawings for non-catalogued items must be specifically prepared for the project.

.6 The verification of shop drawings is general and has the main purpose of avoiding as many errors as possible in manufacturing. This verification does not relieve the relevant section of its liability for errors, omissions, information, dimensions, quantity of equipment, etc., appearing in their drawings.

.7 The verification of the shop drawings by the Engineers does not diminish the responsibility of the supplier to ensure that the equipment meets all applicable codes and standards, as well as the requirements in this specification.

.8 When shop drawings are resubmitted or installed, inform the Engineer in writing of changes made, other than those requested by the Engineer.

.9 When equipment is manufactured before the verification of the shop drawings by the Engineer, the Engineer may refuse the equipment. The Contractor is responsible for any costs associated with the refusal.

.10 The drawings must be in French.

1.18 COORDINATION DRAWINGS

.1 General:

.1 Coordination drawings, also called composite drawing, are required in all cases where interference between different trades' works need such drawings to illustrate that the work is realizable.

.2 Coordination drawings must show clearly and precisely all the work involved, those of the relevant section and those done by others.

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

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

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

.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 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.

1.20 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

1.21 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. A full, verified pdf scanned copy must be sent to the Customer.

.2 These manuals must contain:

.1 A list and illustration of all equipment components: pumps, fans, filters, controls, burners, alarm panels, lighting fixtures, transformer stations, generators, fire alarms, etc.

.2 A copy of the approved shop drawings, and as executed.

.3 The instructions for lubrication published by the manufacturers with the specifications of the oils and greases to be used and the frequency of lubrication.

.4 A diagram indicating the identification numbers of each valve, the normal operating position, the location, and flow direction for each of the piping systems.

.5 Prepare a properly attached glossary containing the number, location, and function of each valve. This glossary should contain a separate chapter for all shut down (or emergency) valves and main valves. The numbering code must be approved.

.6 A diagram of the controls with explanatory text.

.7 A list identifying access points to fire shutters and controls in the walls and ceilings.

.8 A list of legends of the piping, the piping identification codes, and ventilation systems.

.9 A list of the systems' final calibration values, as approved.

.10 A list of the different sub-Contractors with names, addresses, and phone numbers.

.11 A list of representatives and/or manufacturers of the installed equipment with names, addresses, and phone numbers.

.12 These instructions must contain all the graphics, curves, capacities and other data provided by the manufacturers concerning the operation and details of all mechanical and electrical equipment installed in the building.

.13 The fan graphics must clearly indicate the specified operating capacities and the required horsepower. These graphics should also indicate the serial number, fan model, and the operating speed.

.3 The entirety must be written in French.

.4 Divide each manual in the sections using blank sheets which have coloured tabs with the necessary identification. For example: "CENTRAL SYSTEM FAN". At the beginning of the manual, insert a table of contents with the title of each section and identification of the corresponding tab.

.5 Each manual is covered with a black cardboard, allowing the binding of loose sheets with 215 mm x 275 mm (8" x 11") binding strips.

.6 Submit one PDF copy to the Engineer for comment. Once approved, provide three (3) copies of the manual to the Owner and one to the Engineer.

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

1.22 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".

1.23 PLACEMENT OF PIPING AND DUCTS

.1 No pipe may be in contact with another. Allow a clearance of at least 15 mm (½") between them. No piping may be in contact with any part of the building. Take special care in the case of piping through a steel beam.

.2 Take particular care to conserve space in vital areas, including in the case of piping rising along columns.

.3 Any piping or ducting that may possibly be covered by insulation must be installed at a sufficient distance from walls, ceilings, columns or other piping, ducts, and equipment to facilitate the insulation of the pipe or duct.

.4 Any piping or ducting placed horizontally must be installed to maximize the headroom of the area. This is of particular importance in rooms where ceilings are suspended, such as in parking lots and warehouses.

.5 Exposed piping should be straight and generally, parallel to the framework.

.6 Consider the symmetry with respect to the piping of the apparent equipment. Consult the Departmental Representative if necessary.

.7 Before installing a pipe or duct, make note of the location of the other mechanical, electrical, Architectural and structural work to avoid interference, otherwise the relevant section will be required to move the pipe or duct at its expense.

.8 When uninsulated piping passes through a wall or a poured concrete floor, install rigid insulation on the pipe before casting, after the installation of the pipe, so that the concrete does not come into contact with the pipe.

1.24 MANUFACTURERS' INSTRUCTIONS

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

.2 Ensure the presence of the manufacturers' representative to attest the conformity of the installation.

1.25 LAYOUT AND ACCESS TO THE EQUIPMENT

.1 Install the equipment so that they are easily accessible for maintenance, disassembly, repair, and moving.

.2 Pay particular attention to the motors, belts, bushings, heat exchangers and boiler tubes, fittings, valves, controls, rotating shafts, etc.

.3 If necessary, install access doors and accessories, such as extensions for the lubrication of bushings, etc.

.4 Installation of equipment:

.1 Ensure that maintenance and disassembly can be done without having to move the connecting elements of the piping and ducts, by the use of union fittings, flanges or valves, and without the building structural members or other installations being obstacles. Dismantling must be possible without emptying networks and/or stopping the power supply to other equipment.

.2 The manufacturer plates and the seals or labels of the equipment standards and approvals organizations must be visible and legible once the equipment is installed.

.3 Provide fasteners and metal accessories of the same texture, colour and finish as the support metal to which they are attached. Use non-corrosive fasteners, anchors, and shims to secure the external and internal work.

.4 Ensure that the floors or tiles on which the equipment will be installed are level.

.5 Check fittings done at the factory and retighten them if necessary to ensure the integrity of the installation.

.6 Provide a means to lubricate the equipment, including Lifetime lubricated shaft housings.

.7 Connect the equipment's drainage piping to the drains.

.8 Align the edges of the pieces of equipment, as well as those of the rectangular identification plaques, and other similar parts with the building walls.

.5 Future provisions:

.1 In any place where a space was left free for future use, ensure that this space remains free and install materials and equipment related to the work so that future connections of the added equipment can be done without needing to redo the floor, walls or ceiling, or even, a portion of the mechanical or electrical facilities.

1.26 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.

1.27 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.

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

.1 General:

.1 Unless otherwise indicated, all direct and indirect costs associated with tracing, marking, openings required for ductwork, piping and electrical conduits, or sleeves to install, are the responsibility of the General Contractor.

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

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

.4 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.

.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.

.3 Vertical openings in concrete for piping:

.1 All new vertical openings to be drilled in concrete with integrated finish or already cast finish, for the laying of pipes, must be performed as follows : in the upper part of the slab, with a sufficient diameter to affix the sealing plate of the sleeve, and in the lower part, with a sufficiently smaller diameter to accommodate the steel sleeve.

1.29 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.

1.30 INSPECTIONS

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

1.31 TESTING

.1 Each section must cooperate with the other sections, so as to enable them to complete their tests within the time period allowed by the Contractor.

.2 Once the test is finished, readjust all the equipment used for this test, to permit their proper operation.

.3 General requirements:

.1 The Engineer may assist, at any time, in any test they deem necessary.

.2 All tests must be performed to the satisfaction of the Engineer.

.3 The Engineer may require a test of installations and equipment before accepting them.

.4 For temporary trials, obtain written permission to operate and test installations and permanent equipment before being accepted by the Engineer.

.5 Give a written 48 h notice to the Engineer before the date of the test.

.6 Provide equipment, meters, material and staff required to run tests during the project until the acceptance of installations by the Engineer and pay all fees.

.7 If a piece of equipment or device does not meet the manufacturer's data or the specified performance during a test, immediately replace the defective unit or part and pay all expenses incurred by the replacement. Make adjustments to the system to achieve the desired performance. Cover all costs, including those of new tests and repair.

.8 Prevent dust, dirt, and other foreign matter from entering the openings of installations and equipment during testing.

.9 Provide to the Engineer a certificate or letter from the manufacturer confirming that each section of the installation was implemented to their satisfaction.

.10 Submit the written test results to the Engineer.

.11 The tests must be performed and accepted prior to the installation of the thermal insulation.

.12 Do not conceal or embedded piping, conduits, or equipment before the tests are completed and accepted.

.13 By submitting the pipe or conduits to the test pressures required in each of the respective sections, take the necessary precautions to prevent the deterioration of equipment and accessories that cannot withstand such pressures.

.14 If it is impossible to test the entire installation in a single trial, it can be divided into several zones, each of which will be tested individually. The installation must be tested in several stages.

.15 Provide hydraulic pumps, air compressors, fans and other equipment necessary to perform all tests and related temporary work.

.16 Correct any leak detected. The defective part must be removed, repaired and the test is redone until the results are satisfactory.

.17 Whenever tests are conducted with water, place the pressure gauge at the highest point of the installation.

.18 Whenever tests are conducted with compressed air, use soap and water on the piping and apparatus to detect air leaks. The air temperature must be the same in the pressure readings. Install a thermometer for this purpose.

.19 For joints with caulking, it is not permitted to repair cracks using other materials.

.20 Provide two copies of a written report for each of the tests performed.

.4 Special requirements:

.1 For details about the tests to perform, see the other sections of this specification.

.2 The presence of a section can be required in a test conducted by another section.

1.32 "WITH RESERVATION" AND "WITHOUT RESERVATION"

.1 With reservation:

.1 The procedure for receiving the work with reserve can only be started when all the following conditions are met:

.1 Much of the work is completed;

.2 The work to be completed could not be completed due to conditions beyond the contractor's control.

.3 The value of the work to be corrected is no more than 0.5% of the total contract amount.

.4 The work to be corrected and deferred do not prevent the work from being ready in every way for the use for which it is intended.

.5 The bulletins or instruction manuals in relation to the article on certificates of compliance for installation, operation and maintenance are provided, written guarantees in relation to the requirements of the tender documents and that the training was provided and commissioning was carried out.

.2 The Contractor may request the receipt with reservation only after completing a full inspection of the work and compiling his own list of defects.

.3 The Contractor notifies the Professional in writing of the completion of the work and requests the receipt with reservation. He is obliged to accompany his request for receipt with reservation of this list of defects.

.4 Within ten (10) business days of receiving such a request, the owner, the professional and the other consultants begin a full inspection of the work after giving the Contractor notice. Unless the Professional objects or does not require it, the Contractor is required to attend this inspection visit.

.5 These lists of work to be corrected and completed are drawn up by the Professional and countersigned by the Contractor. The date of the signing of these lists is the date of receipt with reservation of the work. The list of work to be corrected also sets out the time frames within which these defects need to be corrected.

.6 An exhaustive list of documents due to the reception with reserved of the work is prepared by the Contractor in accordance with the tender documents or as specified in the minutes of the site meetings. The Certificate of Receipt with Reservation of Work must also contain a recommendation from the Professional that the work is ready for its intended use and that the Company may take possession of it.

.7 However, unqualified receipt cannot be declared until all work and defects have been completed.

.2 Reception without reserve:

.1 As soon as the work is corrected and completed in accordance with the lists established at the time of the receipt with reservation, the Contractor must apply for an inspection in order to receive the work without reservation by the Company. On this occasion, he must provide the required certifications and documents. However, the Contractor is required to ensure that a single review inspection of defective work reported at the reservation reception will not have to be carried out by the Professional and other consultants for reception without reserve. As a result, if further inspections are required, the costs of any additional inspection by the Professional and other consultants will be borne by the Contractor and will be retained by the owner from the sums that are due. Such billing will be based on the current hourly rates of the associations of the professionals concerned.

.2 Following the contractor's request for an inspection, the Professional, in the company of the same officials as at the reception with reservation, makes an inspection of the work and prepares, if necessary, a new list of corrections or repairs that The Contractor must make before the signature of the certificate of receipt without reservation.

.3 Before the signature of the Certificate of Receipt without reservation, the Contractor transmits to the owner, through Professional, all documents and equipment due to the Contractor and prepared at the reception with reservation. The reservation without receipt cannot be declared until the maximum period for the service to the owner of the notice of preservation of the legal mortgage.

1.33 FINAL TESTING

.1 Each section must include all costs of final testing to the overall price in its tender. When the work is fully completed and settings, calibrations, and preliminary tests are successfully performed, run the final tests. Notify the Departmental Representative early enough to allow him to attend any of the tests judged necessary.

.2 In order to demonstrate that the work is complete and executed satisfactorily, each piece of equipment must run for a minimum period of fifteen days and that, prior to acceptance "with reservation". During this period, all equipment must operate simultaneously and not consecutively. The operation must be in automatic mode and set on controls as planned in the operating sequences.

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

1.34 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

1.35 WARRANTY

.1 Each section guarantees its work for a period of one year after acceptance "with reservation" of the work by the Owner. It is required to repair or replace, at its expense, any defects that would become apparent during this period and that, within 48 h after having been formally notified.

.2 Manufacturers must offer a one (1) year warranty from the starting operation date or eighteen (18) months from the date of delivery to the site, as appropriate. The warranty must include the cost of materials and labour, and the replacement of defective parts and/or manufacturing defect. In the case of chillers, a five-year warranty applies if the refrigerant charge is contaminated due to the compressor motor burning.

.3 The warranty is for a period greater than one (1) year (extended/or special warranties), for the areas indicated in the respective specifications.

.4 This warranty is fully independent of the article of the Civil Code concerning the five (5) year warranty.

.5 General conditions:

.1 It is expected that several contracts of the same discipline may be executed by different companies, that another company may have adjustments or tests to be executed on its work, that another company may have work to be done which are a subsequent phase of its work, that each company is committed, through this specification, to accept that its work is subject to all conditions listed above without changing the terms of the warranty.

.6 The use of permanent equipment for temporary purposes does not relieve the relevant section of its responsibilities and obligations with respect to the acceptance and guarantee of its work.

.7 The Engineer and/or the Owner reserve the right start the equipment and mechanical and electrical works without affecting the section's obligation to see to the full maintenance of its work up to acceptance "with reservation".

1.36 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.

1.37 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.

1.38 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".

1.39 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 is the responsibility of each concerned mechanical and electrical section.

.3 Occupied rooms:

.1 The work is being done during the occupancy of rooms in the building, therefore, the work must be performed by stages in the rooms designated by the Owner.

.2 Perform work after prior agreement with the Owner and establish an acceptable work schedule with the Owner.

.3 Before undertaking work in a given area, ensure the availability of all equipment, tools, and labour required to perform the work without interruption.

.4 Follow the Owner's instructions as to the delivery to the worksite of its personnel and equipment.

.5 The Owner will indicate which staircase can be used and within what limits it is permitted to circulate in the present corridors.

.6 Take all necessary precautions to adequately protect existing installations in these areas.

.7 At no time must the traffic and the functioning of the building services be impeded. Follow all of the Owner's instructions.

.4 Noise:

.1 Because of the proximity of the occupied premises, take all necessary measures to reduce the noise from construction and demolition.

.5 Other restrictions:

.1 In order not to impair the function of the building that must remain in operation during construction:

.1 No vehicles other than trucks used to transport equipment has access to the site for the duration of the works.

.2 The use of all elevators is prohibited for construction purposes.

.3 The interior circulation outside the boundaries of the services to be renovated must be minimized.

.4 The access permitted to the various rooms, for demolition and construction purposes, must be determined by the Owner.

.2 Obey the Owner's rules and directives about signs, announcements, advertisements, smoking, etc.

.3 Limit equipment/materials to the area delimited set by the Owner for the storage of equipment. They must not congest the area. No part of the construction is to be burdened with a load of equipment that may be hazardous for it.

.4 Follow the Owner's sterility standards.

.6 Dismantling of existing piping, materials, and equipment. Unless otherwise instructed:

.1 Any removed pipe, fitting, or valve should not be reused.

.2 No device should be reused.

.3 The dismantling of pipes, materials and existing equipment is the responsibility of each concerned mechanical and electrical section unless indicated otherwise.

.4 All existing equipment and material removed and not re-used or not returned to the Owner, as described below, belong to the respective mechanical or electrical section who are to dispose of them as quickly as possible off site.

.5 Every concerned mechanical and electrical section must anticipate the cost of transporting waste off site and bear all related costs to dispose of it.

1.40 EQUIPMENT PROVIDED AND INSTALLED BY OWNER

.1 The RMN equipment is supplied and installed by the Owner.

.2 Each relevant section is liable for any damage it may cause the equipment to which it performs electromechanical connections.

.3 Refer to the drawings and specifications for the equipment.

1.41 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.

1.42 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.

1.43 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.

.2 Duct cleanliness:

.1 All ducts and ventilation equipment should be regularly maintained for cleanliness. Along the progression and the work and nearing completion of the work, examinations will be done to ensure that dust levels do not exceed 0.75 mg/100 cm² to respect the NADCA ACR-standard. See section 23 01 31, article "QUALITY CONTROL".

1.44 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.

1.45 SECURITY SCREENING

.1 All personnel involved in the execution of the work will be subjected to a security screening. Obtain the required authorisations, as per the requirements, for all personnel who are to be present on site.

.2 Personnel will be screened every day the beginning of the workday, where they will be provided with a security pass they must carry on their person at all times, to be returned to security at the end of the day.

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

NOTE: select the correct form based on the application used to create the construction documents

RESPONSIBILITY WAIVER – DWG PLANS

The _____

Mr./Ms. _____
Bouthillette Parizeau
9825 Verville Street
Montréal (Québec)
H3L 3E1

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: _____

RESPONSIBILITY WAIVER – REVIT MODEL

The _____

Mr./Ms. _____
Bouthillette Parizeau
9825 Verville Street
Montréal (Québec)
H3L 3E1

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 Revit model 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 Revit model in question contain certain inaccuracies or errors.
- That Bouthillette Parizeau cannot be held responsible for any errors that results from the use of the model 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 Revit model, as if we had created it ourselves.

Signature: _____

Name (in print): _____

Address: _____

Telephone: _____

Email: _____

END OF SECTION

TABLE OF CONTENTS

Part 1 General

1.1 GENERAL REQUIREMENTS

.1 The use of multiple brands or manufacturers for the same device is prohibited.

1.2 RELATED REQUIREMENTS

.1 Section 20 00 10 – Mechanical and electrical general instructions.

.2 Section 21 13 13 – Wet pipe sprinkler systems.

.3 Section 23 05 48 – Vibrations and seismic controls for HVAC piping and equipment.

1.3 REFERENCES

.1 American National Standards Institute (ANSI) American Water Works Association (AWWA):

.1 ANSI/AWWA C110/A21.10 12 – Ductile Iron and Gray Iron Fittings.

.2 ANSI/AWWA C151/A21.51 09 – Ductile Iron Pipe, Centrifugally Cast, for Water.

.2 American National Standards Institute (ANSI):

.1 ANSI/ASME B1.20.1-2013 – Pipe Threads, General Purpose (Inch).

.2 ANSI/ASME B16.3-2011 – Malleable Iron Threaded Fittings Classes 150 and 300.

.3 ANSI/ASME B16.9-2012 – Factory Made Wrought Buttwelding Fittings.

.4 ANSI/ASME 2013 – Boiler and Pressure Vessel Code – Section IX, Welding and Brazing Qualifications.

.3 American Society of Mechanical Engineers (ASME):

.1 ASME B31.1-2014 – Power Piping.

.4 American Society for Testing and Materials International (ASTM):

.1 ASTM-A53/A53M-2012 – Standard Specification for Pipe, Steel, Black and Hot-Dipped Zinc Coated, Welded and Seamless.

.2 ASTM-A106/A106M-2015 – Standard Specification for Seamless Carbon Pie for High Temperature Service.

.3 ASTM-A126-04 (2014) – Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.

.4 ASTM-A135/A135M-09 (2014) – Standard Specification for Electric Resistance Welded Steel Pipe.

.5 ASTM-A197/A197M-00 (2015) – Standard Specification for Cupola Malleable Iron.

.6 ASTM-A234/A234M-2015 – Standard Specification for Pipe Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service.

.7 ASTM-A307-14 – Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60,000 psi Tensile Strength.

.8 ASTM-A536-84(2014) – Standard Specification for Ductile Iron Castings.

.9 ASTM-A795/A795M 13 – Standard Specification for Black and Hot Dipped Zinc Coated (Galvanized) Welded and Seamless Steel Pipe for Fire Protection Use.

.10 ASTM-D3139-98(2011) – Standard Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals.

.5 Canadian Standards Association (CSA):

.1 CSA B64 Series-11 – Backflow Preventers and Vacuum Breakers.

.2 CSA B131.9-1978 – Gray Iron and Ductile Iron Fittings, 2 Inches Through 48 Inches for Water and Other Liquids.

.3 CSA B137 Series 13 – Thermoplastic Pressure Piping Compendium (Consists of B137.0, B137.1, B137.2, B137.3, B137.3.1, B137.4, B137.4.1, B137.5, B137.6, B137.8, B137.9, B137.10, B137.11 and B137.12).

.6 National Fire Protection Association (NFPA):

.1 NFPA-10 – Portable Fire Extinguishers, 2010 Edition.

.2 NFPA-13 – Standard for the Installation of Sprinkler Systems, 2013 Edition.

.3 NFPA-14 – Standard for the Installation of Standpipe and Hose Systems, 2013 Edition.

.4 NFPA-20 – Standard for the Installation of Stationary Pumps for Fire Protection, 2013 Edition.

.5 NFPA-25 – Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems. 2014 Edition.

.6 NFPA-291 – Recommended Practice for Fire Flow Testing and Marking of Hydrants, 2016 Edition.

1.4 SCOPE OF WORK

.1 Work includes:

.1 The work generally includes labour, delivery and installation of all materials and equipment necessary for the work of fire protection shown in the drawings and specifications.

.2 Scheduling: The work must be completed within a maximum of seven (7) weeks following the signing of the contract of the general contractor. To meet this schedule, day, evening and weekend work is permitted.

.3 The work includes, but is not limited to:

.1 Dismantling as specified in the plans.

.2 The refitting of the underwater sprinkler network as indicated on the plans. Please note that semi-recessed nozzles are replaced by pendant-type nozzles.

.3 Payment of all fees, permits, inspection fees and other costs.

.4 Supports and structural steel components required to support the piping and equipment.

.5 All the elements required to complete the seismic installation.

.6 The supply and installation of the thermal insulation (of the water inlet until backflow). Refer to Division 23.

.7 Portable fire extinguishers.

.8 Erection drawings.

.9 Installation drawings.

1.5 STANDARDS

.1 Work in accordance with the following standards and regulations:

.1 Construction Code of Québec (2005).

.2 Building Code of Ontario (2012).

.3 National Building Code (2015).

.4 Federal regulations, provincial and municipal, with regards to construction and fire protection.

.5 Standardization Guide by Factory Mutual.

.6 Standards of the National Fire Protection Association, last edition: NFPA-10, NFPA-13, NFPA-14, NFPA 20, NFPA-___ (other if required).

.7 Safety Code of Québec, section 6.2.12.2, CSA B64-10-M "Backflow preventers and vacuum breakers".

1.6 AUTHORITIES HAVING JURISDICTION

.1 The authorities having jurisdiction are:

.1 Municipal or city fire department.

.2 Québec Régie du Bâtiment.

.3 Departmental Coordinator for the Protection Against Fires of Canada.

.4 Others.

1.7 INSTALLATION DRAWINGS

.1 See sections "SHOP DRAWINGS" and "ERECTION DRAWINGS" in section 20 00 10 – Mechanical and electrical general instructions.

.2 Drawings must clearly indicate:

.1 Name of the department or agency.

.2 Location including the address.

.3 Type of occupation for each room or area.

.4 The make, model and the diameter of the automatic sprinklers.

.5 Name and address of the installer.

.3 The summary form should clearly indicate:

.1 The date.
.2 Location.
.3 Name of the department or agency.
.4 Building number or other designation.
.5 Description of the level of risk of fire.
.6 Name and address of the Contractor or designer.
.7 The name of the approval body.
.8 Network design criteria, including the expected scope, the minimum flow of water density and scope of each sprinkler head.
.9 The total amount of water required, according to calculations, taking into account the internal and external hydrant hoses.
.10 Information about the water supply.

1.8 REQUIRED DOCUMENTS

.1 Provide the following documents:

.1 A list of identification of piping and valves legends. Refer to section 23 05 53.01 – Mechanical identification.
.2 Certificates of materials and tests carried out by the Contractor.
.3 Certificates of approval by the authorities concerned.
.4 Approval certificates of coordination drawings and hydraulic calculations by the relevant authorities.
.5 Inspection certificates from the competent authorities.
.6 Certificates of guarantee see the article "GUARANTEE", section 20 00 10 – Mechanical and electrical general instructions.
.7 Instruction manuals for operation and maintenance of the equipment. See the article "OPERATING INSTRUCTION MANUAL AND MAINTENANCE", section 20 00 10 – Mechanical and electrical general instructions.
.8 Maintained drawings, see the article "UPDATED REQUIRED DRAWINGS". section 20 00 10 –Mechanical and electrical general instructions.

1.9 SEPARATE PRICE

.1 Provide with the submission, an overall fixed price covering all the work of the "FIRE PROTECTION" section. In addition to the lump sum covering the work indicated in the quote and in the drawings, provide a list of unit prices requested in the tender form.

Part 2 Products

2.1 GENERAL PIPING

.1 Design the system in accordance with NFPA standards, complete with all accessories, excess pressure pumps, alarms and surveillance and fittings of an approved type.

.2 Pipes and fittings of an approved type, conforming to the FM or ULC NFPA identified and designed to withstand an operating pressure of 1210 kPa.

.3 Install all valves shown in the drawings in areas where necessary for the proper functioning of the system and where required by NFPA.

.4 Valves taps, valves, check valves, butterfly valve, as indicated in the drawings, of the size of the piping approved by ULC or FM.

.5 Each type of piping, elbows, reducers elbows, adapters, couplings and unions, must be of the same brand.

2.2 PIPING ABOVE GROUND AND UNDER 1210 KPA

.1 Conforms to NFPA.

.2 Steel pipe:

.1 NPS 2 and under:

.1 Piping with threaded joints:

.1 Piping in black steel or galvanized steel, series 40, ASTM-A53, ASTM-A135 and ASTM-A795.

.2 Cast iron fittings ASTM-A126, 860 kPa, approved by UL, threaded, hydrostatic pressure of 1210 kPa operating at 66°C.

.2 Piping with rolled mechanical joints:

.1 Piping in black steel, series 10, ASTM-A53, ASTM-A135 and ASTM-A795.

.2 Cast iron fittings ASTM A126, 860 kPa, approved by UL, threaded, hydrostatic pressure of 1210 kPa operating at 66°C.

.3 Piping with grooved mechanical joints:

.1 Piping in black steel, series 40, ASTM-A53, ASTM-A135 and ASTM-A795.

.2 Cast iron fittings ASTM-A126, 860 kPa, approved by UL, threaded, hydrostatic pressure of 1210 kPa operating at 66°C.

.3 Mechanical piping seals:

.1 General:

.1 Grooved pipe, series 40, in mechanical seals, free of marks, projections or recesses over the entire surface in contact with the sealing gasket. Cut straight and prepare the ends of the pipe according to manufacturer standards.

.2 Groove:

.1 The groove must have a square or round shape by rolling and dimensions must be given in manufacturer's table catalog.

.3 Filling:

.1 Resilient elastomeric seal, center groove, following the contours of the cavity and forming a pressurized watertight point around the pipe when the ring is tightened.

.4 Connections:

.1 Fittings formed of ductile iron ring segments enclosing the liner and fitting into the grooves of the pipes.

.2 Use fittings with or without set, so as to allow for expansion and angular adjustment, as required by the installation.

.3 Accepted materials:

.1 For steel: such as Victaulic nos. 005, 07, 72, 77, 920N, 922 and 009H or approved equivalent,

.4 Prohibited materials:

.1 Mechanical T joints must be made using two collars in ductile iron. Assembly using cast iron collars and U-bolts, such as Victaulic nos. 921 and 925 or other similar styles, are not acceptable.

.5 Bolting:

.1 Use thermally treated bolts, oval collar and pulling head, adapting to the same hole shape and for clamping one side.

2.3 SEISMIC CONTROLS

.1 Seismic controls must be made according to standards and enforced regulations. Refer to section 23 05 48 – Vibrations and seismic controls for HVAC piping and equipment

2.4 MANUFACTURER LIST

.1 Comply with article "PRODUCTS USED FOR TENDERS AND EQUIVALENCES" from section 20 00 10.

.2 List of manufacturers, section 21 12 01:

.1 Piping:

.1 Allied Tube

.2 American Tube and Piping

.3 Grinnell

.4 Sidbec-Dosco

.5 Steel of Canada

.6 Stelco

.2 Mechanical Joints:

.1 Anvil

.2 VGS

.3 Victaulics

.4 Tyco

.3 Threaded connections:

.1 Anvil

.2 Central

.3 Ward

Part 3 Execution

3.1 GENERAL

.1 Piping placement, location of equipment and special devices, etc., mentioned in the specifications or in drawings indicating the general layout of equipment.

.2 Perform installation according to the standards and learn about the architectural layout of the building.

.3 Install upright piping in a straight line according the required gradients.

.4 No pipe should come in contact with the concrete or the ground.

.5 Install all hoses in such a way to avoid tensile stress or compression.

.6 Do not bend the pipe in any way.

.7 The identification of the pipe markings must always be legible for easy inspection.

3.2 ABOVE GROUND PIPING

.1 See the article "LOCATION OF PIPING AND CONDUIT" in section 20 00 10 – Mechanical and electrical general instructions.

3.3 SLOPES

.1 Install the system in such a way that it empties completely. Install drain taps at the low points.

3.4 SUPPORTS

.1 Conform to the NFPA.

.2 Secure all pipes using brackets and anchors approved by NFPA.

.3 Adjustable supports with steel rod securely fastened to the structure.

.4 Piping up to NPS 4, the threaded rods will be 9 mm. For piping NPS 5 to NPS 8, the rods will be 13 mm. For piping NPS 10 and NPS 12 in diameter, the rods will be 15.6 mm.

3.5 ANCHORS

.1 Adequately anchor in such a way to avoid any stress to joints and/or warping. Using anchors made of welded structural steel firmly secured to the structure by means of anchoring bolts, size and capacity proportional to the weight.

.2 Attach anchors to the main beams and slabs cast, but not to pre-stressed or precast slabs.

.3 The structure should not be damaged by the anchors. Submit anchor positions for approval to the structural Engineer with proper coordination drawings.

3.6 TESTING

.1 See sections "TEST", "FINAL TEST" and "TEST BY OWNER" of section 20 00 10 - Mechanical and electrical general instructions.

.2 Maintain leak-free status for at least two hours in all piping, with hydrostatic pressure of 1400 or 350 kPa over the normal operating pressure.

.3 Provide a certificate stating the results of the tests for each system.

.4 The Contractor will provide the hydraulic pump, connections, and temporary labor needed for these tests.

.5 Set all devices so that they function properly.

END OF SECTION

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Partie 1 General

1.1 RELATED REQUIREMENTS

.1 Section 20 00 10 – Mechanical and electrical general instructions.

.2 Section 21 05 05 – Common work results for fire suppression.

1.2 REFERENCES

.1 National Fire Prevention Association (NFPA):

.1 NFPA-13 – Standard for the Installation of Sprinkler Systems – 2013 Edition.

.2 NFPA-25 – Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems – 2014 Edition.

1.3 DESIGN REQUIREMENTS

.1 Design the sprinkler water systems in accordance with the requirements and recommendations of NFPA-13, with respect to the hydraulic calculations, for a uniform distribution of water throughout the protected area. See section 21 05 05 – Common work results for fire suppression, design criteria.

.2 Implemented systems must be complete and ready for use, and they must include all the materials, elements and interior and exterior accessories necessary for this purpose.

.3 Design each system taking into account all design features and all structures and elements such as hidden spaces, piping, electrical equipment and air ducts, indicated in detail on shop drawings.

.4 Determine the location of sprinkler heads according to the panels/ceiling tiles, lighting fixtures and air diffusers.

.5 Materials and fire protection equipment must be approved by the ULC for use in an automatic water sprinkler system.

.6 Design the system with seismic protection in the case of buildings in earthquake zones (3) and (4), and protection for essential services or to very high risk in the case of buildings located in the seismic zone (2).

.7 Location of sprinkler heads:

.1 Determine the location of the sprinklers according to the characteristics of the ceiling, the spacing between the heads must not exceed that specified in NFPA-13.

.2 Ensure uniform spacing of sprinklers along the bypass lines.

.3 The position of the fire extinguisher heads in the plans is intended to maximize spacing with the new magnetic resonance equipment, while meeting the requirements of the NFPA-13 standard.

.8 Water distribution:

.1 Ensure that water distribution is uniform throughout the area or throughout the area protected by the requested extinguisher heads.

.2 The flow of the most hydraulically disadvantaged heads must match 100% of the prescribed spray density.

.9 Surface application:

.1 Most hydraulically disadvantaged area, determined in accordance with NFPA-13.

1.4 SUBMITTALS

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

.2 Product data:

.1 Submit manufacturer's printed product literature, specifications and data sheet for fixtures and equipment.

.3 Certificates:

.1 Submit certificates signed by the manufacturer certifying that the products and materials comply with the specified performance and physical requirements.

1.5 CLOSEOUT SUBMITTALS

.1 Submit all document/elements required, in accordance with section 20 00 10 – Mechanical and electrical general instructions.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Transport, store and handle hazardous materials in accordance with section 20 00 10 – Mechanical and electrical general instructions.

.2 Shipping and receiving: deliver material to site in the original packaging, which must bear the name and address of the manufacturer.

.3 Waste management and disposal:

.1 Separate waste materials for recycling in accordance with section 20 00 10 – Mechanical and electrical general instructions.

.2 Remove from site and dispose of packaging materials at appropriate recycling facilities.

.3 Collect and separate for disposal paper, plastic, polystyrene and corrugated cardboard packaging material for recycling in accordance with the waste management plan.

.4 Separate steel, metal and plastic materials in designated containers for recycling in accordance with the waste management plan.

.5 Divert unused metal materials from landfill to metal recycling facility.

Partie 2 Product

2.1 PIPING AND VALVE CONNECTIONS

.1 In accordance with NFPA-13.

.2 See section 21 05 05 – Common work results for fire suppression.

2.2 SPRINKLERS

.1 Approved type, misting with fuse, to varying degrees as required.

.2 With appropriate melting points at places where hot air is circulated through the ventilation grilles, heaters or other appliances that produce heat.

.3 Sprinklers shall be as specified or an approved equivalent.

.4 Sprinklers of the following type:

.1 Dry: Viking no. VK548, chrome installation with extension towards the bottom, nozzle protected against freezing.

.2 Rapid response heads: every head located in an area with low or normal risk density should be of rapid response type, as outlined by the NFPA-13.

2.3 PROTECTIVE BASKETS

.1 Install protective baskets in places where the nozzles are susceptible to mechanical shock and where indicated in drawings. They must be securely fastened.

.2 Protective baskets are painted red for bronze finished nozzles, and for chrome finished nozzles.

.3 Install protective screens on the baskets with sprinklers at the locations shown in the drawings.

.4 These baskets must be approved for the type of head installed.

2.4 MANUFACTURER LIST

.1 Comply with article "PRODUCTS USED FOR TENDERS AND EQUIVALENCES" from section 20 00 10.

.2 List of manufacturers, section 21 13 13:

.1 Sprinkler heads:

.1 Central
.2 Globe
.3 Grinnell
.4 Reliable
.5 Victaulic
.6 Viking

Partie 3 Execution

3.1 MANUFACTURERS INSTRUCTIONS

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

3.2 INSTALLATION

.1 Install automatic sprinkler systems, check and submit them to an acceptance test in accordance with NFPA-13 and NFPA-25.

3.3 PIPING INSTALLATION

.1 Install level and square the piping so that it rests evenly on its supports and suspensions. Do not attach the suspensions to plaster ceilings.

.2 Make sure the interior and the ends of the new pipe as well as the existing pipe are free from water debris.

.3 During the installation and at the end of each work period, seal the open ends of the pipe with caps or other approved methods to prevent the entry of foreign matter.

.4 Inspect the pipes before setting them into place.

3.4 ON SITE QUALITY CONTROL

.1 Testing/Site Inspections:

- .1 Perform the required tests to verify compliance with the prescribed requirements.
- .2 Perform the required tests and inspections and approve the piping prior to concealing it.
- .3 Preliminary tests:
  - .1 Conduct hydrostatic testing for each system at a pressure of 200 lb/in² for a period of two (2) hours, there must be no leakage or pressure drop during this test.
  - .2 Flush drinking water pipes in accordance with NFPA-13.
  - .3 Perform required tests and inspections and approve the piping installed in empty ceiling spaces before setting the ceilings.
  - .4 Test the alarms and other related devices.
  - .5 Once testing is complete and corrections have been made, submit the certificate of inspection, signed and dated in accordance with NFPA-13.
- .4 Final tests and inspections:
  - .1 Do not request to have tests and final inspections performed before the preliminary tests are completed and any corrections made.
  - .2 Application for final inspection must be made at least fifteen (15) days before the desired inspection date.
  - .3 Repeat required testing as directed.
  - .4 Correct any anomalies and conduct additional tests until the systems comply with contractual requirements.
  - .5 Provide the hydraulic pump, temporary connections, and labor necessary for carrying out the tests.
  - .6 Provide a certificate indicating the test results for each system.

END OF THE SECTION

TABLE OF CONTENTS

Part 1 General

1.1 GENERAL REQUIREMENTS

.1 Section 20 00 10 – Mechanical and electrical general instructions.

1.2 REFERENCES

.1 Health Canada/Information System Hazardous Materials (WHMIS):

.1 Material Safety Data Sheets (MSDS).

.2 National Fire Protection Association (NFPA):

.1 NFPA-10 – Standard for Portable Fire Extinguishers, 2013 Edition.

1.3 SUBMITTALS

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

.2 Product data:

.1 Submit manufacturer's printed product literature, specifications and data sheet for fixtures and equipment.

.3 Certificates:

.1 Submit certificates signed by the manufacturer certifying that the products and materials comply with the specified performance and physical requirements.

1.4 CLOSEOUT SUBMITTALS

.1 Submit all document/elements required, in accordance with section 20 00 10 – Mechanical and electrical general instructions.

.2 Operation and maintenance data (O&M): provide instructions with respect to the operation and maintenance, to be incorporated into the O&M manual.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Transport, store and handle hazardous materials in accordance with section 20 00 10 – Mechanical and electrical general instructions.

.2 Shipping and receiving: deliver material to site in the original packaging, which must bear the name and address of the manufacturer.

Part 2 Product

2.1 GENERAL

.1 Fire extinguishers must be ULC approved and meet the requirements of Canada's National Fire Prevention Code, NFPA-10 standard and meet the regulation concerning fire prevention in the municipalities concerned.

.2 Label:

.1 Attach or stick onto the fire extinguisher a label indicating the month and year of installation. Provide a space to record the dates of the periodic maintenance.

.2 Register on a permanent plaque the user manual and guidelines for re-filling.

2.2 MULTIPURPOSE POWDER – TYPE 2

.1 Pressurized multipurpose powder ABC classification 6A, 80 BC, capacity of 4.5 kg (10 lb), operating at a pressure of 1620 kPa (235 lb/in²), available at C.F.H. Security Inc. no. WBDL-ABC10, with wall bracket support.

2.3 MANUFACTURER LIST

.1 Comply with article "PRODUCTS USED FOR TENDERS AND EQUIVALENCES" from section 20 00 10.

.2 List of manufacturers, 21 44 16.19:

.1 Fire Accessories by P.L. Inc.

.2 Ansul Clean Guard (Simplex Grinnell)

.3 C.F.H. Security Inc.

.4 Chubb

.5 National Fire Equipment Ltd.

.6 Safety First

Part 3 Execution

3.1 GENERAL

.1 Final location to be determined on the spot by the fire department.

.2 Install fire extinguishers so that the top is at a height of 1520 mm (60") maximum above the floor.

3.2 LOCATIONS

.1 In the laboratory (room 161):

.1 Type 2.

.2 Quantity: 1

3.3 QUALITY CONTROL

.1 Spot checks by the manufacturer:

.1 The manufacturer shall make recommendations regarding the use of the product and make periodic visits to check if the implementation was performed according to the recommendations.

END OF SECTION

TABLE OF CONTENTS

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 20.

1.2 SCOPE OF THE WORK – PLUMBING

.1 Work included:

.1 Generally, the works include labour, delivery, and installation of all materials and equipment needed for the plumbing works indicated in the drawings and the specification.

.2 Scheduling: Work must be completed within seven (7) weeks following the signing of the general contractor's contract. To meet this time frame, day, evening and weekend work is permitted.

.3 These works include, but are not limited to:

.1 The removal of all fixtures, piping and other existing accessories that are not essential or that disrupt the new installation and/or need to be removed in accordance with the municipal and provincial plumbing regulations.

.2 A new 100 PSIG compressed air network, including all required accessories, the displacement of an existing air filter on the wall and the connection to the existing network.

.3 A new nitrogen network, including all the required accessories (valve, pressure regulator, etc.), connected to the existing network.

.4 An additional new nitrogen network, including all the required accessories (valve, pressure regulator, etc.), connected to a cylinder.

.5 A new helium network, including all the required accessories (valve, pressure regulator, etc.), connected to a cylinder.

.6 The special connections.

.7 The structural steel supports and components.

.8 The testing.

.9 Payment of all expenses, permits, inspection fees, and other fees for this installation.

1.3 SPECIAL CONNECTIONS

.1 In general, special connections include all connections to fixtures, all pipes, adapters, stop valves, by-passes, unions, flanges, filters, air vents, test valves, drain valves, control valves, shock dampers, buffer tanks, traps, ventilation ducts, flexible joints and other accessories necessary to operate the fixtures.

1.4 DOCUMENTS TO SUBMIT

.1 Submit the following documents:

.1 A list of the identification legends for the piping, valves, and fittings, in compliance with Division 20.

.2 Copies of the instruction manuals for the operation and maintenance of the equipment, in compliance with Division 20.

.3 Up to date drawings, in compliance with Division 20.

1.5 GLOBAL PRICE – SEPARATE PRICE

.1 Provide with the tender an all-inclusive price covering all the work done by Division 22 "PLUMBING".

Part 2 Product

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 SYSTEM CLEANING

.1 Clean the inside and outside all components, devices, and systems, including strainers and filters.

3.2 PROTECTION

.1 By the means of suitable elements, prevent dust, dirt and other foreign matter from entering the openings of the devices, equipment, and systems.

CERTIFICATE OF COMPLIANCE

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 in effect.

Social reason: _____

Address: _____

Telephone number: _____

Signatory name: _____

Signature: _____

Signatory title: _____

COMPANY SEAL

END OF SECTION

TABLE OF CONTENTS

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 20 00 10 – Mechanical and electrical general instructions.

.2 Section 23 05 05 – Installation of pipework.

.3 Section 23 05 17 – Pipe welding.

.4 Section 23 05 48 – Vibrations and seismic controls for HVAC piping and equipment.

1.2 REFERENCES

.1 American Society of Mechanical Engineers (ASME):

.1 ASME Boiler and Pressure Vessel Code section VIII Pressure Vessels:

.1 BPVC-VIII B – 2013, BPVC Section VIII – Rules for Construction of Pressure Vessels Division 1.

.2 BPVC-VIII-2 B – 2013, BPVC Section VIII – Rules for Construction of Pressure Vessels Division 2 - Alternative Rules.

.3 BPVC-VIII-3 B – 2013, BPVC Section VIII – Rules for Construction of Pressure Vessels Division 3 – Alternative Rules High Press Vessels.

.2 ASME B16.5-2013 – Pipe Flanges and Flanged Fittings: NPS 1/2 through NPS 24 Metric/Inch Standard.

.3 ASME B16.11-2011 – Forged Fittings, Socket-Welding and Threaded.

.2 American Society for Testing and Materials International (ASTM):

.1 ASTM-A53/A53M-12 – Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.

.2 ASTM-A105/A105M-14, Standard Specification for Carbon Steel Forgings for Piping Applications.

.3 ASTM-A181/A181M-14 – Standard Specification for Carbon Steel Forgings for General Purpose Piping.

.4 ASTM-A234/A234M-15 – Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service.

.5 ASTM-A307-14 – Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60,000 psi Tensile Strength.

.6 ASTM-B88-14 – Standard Specification for Seamless Copper Water Tube.

.3 Canadian Standards Association (CSA):

.1 CSA B51-14 – Boiler, Pressure Vessel and Pressure Piping Code.

.4 Health Canada - Workplace Hazardous Materials Information System (WHMIS):

.1 Material safety data sheets (MSDS).

1.3 SUBMITTALS

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

.2 Product data:

.1 Submit manufacturer's printed product literature, specifications and data sheet for fixtures and equipmen,. as well as the manufacturer's instructions and documentation. Technical sheets must indicate product characteristics, performance criteria, dimensions, limits and finish.

.3 Certificates:

.1 Submit certificates signed by the manufacturer certifying that the products and materials comply with the specified performance and physical requirements.

1.4 CLOSEOUT SUBMITTALS

.1 Submit all document/elements required, in accordance with section 20 00 10 – Mechanical and electrical general instructions.

.2 Operation and maintenance data (O&M): provide instructions with respect to the operation and maintenance, to be incorporated into the O&M manual.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Transport, store and handle hazardous materials in accordance with section 02 81 01 – Hazardous materials.

.2 Shipping and receiving: deliver material to site in the original packaging, which must bear the name and address of the manufacturer.

Part 2 Product

2.1 GENERAL

.1 Compressed air supply system for equipment provided by the Owner.

.2 The compressed air must be of quality suitable for instrumentation use, exempt of solid particles, water and atomized oil, etc.

.3 Install the compressed air supply networks as shown in the drawings.

.4 See diagram and details on the drawings.

2.2 PIPING: 1035 KPA AND LESS

.1 Piping:

.1 Copper, NPS 2½ and smaller: hard copper type, ASTM-B88.

.2 Joints:

.1 Copper:

.1 Between the header and the compressor: welded with silver solder.

.3 Pipe connections:

.1 Copper:

.1 Emco wrought tees, welded with 95% tin and 5% antimony solder.

.2 Steel:

.1 NPS 2 or smaller:

.1 Threaded tees (Anvil).

.2 NPS2½ to NPS 12:

.1 Series 80 with butt weld or with socket and weld, compliant with the ASME standard B16.11

.2 Weldless standard steel tees to ASTM-A234.

.2 Valves:

.1 Globe valve:

.1 NPS 2 or smaller:

.1 Copper:

.1 Bronze body, bronze components, solder end joints, Crane fig. no. 1310.

.2 Check valve:

.1 NPS 3 or smaller:

.1 Copper and steel:

.1 Bronze body, bronze components, threaded ends with adaptor for solder end joints for a copper installation, Crane fig. no. 137.

2.3 PRESSURE REDUCING AND LUBRICATION STATION

.1 The pressure reducing station includes pressure gauges, strainers, pressure reducing valve, safety valve, lubricator, etc. See model and accessories in the table.

2.4 AUTOMATIC DRAIN TRAPS

.1 Armstrong automatic drain traps, for and operating pressure of 690 kPa (100 lb/in^2).

2.5 MANUFACTURER LIST

.1 Comply with article "PRODUCTS USED FOR TENDERS AND EQUIVALENCES" from section 20 00 10.

.2 Manufacturer list, section 22 15 00:

.1 Compressed air piping:

.1 Copper piping:

.1 Anaconda America Brass Co.
.2 Anvil
.3 Noranda Copper Brass Ltd

.2 Pressure reducing station:
.1 Honeywell
.2 Johnson
.3 Watts Regulation Co.
.4 Wilkerson

.3 Water drain traps:
.1 Armstrong
.2 Honeywell
.3 Johnson

.4 Piping accessories:
.1 Copper fittings:
.1 Anvil
.2 Emco
.3 Mueller

.5 Valves:
.1 Valves:
.1 Anvil
.2 Crane
.3 Kitz Corp.
.4 Milwaukee
.5 Newman Hattersley
.2 Check valves:
.1 Crane
.2 Kitz Corp.
.3 Milwaukee
.4 Newman Hattersley

Part 3 Execution

3.1 PIPING

.1 Comply with requirements of the section 23 05 05 – Installation of pipework.

.2 Support all piping adequately to avoid any bending, install at right angles and elsewhere where required.

.3 Install the pressure reducing stations in the mechanical rooms, complete pressure reducing stations with filters, pressure gauges, strainers, pressure reducing valves, and safety valves.

.4 At the bottom of all vertical piping, install drip leg with water drain vents.

.5 Do not install pipes on cold surfaces. When they are close to ventilation ductwork or insulated pipes, piping they must not be covered with insulation.

3.2 PIPING, TESTS

.1 Test all compressed air main piping for at least two hours at 860 kPa.

3.3 AUTOMATIC DRAIN TRAPS

.1 Install units of sufficient capacity in places shown on the drawings.

3.4 COMPRESSED AIR PIPING NETWORKS

.1 Install shut-off valves at outlets, on the main supply pipes and other locations as indicated.

.2 Install quick connect couplings and pressure gauges on descending feed stations.

.3 Install union fittings to enable the removal or replacement of equipment and appliances.

.4 Install tees rather than elbows in locations where the piping changes direction and seal the unconnected ends of the tees.

.5 Install unused piping with a slope of at least 1%.

.6 Tap the piping to the main pipe on the upper part of the main pipe.

.7 Weld steel pipes in accordance with section 23 05 17 – Pipe welding and the following requirements:

.1 Requirements of ASME standards and those of the competent authority.

.2 Regardless of their dimensions, all concealed and inaccessible piping must be welded.

3.5 CLEANING

.1 Piping cleaning: inject air inside the piping in order to clean it thoroughly and remove any oil or foreign matter.

.2 Ensure that the system is accepted by the competent authorities.

.3 Perform cleaning according to manufacturer's recommendations.

.4 Once installation and performance verification are completed, remove any surplus material, waste material, tools and equipment from the site.

END OF SECTION

TABLE OF CONTENTS

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 20 00 10 – Mechanical and electrical general instructions.

.2 Section 22 05 00 – Common work results for plumbing.

.3 Section 23 05 48 –Vibrations and seismic controls for HVAC piping and equipment.

1.2 SCOPE OF WORK

.1 Included work:

.1 In general, the work includes the labour, the supply and the installation of all materials and equipment necessary for the medical gas work indicated on the drawings and specifications.

.2 These works include, but not limited to:

.1 A nitrogen distribution system, complete with pipes, fittings, valves, regulators, pressure gauges, common bottle feeding ramp (1 cylinder), supply cylinder and other accessories.

.2 All electrical connections from electrical sources provided for this purpose by the Contractor responsible for the work of the Division 26, for the following equipment: nitrogen.

.3 Identification of the piping, valves, access doors, access panels, tiles, devices, and other accessories, in accordance with CSA Z7396.1 standards for modified and/or new sectors.

.4 All supports.

.5 All tests.

.6 Sleeves and their acoustic insulation.

.7 All new openings required of 150 mm and smaller.

.8 Training of the maintenance staff.

.9 Paraseismic measures: the supply and installation of all the paraseismic measures concerning the medical gases, in accordance with section 23 05 48 - Vibrations and seismic controls for HVAC piping and equipment, including a report written and signed by the Engineer responsible for the seismic system.

.2 Excluded work:

.1 In general, the following work is excluded:

.1 The insulation work.

.2 Controls work, except those specifically requested in this tender.

.3 Electrical connections, except those specifically requested in this tender.

.4 Flashing work.

1.3 QUALIFIED LABOUR

.1 This section's Contractor will need to have done, by qualified, specialized, and approved labourers, all nitrogen work.

.2 All work on the medical gas system must be performed by installers holding the CSA "Medical Gas Piping & Systems Installation Personnel Certification Program" certification.

1.4 TESTING AND CERTIFICATION

.1 The following tests in the given order: pressure test, waterproofing test, safety valve check, exit check and for each test the necessary corrections to be made, before proceeding with the next step.

1.5 DOCUMENTS REQUIRED

.1 Provide the following documents:

.1 Certificates of approval from the concerned authorities.

.2 Warranty certificate, in accordance with Division 20.

.3 Copies of the instruction manuals for equipment operation and maintenance, in accordance with Division 20.

.4 Drawings kept up to date, in accordance with Division 20.

Part 2 Product

2.1 NOT USED

.1 Not Used

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

TABLE OF CONTENTS

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 20 00 10 – Mechanical and electrical general instructions.

.1 Section 22 05 00 – common work Results for Plumbing.

.2 Section 22 60 00 – Common work results for medical gas.

.3 Section 23 05 48 –Vibrations and seismic controls for HVAC piping and equipment.

1.2 REFERENCES

.1 ASME B16.22-12 – Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.

.2 ASME B16.50-2001 (R2008) – Wrought Copper and Copper Alloy Braze-Joint Pressure Fittings.

.3 ASME B40.100-2005 – Pressure Gauges and Gauge Attachments.

.4 ASME Boiler and Pressure Vessels Code (BPVC)-2010, section VIII – Rules for Construction of Pressure Vessels.

.5 ASTM-B32-08 – Standard Specification for Solder Metal.

.6 ASTM-B819-00(2011) – Standard Specification for Seamless Copper Tube for Medical Gas Systems.

.7 ASTM-B828-02(2010) – Standard Practice for Making Capillary Joints by Soldering of Copper and Copper Alloy Tube and Fittings.

.8 ASTM-D2855-96(2010) – Standard Practice for Making Solvent-Cemented Joints with Poly(Vinyl Chloride) (PVC) Pipe and Fittings.

.9 AWS A5.8/A5.8M-2011-AMD 1 – Specification for Filler Metals for Brazing and Braze Welding.

.10 CAN/CSA Z305.1-92 (R2001) – Non-Flammable Medical Gas Piping Systems.

.11 CAN/CSA Z7396.2-02 (R2007) – Medical Gas Pipeline Systems - Part 2: Anaesthetic Gas Scavenging Disposal Systems (Adopted ISO 7396-2:2000, first edition, 2000-11-15, with Canadian deviations).

.12 CSA B51-09 – Boiler, Pressure Vessel, and Pressure Piping Code.

.13 CSA C22.1-12 – Canadian Electrical Code, Part I (22nd Edition), Safety Standard for Electrical Installations.

.14 CSA Z7396.1-17 – Medical Gas Pipeline Systems - Part 1: Pipelines for Medical Gases, Medical Vacuum, Medical Support Gases, and Anaesthetic Gas Scavenging Systems.

.15 NEMA-250-2008 – Enclosures for Electrical Equipment (1000 Volt Maximum).

.16 NFPA-55 – Compressed Gases and Cryogenic Fluids Code, 2013 Edition.

.17 Standard NQ 5710-500 - Flammable Medical Gas - Distribution Networks of Facilities Providing Health Services - Characteristics and Testing Methods.

.18 CSA (Canadian Standards Association).

.19 UL (Underwriters Laboratories Inc.).

1.3 SUBMITTALS

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

.2 Product data:

.1 Submit manufacturer's printed product literature, specifications and data sheet for fixtures and equipment.

.3 Shop drawings:

.1 Shop drawings must include the seal and signature of a professional Engineer recognized in Canada, in the province of Québec.

.4 Certificates:

.1 Submit certificates signed by the manufacturer certifying that the products and materials comply with the specified performance and physical requirements.

1.4 CLOSEOUT SUBMITTALS

.1 Submit all document/elements required, in accordance with section 20 00 10 – Mechanical and electrical general instructions.

.2 Operation and maintenance data (O&M): provide instructions with respect to the operation and maintenance, to be incorporated into the O&M manual.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Transport, store and handle hazardous materials in accordance with section 02 81 01 – Hazardous materials.

.2 Shipping and receiving: deliver material to site in the original packaging, which must bear the name and address of the manufacturer.

.3 Waste management and disposal:

.1 Separate waste materials for recycling in accordance with section 20 00 10 – Mechanical and electrical general instructions.

.2 Remove from site and dispose of packaging materials at appropriate recycling facilities.

.3 Collect and separate for disposal paper, plastic, polystyrene and corrugated cardboard packaging material for recycling in accordance with the waste management plan.

.4 Separate steel, metal and plastic materials in designated containers for recycling in accordance with the waste management plan.

.5 Divert unused metal materials from landfill to metal recycling facility.

Part 2 Product

2.1 PIPING AND FITTINGS

.1 Copper, type L, hard, ASTM-B-819, seamless, cleaned of any grease at the factory before being delivered to the site and covered with protective caps. In ground piping to be is K type, soft, seamless, instead of L.

.2 Piping identified as "MED".

.3 Silver solder with copper fittings, forged brass or bronze, designed for welding, according to the standard CSA Z7396.1-17, and by installed by a certified labourer.

.4 When connecting pipes by brazing, a continuous flow of nitrogen serves as pressure inside the pipes.

.5 Bronze fittings, ASTM-B-61.

2.2 VALVES

.1 Ball type with lever handle indicating the position of the valve, removable lever, a quarter turn from fully open to fully closed, bronze body in three parts bolted together with a swivelling central portion serving as a union. Chrome plated ball sealing the valve in both directions when the tap is closed, self-aligning ball type, BUNA-N flexible seats (made of Teflon, on a 100 mm in diameter valve), stem seals with conduit extension made of copper type K 300 mm on each side, silver solder, operating pressure of 2070 kPa, NFPA, NQ, CGA and CSA certified.

.2 Stop valves at the supply source, compliant with CSA standards.

.3 Valves cleaned of any grease at the factory and delivered to site with protective caps and packaged individually in a sealed plastic bag.

.4 High pressure type check valves, compliant with the CSA standards.

.5 Identify the valves by a colour code and the name of the connected gas.

2.3 PRESSURE GAUGES

.1 Pressure gauges for positive and negative pressure with a 100 mm in diameter steel housing, phosphor bronze Bourdon tube, and cleaned for oxygen service.

.2 Pressure gauges for pressures higher than 6894 kPa with a 100 mm steel housing, beryllium copper tubing, and cleaned for oxygen service.

.3 6 mm brass fitting, mounted on a DISS adapter indexed for the gas it supplies.

.4 Pressure gauges with appropriate scales and with readings in both SI and imperial system units.

.5 Pressure gauges, Vitalaire VA-JPPO series for positive pressure and VA-JPNE series for negative pressure.

2.4 CHECK VALVES

.1 Check valve, Amico Alert 1 series.

.2 Bronze body with positive closure with a self-aligning spring piston and completed by a cushioned seat.

.3 Snap action vibration free valve.

.4 Each valve has undergone a 100% leak-proof test and has been cleaned for oxygen service.

.5 Check valves comply with the standards CSA Z302-1 and CSA Z7396.1-17, the most recent editions.

.6 Check valves distributed by Vitalaire, VA-VV-CHK series.

2.5 LABORATORY GAS COLLECTORS

.1 Manufacturers: subject to the compliance with the specifications, provide the products of one of the following manufacturers:

.1 Praxair;
.2 Western Enterprises;
.3 Allied Healthcare Products inc.; Oxequip Health Industries;
.4 Amico Corporation;
.5 BeaconMedaes;
.6 Squire-Cogswell/Aeros Instruments inc.;
.7 Class 1 Inc.;
.8 Or approved equivalent.

.2 Brass collector designed for laboratory gas supply with a main feed and a reserve feed. A drop in pressure does the transfer of the main supply to the reserve power automatically.

.3 Collector including:

.1 Pressure regulators with pressure gauges that include devices to set somes conditions to activate an alarm to the alarm panel and a manual device to select the main cylinder off the reserve cylinders and vice versa during the automatic transfer to reserve transfer. The assembly is mounted on a stainless steel plate for wall attachment;
.2 Safety valve;
.3 Pressure regulator with pressure gauge at the exit of the collector;
.4 Alarm panel to allow the transmission of an alarm indicating that the reserve is working on the building management system;
.5 Isolation valve pour each of the feeder;
.6 Supply feeder for the cylinders in normal operation and for the reserve ones.

.4 Non-ferrous metal distribution feeds, duplex, provided for the number of bottles indicated. Units designed for an entry pressure of at least 1,380 kPa (200 psig). Main pipe for bottle battery for each isolation valve of the different bottles, flexible stainless steel fitting with retaining valve input connections (pigtail) compliant with CGA V-1.

.5 List of collectors:

.1 Nitrogen collector: one (1) cylinder in function. Supply pressure at the exit of the collector: 50 PSI. Such as Praxair PRS50264D21-580 model or approved equivalent.

.2 Helium collector: one (1) cylinder in function. Supply pressure at the exit of the collector: 50 PSU. Such as Praxair PRS50264D21-580 model or approved equivalent.

.6 Fixation: On the wall, with mounting supports for pressure regulators assembly, pressure gauges, safety valves and alarm device of the collector and distribution feeders.

2.6 MANUFACTURER LIST

.1 Comply with article "PRODUCTS USED FOR TENDERS AND EQUIVALENCES" from section 20 00 10.

.2 Manufacturer list, section 22 61 16:

.1 Copper piping:

.1 Anaconda American Brass Co.

.2 Noranda Copper & Brass Ltée

.2 Copper fittings:

.1 Emco

.2 Grinnell

.3 Mueller

.3 Valves:

.1 Amico

.2 Beacon Medeas

.3 Class 1 Inc.

.4 EEME

.5 Ohmeda (Ohio)

Part 3 Execution

3.1 PIPING INSTALLATION

.1 The pipes are new, straight, and installed parallel to the main axes of the building. The piping must not be bent or in tension.

.2 Ream cut pipes.

.3 Pipes, fittings, and accessories are cleaned of grease in the factory and delivered with caps.

.4 Cap the pipes as the installation progresses to prevent any contamination.

.5 The piping should not bear the weight of other pipes or provide support for them.

.6 Support spacing must comply with the requirements to the standard CSA Z7396.1-17.

.7 Dielectrically insulate the supports.

.8 The supports must not rest on welded joints.

.9 Except the required threaded fittings and flare type brass joints approved for medical gases, braze all joints with a silver alloy solder having a minimum fusion point of 525°C and maintain a constant nitrogen circulation inside the pipe during the brazing. Install all threaded joints with a sealing paste approved for oxygen and other medical gases or square-edged with soft solder to the male threads.

.10 During the welding of valves, see to moving the central section of the valves to prevent damage to the components that cannot withstand high temperatures.

.11 All shut-off valves are easily accessible.

.12 The Sub-Contractor must take all necessary precautions to prevent cross connections between different medical gases.

.13 Installation restrictions:

.1 Prohibited: installation practices involving temporary connections between the pipe networks made to facilitate the simultaneous pressurizing of these networks from a common gas source to perform pressure tests. The ban is intended to prevent cross-connections that could occur if a temporary connection was not removed.

3.2 EQUIPEMENT INSTALLATION

.1 Protect the equipment against dust and property damage.

.2 Install visible equipment precisely and levelled.

.3 Provide, for approval by the Architect and Engineer, coordination drawings showing the exact position of panels and enclosures on the walls. When valve enclosures are individually installed on the walls, their positions will also be submitted for approval with the appropriate erection drawings.

3.3 CLEANING

.1 Perform the cleaning work, compliant with to the standard BNQ-5710-500.

END OF SECTION

TABLE OF CONTENTS

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 20 00 10 – Mechanical and electrical general instructions.

1.2 SUBMITTALS

.1 Product data:

.1 Submit manufacturer's printed product literature, specifications and data sheet for fixtures and equipment. Data sheets must include product characteristics, performance criteria, dimensions, limits and finish.

.1 Shop drawings:

.1 Shop drawings must include:

.1 Assembly and installation details.

.2 Required information to permit operation and maintenance (O&M) of the devices.

.2 Submit the following documents along with the shop drawings and data sheets:

.1 Shop drawings for the bases, stands, supports and anchoring bolts.

.2 Data regarding sound level of systems and devices if applicable.

.3 Performance curves with operating points indicated.

.4 Documentation from the manufacturer certifying that the products provided are the most current model.

.5 Certificate of compliance with relevant codes.

1.3 CLOSEOUT SUBMITTALS

.1 Submit the required documents/elements in accordance with section 20 00 10 – Mechanical and electrical general instructions.

.2 Operation and Maintenance data (O&M): provide instructions with respect to the operation and maintenance, to be incorporated into the O&M manual.

.1 The O&M manual must be approved, before the final inspection, by the Consultant. Final copies to be submitted to the Owner.

.2 Operational documentation must include the following:

.1 Control diagrams for each system, including local interface controls.

.2 A description of each system and related control devices.

.3 A description of the operating sequences for each system under different loads, including programmed set points and seasonal changes.

.4 Instructions for the operation of each device and its components.

.5 Instructions of measures to be taken in case of equipment/material failure or malfunction.

.6 Table of flow devices and a flow diagram.

.7 A colour code legend.

.3 Maintenance documentation must include the following:

.1 Instructions for the maintenance, reparation, operation and troubleshooting of every component,

.2 A maintenance schedule specifying the frequency and the length of work as well as tools required to perform the work.

.4 Performance documentation must include the following:

.1 Performance data supplied by the manufacturer of the equipment/material, specifying the performance level of each, measured after the commissioning process has been completed.

.2 Results from the performance testing of the equipment/material.

.3 All other documentation specified in other sections of the contractual documents.

.4 TAB (testing, adjusting and balancing) reports in accordance with requirements from section 23 05 93 – Testing, adjusting and balancing for HVAC.

.5 Additional information:

.1 Prepare sheets for any additional documentation to add to the appendix of the O&M manual.

.6 "As-built" drawings:

.1 Before performing TAB work, complete the as built drawings.

.2 Mark on every drawing on the lower right side in at least 12 mm font "AS-BUILT' DRAWINGS: THIS DRAWING WAS REVIEWED AND REPRESENTS THE SYSTEMS/MECHANICAL DEVICES AS THEY WERE INSTALLED" (Contractor signature) (Date).

.3 Submit the as-built drawings to the Consultant for approval and make any required corrections as instructed.

.4 Perform TAB work with as built drawings at hand.

.5 Submit reproducible as built drawings along with O&M manual.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Transport, store and handle hazardous materials in accordance with section 20 00 10 – Mechanical and electrical general instructions.

.2 Shipping and receiving: deliver material to site in the original packaging, which must bear the name and address of the manufacturer.

1.5 SPECIFIC CONDITIONS – VENTILATION

.1 The specific requirements of the mechanical and electrical works, Division 20, apply to this section.

.2 The following sections are included in the scope of the ventilation work and complement each other to form a whole.

.1 Section 23 05 00 – Common work results for HVAC.

.2 Section 23 05 13 – Common motor requirements for HVAC equipment.

.3 Section 23 05 29 – Hangers and supports for HVAC piping and equipment.

.4 Section 23 05 48 – Vibration and seismic controls for HVAC piping and equipment.

.5 Section 23 05 53.01 – Mechanical identification.

.6 Section 23 05 93 – Testing, adjusting and balancing for HVAC.

.7 Section 23 07 13 – Duct insulation.

.8 Section 23 31 13.01 – Metal Ducts – Low pressure to 500 Pa.

.9 Section 23 33 00 – Air duct accessories.

.10 Section 23 33 15 – Dampers – Operating.

.11 Section 23 33 46 – Flexible ducts.

.12 Section 23 34 00 – HVAC fans.

.13 Section 23 36 00 – Air terminal units.

.14 Section 23 37 13 – Diffusers, registers and grilles.

.3 Scope of work

.1 Work included:

.1 The work includes, in general, labor, supply, and installation of all materials and equipment necessary for ventilation – air-conditioning work indicated on the drawings and in the specification.

.2 Scheduling: Work must be completed within seven (7) weeks following the signing of the general contractor's contract. To meet this time frame, day, evening and weekend work is permitted.

.3 This work includes, but is not limited to:

.1 The renovation of ventilation systems in Room 161, as outlined in the plans.

.2 All special connections and ducts.

.3 All supports and structural steel components required to support the ducts and the equipment.

.4 All access doors.

.5 All new openings. See Division 20.

.6 All demolition, relocation, and recalibration work for ducts, terminal units, and diffuser grilles, as shown in the drawings.

.7 The coordination of coordination drawings from sections from Divisions 21, 22, 23, 25, and 26, in accordance with the requirements of the section 20 00 10 – Mechanical and electrical general instructions, as well as the coordination of acoustic and vibration work.

.8 Identification of the systems' ventilation ducts, the devices, and the other accessories, in accordance with section 23 05 53.01 – Mechanical identification.

.9 All tests.

.10 All work for the balancing and the adjustments of the air quantities.

.11 Paraseismic measures for ventilation – air conditioning work, according to section 23 05 48 – Vibration and seismic controls for HVAC piping and equipment.

.12 Duct cleanliness:

.1 All ventilation ducts and equipment should be regularly maintained to a state of cleanliness. As the work progresses and near the completion of the work, examinations will be done to ensure that dust levels do not exceed 0.75 mg/100 cm² to comply with the NADCA-ACR standard. See Section 23 01 31 – Air duct cleaning and HVAC systems.

.4 Documents to provide:

.1 Provide the following documents:

.1 The certificates of approval from the concerned authorities.

.2 Shop drawings, device drawings, and coordination drawings.

.3 A list of duct identification legends.

.4 Copies of the instruction manuals for the equipment operation and maintenance.

.5 Up to date drawings.

.6 A list indicating for each electric motor: the current in amperes at zero load and at normal load, the capacity of the heater installed in the starter, and the value of the maximum current in amperes inscribed on the motor plate.

.7 A full report of the results requested in the article "VENTILATION SYSTEMS' TAB REPORT" from the section 23 05 93 – Testing, adjusting and balancing for HVAC

.5 Submissions – Prices to provide:

.1 Global price:

.1 Provide with the submission, a global inclusive price covering all the "VENTILATION – AIR-CONDITIONING" work.

.2 Declared price:

.1 Also, provide the prices declared as included in the overall price for the following work:

.1 Thermal insulation

.6 Submissions – Other information:

.1 All work described in section 23 05 93 – Testing, Adjusting and Balancing for HVAC should be performed by a company member of the NEBB (National Environmental Balancing Bureau) or the AABC (Associated Air Balance Council). Indicate the name of the selected specialized company.

.1 Acceptable companies:

.1 Montreal:

.1 Caltech

.2 Hydraulique

.3 Service de mise au point Leblanc Inc.

.2 All work described in section 23 05 48 – Vibration and seismic controls for HVAC piping and equipment. Indicate the name of the selected company.

.1 Acceptable companies:

.1 The list of acceptable companies appears in the same article.

1.6 ELECTRICAL CONNECTIONS

.1 Each relevant mechanical section must provide and install the motors, the thermostats, the controllers, and the other devices specific to their own specialty shown on the drawings and/or requested in the specification.

.2 Unless otherwise indicated, each relevant mechanical section must provide the starters and the transformers relating to their specialty. These starters and transformers are installed and connected by Division 26.

.3 According to the indications on the diagrams and the drawings, Division 25 or 26 must provide and install the ducts, the cables, and the boxes with complete connections for all mechanical devices, under the supervision of the Division that provided the device.

.4 However, each relevant mechanical section is solely responsible for the operation of their own equipment. They must check all the electrical control sequences and the protection of each device by checking all the overload relays.

.5 Each relevant mechanical section is solely responsible for the selection of the overload relays.

.6 All electrical connections must comply with the electrical specification requirements.

Part 2 Product

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

TABLE OF CONTENTS

Part 1 General

1.1 RELATED SECTIONS

.1 Section 20 00 10 – Mechanical and electrical general instructions.

1.2 REFERENCES

.1 American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE):

.1 ASHRAE 90.1-01 – Energy Standard for Buildings Except Low-Rise Residential Buildings (IESNA cosponsored; ANSI approved; Continuous Maintenance Standard).

.2 Electrical Equipment Manufacturers' Association Council (EEMAC)

1.3 SUBMITTALS

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

.2 Product data:

.1 Submit manufacturer's printed product literature, specifications and data sheet for fixtures and equipment in accordance with section 20 00 10 – Mechanical and electrical general instructions. Data sheets must include product characteristics, performance criteria, dimensions, limits and finish.

.3 Documents to submit at the end of work:

.1 Submit the maintenance documents of the motors, transmissions and guards, and attach them to the manual described in section 20 00 10 – Mechanical and electrical general instructions.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Transport, store and handle materials in accordance with section 20 00 10 – Mechanical and electrical general instructions.

.2 Transport and store materials according to manufacturer’s written instructions.

Part 2 Product

2.1 GENERAL

.1 Provide the prescribed motors for the aimed mechanical devices and systems.

.2 T-Frame type motor housing, class B insulation, type with silencer, and special type junction box.

.3 Some motors must be explosion-proof. See the respective sections.

.4 Some motors must be of a special type, which can withstand high ambient temperatures, such as those installed in boiler rooms, transformer rooms, generator rooms, or other.

.5 All motors, except those that are directly connected, must be installed on sliding rails enabling easy adjustment and connected to their respective devices with V belts. Adjustment on sliding rails should be done with worm screws. The metal frame forming the bottom of the unit and the motor must be built in one piece if the frame is the assembly's only base. All motors connected to devices with belts must have their axes chosen to firmly support the pulleys and to cross them entirely.

.6 When frequency inverters are used to control the speed of the motors, the motors must be of the Inverter-Duty type, class F insulation, compliant with NEMA MG1-1993, part 31.

.7 Replace, at no cost to the Owner, all excessively noisy or vibrating motors.

2.2 CHARACTERISTICS

.1 Comply with the following characteristics:

Description	Power (HP)		
	0 to 7½	10 to 15	20 or more
Regular "drip proof" (open engine protected)	Yes	Yes	Yes
Service factor	1.15	1.15	1.15
Possible overheating	90°C	90°C	90°C
Thermistor type thermal protection on each winding			Yes
Multiple groove pulley for V-belt and variable diameter	Yes		
Multiple groove pulley for V-belt and fixed diameter		Yes	Yes
Grease lubricating ball and/or roller bearings		Yes	Yes
Permanently lubricated ball bearings	Yes		

.2 The manufacturer must provide terminals with identified connections. The motor's terminal box must be of an appropriate size and have a double compartment, without knockouts (knockouts will be made on-site by the Division 26).

2.3 SINGLE SPEED MOTORS

.1 Single coil and normal torque motors. Unless otherwise indicated, the motors with six leads for star and triangle connections are prohibited when used with starters other than star-delta.

2.4 MANUFACTURER LIST

.1 Must comply with the article "PRODUCTS USED FOR SUBMISSIONS AND EQUIVALENCES" from section 20 00 10.

.2 List of manufacturers, section 23 05 13:

.1 Motors:

.1 Baldor

.2 Canadian General Electric

.3 Canadian Westinghouse

.4 Leeson

.5 Magnetek
.6 Marathon
.7 Reliance
.8 Tamper
.9 Toshiba

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION

.1 Fix the devices and the components securely into place.

.2 The appliances and the components must be removable for maintenance and they must be easy to put back and fix into place.

3.3 MOTOR START–UP

.1 Before operating the engine for the first time, the Division 26 must:

.1 Ensure the presence of the section that provided the engine.

.2 Check the motor's direction of rotation. If the rotation is wrong, see to the corrections and the new connections on the motor and not in the starter, in order to respect the wiring's colour coding.

.3 Ensure the main shaft's free movement for all pumps with mechanical joints before starting the motor.

.4 Check the overload protection and the overcurrent protection to ensure that they are adequate.

.5 Check the insulation at the "megger".

.6 Measure the voltage of the electric circuit powering the motor.

.7 Check the voltage (volt) and the current (ampere) of each motor at the start-up and normal operation on each phase.

.8 Check the operation of the motor control centers and the switches.

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

.3 The motors' manufacturers must provide the start-up curves of the motor.

END OF SECTION

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Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 20 00 10 – Mechanical and electrical general instructions.

1.2 REFERENCES

.1 American National Standards Institute/American Society of Mechanical Engineers (ANSI/ASME):

- .1 ANSI B16.12-2009(R2014), Cast Iron Threaded Drainage Fittings
- .2 ANSI/ASME B31.1-2014 – Power Piping.
- .3 ANSI/ASME B31.3-2014 – Process Piping.
- .4 ANSI/ASME, Boiler and Pressure Vessel Code 2007:
  - .1 BPVC 2015 – Section V – Non-Destructive Examination.
  - .2 BPVC 2015 – Section IX – Welding and Brazing Qualifications.

.2 American National Standards Institute/American Water Works Association (ANSI/AWWA):

- .1 ANSI/AWWA C206-11 – Field Welding of Steel Water Pipe.

.3 American Welding Society (AWS):

- .1 AWS C1.1M/C1.1-2000(R2012) – Recommended Practices for Resistance Welding.
- .2 AWS Z49.1-2012 – Safety in Welding, Cutting and Allied Process.
- .3 AWS W1-2015 – Welding Inspection Handbook.

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

- .1 CSA W47.2-2011 – Certification of companies for fusion welding of aluminum.
- .2 CSA W48-14 – Filler metals and allied materials for metal arc welding.
- .3 CSA B51-14 - Boiler, pressure vessel, and pressure piping code.
- .4 CSA-W117.2-12 – Safety in welding, cutting, and allied processes.
- .5 CSA W178.1-14 – Certification of welding inspection organizations.
- .6 CSA W178.2-14 – Certification of welding inspectors.

1.3 SUBMITTALS

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

1.4 QUALITY ASSURANCE

.1 Qualifications of the labour:

- .1 Welders:
  - .1 All welders must have the experience and capabilities listed in the standard CSA B51.

.2 Employ qualified welders who have certificates from the relevant authorities for every welding process used.

.3 Submit the qualification certificates of the welders.

.4 Every welder must identify their work with a stamp provided to them by the relevant authority.

.5 Companies performing aluminum fusion welding must be accredited in compliance with the standard CSA W47.2.

.2 Inspectors:

.1 Inspector must have the experience and competencies defined in CSA W117.2.

.3 Certification:

.1 The welding processes must be performed in compliant with CSA B51.

.2 A copy of the description of the welding processes employed must be kept on-site for reference purposes.

.3 Safety rules must be followed for welding, cutting and other related activities compliant with CSA W117.2.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Transport, store and handle hazardous materials in accordance with section 20 00 10 – Mechanical and electrical general instructions.

.2 Deliver the materials on site in their original packaging, which must bear a label indicating the manufacturer's name and address.

Part 2 Product

2.1 GENERAL

.1 Piping NPS 2 or smaller: unless otherwise indicated, threaded fittings (standard threads) with union-fittings at the equipment.

.2 Piping NPS 2½ or larger: unless otherwise indicated, welded joints with flanged fittings at the equipment.

2.2 THREAD

.1 The thread must have a length equal to the threading tool’s thickness and seals coated with a thick layer of paint. The paint can be replaced with Teflon tape if the temperature permits. Perfectly ream all pipe ends.

.2 Fittings with threaded joints, compliant with ANSI B16.12.

2.3 ELECTRODES

.1 Comply with relevant CSA W48 series standards.

2.4 WELDING – GENERAL

.1 All welds must be perfectly smooth and free of lumps, scales, and other imperfections.

.2 The reducers and branches made of cut and welded pipe are not accepted. Only use fittings prepared for welding.

.3 The metal used for welding connections must comply with the standard ASTM-B32 "Solder Metal".

.4 Soldered joint fluxes must comply with the standard ASTM-B813 "Liquid and Paste Flux for Soldering of Copper and Copper Alloy Tube".

.5 Alloys used for brazing must comply with the standard ANSI/AWS A5.5M/A5.5 "Filler Metal for Brazing and Braze Welding" and be BCuP type.

.6 Welding – Copper piping:

.1 "Unleaded solder" means brazing with an alloy composed of antimony, copper, silver and tin (Aquasol).

.2 "95-5 solder" means brazing with 95% tin and 5% antimony.

.3 According to the descriptions of the piping and valves, weld copper piping with unleaded solder, 95-5, or silver solder.

.4 DWV type: 95-5 solder.

.5 K, L, and M types:

.1 NPS 2 and smaller: unleaded solder.

.2 NPS 2½ and larger: silver solder.

.6 Gaskets between flanged valves and copper piping are fitted with welded "wrot" wrought bronze flange couplings, with appropriate gaskets, bolts, washers, and nuts.

.7 Joints between threaded valve ends and copper piping are with copper adapters and welded male and female ends.

.8 High pressure copper pipe joints (1200 kPa or higher) are welded with silver solder, in accordance with ANSI B16.22.

Part 3 Execution

3.1 QUALITY OF THE WORK EXECUTION

.1 Execute the welding work in accordance with the standards ANSI/ASME B31, ANSI/ASME Boiler and Pressure Vessel Code, sections I and IX, and ANSI/AWWA C206, by using methods compliant to the AWS standards B.3 and C1.1 and the relevant requirements of the relevant provincial authorities.

3.2 REQUIREMENTS RELATED TO THE INSTALLATION OF COMPONENTS NECESSARY FOR PIPE WELDING

.1 Each weld must bear the mark of a welder who did it.

.2 Backup rings:

.1 If necessary, adjust the rings so as to minimize the space between themselves and the inner pipe wall.

.2 Do not install rings for orifice flanges.

.3 Fittings:

.1 Fittings NPS 2 and smaller: welded couplings.

.2 Bypass fittings: welded tees or wrought fittings.

3.3 INSPECTIONS AND CONTROLS – GENERAL REQUIREMENTS

.1 Before starting the work, review with the Engineer all requirements relating to the quality of the welds and the acceptable defects indicated in the relevant standards and codes.

.2 Establish an inspection and control plan for approval by the Engineer.

.3 Do not conceal welds until they have been examined, subjected to controls, and approved by an inspector.

.4 Allow the inspector to visually inspect welds at the start of welding work, as required by the Welding Inspection Handbook. If necessary, repair or redo defective welds according to the requirements of the relevant codes and the specification's requirements.

.5 Definitions:

.1 Tests:

.1 Procedures for all visual observations and non-destructive testing, such as:

.1 Radiography.

.2 Ultrasound.

.3 Eddy current.

.4 Penetrating liquid.

.5 Magnetic particle method.

.2 Inspection:

.1 Performance verification of the tests mentioned above.

.2 Note: the welds that do not require testing by the standard B31.1 will be deemed acceptable if they pass the visual inspection and the pressure testing.

.3 Hydrostatic test:

.1 Air vents at high points to remove air during the filling.

.2 Media: water.

.3 All equipment and accessories that cannot withstand the test pressure must be disconnected or isolated.

.4 Test pressure: minimum of 1.5 times the design pressure for a minimum period of two hours, then the test pressure may be reduced to the design pressure and that for the entire period required to inspect the network and detect leaks.

.5 Do not perform any tests with air, unless the piping system is designed not to be filled with water, the pipe system cannot tolerate traces of the test media.

.4 Visual examination:

.1 Visual examination must be performed by a specialized independent laboratory under the responsibility of the Contractor.

.2 The following indications are unacceptable:

.1 Cracks on the outer surface.

.2 Undercut (maximum 0.8 mm).

.3 Reinforcement (maximum 1.6 mm).

.4 Lack of fusion at the surface.

.5 Incomplete penetration (when the inner surface is accessible).

.5 Pressure test:

.1 Boiler external piping:

.1 Hydrostatic test according to ASME section 1 PG-99. These tests must be performed in the presence of an authorized inspector.

.2 Other piping.

.1 Pipes open to the atmosphere do not need to be tested (vent, drain downstream of the last shut-off valve).

.6 Non-destructive test requirements for the welds:

Description	Operating conditions		
Temperature	400°C or lower	401°C or higher	175°C < T < 450°C
Pressure	All	All	P > 7100 kPa
Weld type: Butt weld Circumference – Longitudinal	Visual inspection – Pressure test	RT for NPS 2 or larger. RT or MT for NPS 2 or smaller.	RT for NPS 2 and walls ¾" or larger. Visual for walls ¾" or smaller, for all diameters.
Soldered connection	Visual inspection – Pressure test	RT for NPS 4 or larger MT or PT for 4" in diameter or smaller.	RT pour branches > NPS 4 and walls ¾" or larger. Visual for walls ¾" or smaller, for all diameters.
Fillet welding, socket, tab, sealing solder	Visual inspection – Pressure test	PT or MT for all dimensions and thicknesses.	Visual for all the diameters and the walls.
RT : radiographic testing MT : magnetic particle testing PT : penetrative liquid testing			

3.4 REJECTED WELD REPAIRS

.1 Subject welds that have been repaired or redone to new inspections and controls, and this, at no additional cost.

END OF SECTION

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Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 20 00 10 – Mechanical and electrical general instructions.

1.2 REFERENCES

.1 American Society of Mechanical Engineers (ASME):

.1 ASME B31.1-07 – Power Piping.

.2 ASTM International:

.1 ASTM-A125-1996(2007) – Standard Specification for Steel Springs, Helical, Heat-Treated.

.2 ASTM-A307-07b – Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.

.3 ASTM-A563-07a – Standard Specification for Carbon and Alloy Steel Nuts.

.3 Factory Mutual (FM).

.4 Manufacturer's Standardization Society of the Valves and Fittings Industry (MSS):

.1 MSS SP58-2002 – Pipe Hangers and Supports - Materials, Design and Manufacture.

.2 MSS SP69-2003 – Pipe Hangers and Supports – Selection and Application.

.3 MSS SP89-2003 – Pipe Hangers and Supports – Fabrication and Installation Practices.

.5 Underwriters' Laboratories of Canada (ULC).

1.3 SUBMITTALS

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

.2 Product data:

.1 Submit manufacturer's printed product literature, specifications and data sheet for fixtures and equipment. Data sheets must include product characteristics, performance criteria, dimensions, limits and finish.

.3 Shop drawings:

.1 Submit shop drawings for the following elements:

.1 Supports, bases and suspensions.

.2 Attachments to the devices and to the building structure.

.3 Structural assemblies.

.4 Certificates:

.1 Submit certificates signed by the manufacturer certifying that the products and materials comply with the specified performance and physical requirements.

.5 Manufacturer instructions:

.1 Submit installation instructions provided by manufacturer.

1.4 CLOSEOUT SUBMITTALS

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

1.5 DELIVERY, STORAGE AND HANDLING

.1 Transport, store and handle materials in accordance with section 20 00 10 – Mechanical and electrical general instructions.

.2 Shipping and receiving:

.1 Deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

Part 2 Product

2.1 SYSTEM DESCRIPTION

.1 Design requirements:

.1 The piping support must be executed according to manufacturer's recommendations, by means of common parts, components, and assemblies.

.2 The maximum load ratings must be determined from the indications concerning allowable stresses, contained in the standards ASME B31.1 or MSS SP58.

.3 The supports, the guides, and the anchors must not transmit too much heat to the building’s structural members.

.4 The supports and the hangers must be designed to support the pipes, the air ducts, and the mechanical equipment in operating conditions, allow the contraction and the expansion movements of supported elements, and prevent excessive stress on the pipes and the devices to which these are connected.

.5 The supports and the hangers must be vertically adjustable after their installation and during the commissioning of the installations. The extent of the adjustment must conform to MSS SP58.

2.2 GENERAL

.1 The components covered by this section must be used for support purposes only. They must not be used to lift, raise, or support other components or devices.

.2 Adequately support to the building’s framework all the piping, equipment, and devices. These supports include all steel structures, steel beams, angle irons, steel angles, steel rods, steel plates, supports from specialised manufacturers, and other accessories needed for this work and all drilling and welding work required.

.3 The supports must be adjustable in length.

.4 The supports must have the strength necessary for all trial, testing, and normal operation conditions.

.5 The supports must allow for the normal expansion and contraction of the piping in all trial, testing, and operation conditions, thus avoiding the transmission of undue forces onto the devices and the structure.

.6 The horizontal and vertical piping must be supported in areas where the vertical displacement of the piping is the smallest.

.7 The vertical piping must be independently supported from the connections and the horizontal branches.

.8 The supports must be installed so as to give the required slopes for the pipes.

.9 When the movement of the horizontal pipe between the two positions hot and cold is such that it causes an angle greater than 4° between the support rod and the vertical, install the pipes' supports and its attachments so that the rod is vertical in the hot position of the pipe.

.10 Install the spring supports at uneven distances to prevent resonance effects.

.11 When several horizontal pipes are supported at the same level, build trapezoidal type supports or other types with steel angles, of a welded construction and made with angle iron or I beams, of sizes proportionate to the loads and firmly anchored to the framework with steel rods or anchor bolts, according to the media type. The spacing between the trapezoidal supports must be determined based on the supported pipe with the smallest diameter.

.12 Submit shop drawings of all the types of supports before their manufacturing and installation.

.13 Finish:

.1 The supports and the hangers must be galvanized and coated with a zinc-rich paint after manufacture.

.2 For copper or brass piping, isolate the support with a strip of neoprene or plastic placed between the support and the pipe. Alternatively, tin the portion of the pipe in contact with the support.

.14 Prohibited work:

.1 The use of perforated or non-perforated metal strips or any other type of non-adjustable supports is prohibited.

.2 Using power socket is prohibited.

.3 It is not allowed to support onto precast concrete structures, unless specially permitted by the structural Engineer who will decide what procedure to follow.

.4 No pipe must be used as an attachment point to support another pipe.

2.3 PIPE HANGERS

.1 The rods for the supports suspended from the ceiling are selected as follows:

.1 After the concrete is poured: using a dowel or expansion anchor combining drill and anchor, such as Hilti HDV and Kwick Bolt TZ or approved equivalent. The dowels must not damage the rebars in the concrete.

.2 Beam clamps for beams and other steel works (like Grinnell fig. 292, 94 and 92), appropriately sized for the load.

.2 Hanger rods: threaded, compliant with MSS SP58.

.1 The suspension rods must not be subjected to stresses other than tensile loads.

2.4 ROD DIAMETERS AND SPACING OF MECHANICAL SUPPORTS

.1 Mild steel support rods, of suitable diameter, and provided with threading of sufficient length to permit level adjustment of the pipes. Each rod with washers, two clamping bolts.

.2 Spacing:

.1 The distance between the supports must be within the maximum allowable spacing indicated in the following tables. Also, provide a supports at very direction change.

.1 Copper or brass piping:

Piping nominal diameter	Rod diameter	Maximum horizontal spacing
NPS 1 or smaller	9.5 mm	1.8 m
NPS 1¼	9.5 mm	2.1 m
NPS 1½	9.5 mm	2.4 m
NPS 2	9.5 mm	2.7 m
NPS 2½	12.7 mm	3 m
NPS 3	12.7 mm	3.4 m
NPS 3½	12.7 mm	3.7 m
NPS 4	15.9 mm	3.7 m
NPS 5	15.9 mm	3.7 m
NPS 6	19 mm	4.3 m
NPS 8	22.2 mm	4.9 m
NPS 10	22.2 mm	5.6 m
NPS 12	22.2 mm	5.8 m

2.5 SUPPORTS FOR HORIZONTAL PIPING

.1 Adjustable saddle support: fitted with a bolt with nipple-spacer, a vertical adjustment nut and a locknut, compliant with the standard MSS SP69.

.2 U-bolts: carbon steel, compliant with MSS SP69, with two (2) nuts at each end compliant with the standard ASTM-A563.

.3 Copper or brass piping:

.1 Piping NPS 4 or smaller:

.1 Hangers in contact with the piping, adjustable Clevis type, copper plated, Grinnell fig. CT-65.

.2 In other cases, Grinnell fig. 65.

.4 Cast iron drainage plumbing and vent with mechanical joints:

.1 Hangers painted with minimum (red lead), series no. 6600 (Fonderie Bibby Ste-Croix).

.5 Installation:

.1 Horizontal aboveground piping: depending on the material and diameter, support the horizontal pipe at the following maximum distances:

.1 Steel, copper, or brass: as indicated in paragraph "ROD DIAMETERS AND SPACING OF MECHANICAL SUPPORTS".

.2 Support for a vent above the roof:

.1 When a vent pipe extends above a roof, it must be securely supported and anchored so as to maintain its alignment.

2.6 ANCHOR BOLTS AND TEMPLATE

.1 Provide templates that will help determine the exact location of the anchor bolts.

2.7 MANUFACTURER LIST

.1 Manufacturer list, section 23 05 29.

.1 Supports:

.1 Cantruss

.2 Grinnell

.3 Fonderie Bibby Ste-Croix

.4 Myatt

.2 Bolts and anchors:

.1 Hilti

.2 Phillips Red-Head

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 HANGER INSTALLATION

.1 Install the hangers so that the rods are properly vertical during operating conditions.

.2 Adjust the height of the rods so that the load is evenly distributed among the hangers.

.3 Fix the hangers to the framework. In this regard, supply and install any additional metal framing members necessary if there are no structural supports provided at to mounting points or if the anchoring sleeves are not arranged at the required locations.

3.3 FINAL ADJUSTMENT

.1 Hangers and Supports:

.1 Ensure that in operating conditions, the pipe suspension rods are oriented vertically.

.2 Balance the loads.

.2 Adjustable cradles:

.1 Tighten the vertical adjustment nut to optimize the performance of the cradle.

.2 Tighten the locknut once the adjustment is completed.

.3 C-clamps:

.1 Fix the C-clamps to the bottom flange of the beams in accordance with the manufacturer's recommendations, and tighten to the torque specified by the latter.

.4 Beam fixation:

.1 Using a hammer, firmly secure the clamp to the beam’s lower flange.

END OF SECTION

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Part 1 General

1.1 RELATED SECTIONS

.1 Section 20 00 10 – Mechanical and electrical general instructions.

1.2 REFERENCES

.1 Health Canada/ Workplace Hazardous Materials Information System (WHMIS):

.1 Material Safety Data Sheet (MSDS).

.2 National Fire Protection Association (NFPA):

.1 NFPA-13 – Standard for the Installation of Sprinkler Systems.

.3 National Building Code of Canada (CNB) – 2010.

1.3 SUBMITTALS

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

.2 Submit shop drawings required in accordance with section 20 00 10 – Mechanical and electrical general instructions.

.1 Shop drawings: shop drawings must include the seal and signature of a professional Engineer recognized in Canada.

.2 Submit a distinct shop drawing for each independent system, the complete installation drawings, and the technical and performance documentation.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Packaging, shipping, handling and receiving:

.1 Transport, store and handle materials in accordance with section 20 00 10 – Mechanical and electrical general instructions.

.2 Transport, store and handle materials in accordance with the manufacturer's written instructions.

.2 Waste management and disposal:

.1 Construction/demolition waste management and disposal: separate waste materials for recycling in accordance with section 20 00 10 – Mechanical and electrical general instructions.

1.5 SCOPE OF THE WORK

.1 Work excluded:

.1 In general, the following work is excluded:

.1 The storage of equipment provided by this section (at the expense of the relevant section).

.2 The installation of equipment provided by this section (at the expense of the relevant section).

Part 2 Product

2.1 VIBRATION ISOLATORS

.1 General:

.1 Characteristics:

.1 Types of vibration isolators:

.1 Nested

.2 Fitted with motion limiter

.3 Hangers

.4 Stabilizer

.2 The model selection is the isolator supplier's responsibility. Choose them for lower frequencies that are susceptible of causing problems.

.3 A maximal compression must not damage the spring. Calculate them and select for a compression not exceeding 2/3 of their maximum compression.

.4 They must be able to control the oscillations and the lateral forces from all direction, and be stable for a lateral displacement of 10 to 20% of the spring's height.

.5 The ratio of the horizontal spring constant to the vertical spring constant must be 1.0 ± 10% (k_H/k_V).

.6 The static deflection in mm is equal to the load divided by the isolator's stiffness constant (f = F/K). This deflection must never be less than the one shown in the vibration bases and isolators tables.

.7 When the required deflection is less than 5 mm, anti-vibration pads can be used to replace the steel springs.

.8 When used to support devices containing a large volume of fluid, they must have motion limiters.

.9 In order to control the lateral movement, install stabilizers when required.

.2 Construction:

.1 Protect the spring with a layer of neoprene or PVC based paint.

.2 Housing made of aluminum or plated with zinc chromate.

.3 Cadmium plated screw fasteners, bolts, nuts, and washers.

.4 Leveling device.

.5 Weld the springs to a steel base at the lower end and to a steel compression plate at the top.

.6 Calculate and choose the dimensions of the plate so that the load does not exceed 690 kN/m². Completely cover the base with a sound-absorbing pad made of 50 durometers embossed neoprene, of a 6.4 mm thickness.

.3 Nested isolators with motion limiters:

.1 Comprising one or more helical springs placed inside a casing made of welded steel parts. The lower part of the rigid casing and the top plate serving as mounting surfaces.

.2 Upper and lower parts connected together with locking mechanisms to prevent the device from rising when emptied.

.4 Vibration isolation hangers:

.1 Spring hanger rods comprising of a steel frame, helical spring(s), spring seats, neoprene impregnated fabric washers, and steel washers, all corrosion proof.

.2 The frame must be capable of withstanding a load exceeding the spring's load by 200% without apparent deformation.

.5 Stabilizers:

.1 Construction similar to the vibration isolation hangers.

.2 Installed vertically, horizontally, or at an angle to always be in compression.

.3 See the drawings.

.6 Anti-vibration pads:

.1 Made of 30 or 50 durometer neoprene, embossed, 16 mm thick. Stick a 6.4 mm thick galvanized steel plate on both faces.

.2 Calculate the dimensions of each pad for an optimal load of 275 kN/m² which corresponds to a 5 mm static deflection.

2.2 MANUFACTURER LIST

.1 Comply with article "PRODUCTS USED FOR TENDERS AND EQUIVALENCES" from section 20 00 10 – mechanical and electrical general instructions.

.2 Manufacturer list, section 23 05 48:

.1 Vibration isolators:

.1 Korfund Sampson Ltd

.2 Mason Industries

.3 Vibro-Racan (Racan Carrier)

.4 Vibron Ltd

Part 3 Execution

3.1 LOCATIONS

.1 At locations described in Part 2.

END OF SECTION

TABLE OF CONTENTS

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 20 000 10 – Mechanical and electrical general instructions.

1.2 REFERENCES

.1 Canadian Gas Association (CGA):

.1 CSA/CGA B149.1-05 – Natural gas and propane installation code.

.2 Canadian General Standards Board (CGSB):

.1 CAN/CGSB-1.60-97 – Interior Alkyd Gloss Enamel.

.2 CAN/CGSB-24.3-92 – Identification of Piping Systems.

.3 National Fire Protection Association (NFPA):

.1 NFPA-13-2002 – Standard for the Installation of Sprinkler Systems.

.2 NFPA-14-2003 – Standard for the Installation of Standpipe and Hose Systems.

1.3 SUBMITTALS

.1 Data sheets:

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

.2 Submit data sheets for the products specified in this section, including colour code.

.2 Samples:

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

.2 Submit samples of signage plates, identification plates and the proposed legend.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Packaging, shipping, handling and receiving:

.1 Transport, store and handle materials in accordance with section 20 00 10 – Mechanical and electrical general instructions.

.2 Transport, store and handle materials in accordance with the manufacturer's written instructions.

.2 Waste management and disposal:

.1 Construction/demolition waste management and disposal: separate waste materials for recycling in accordance with section 20 00 10 – Mechanical and electrical general instructions.

.2 Divert unused paints and coating products from landfill to recognized hazardous material facility.

Part 2 Product

2.1 IDENTIFICATION AND REGISTRATION PLATES

.1 The devices must be fitted with identification plates showing the dimensions, the equipment designation, and all the information normally provided: serial number, voltage, serial number, number of cycles, number of phases, motor power in HP, capacity, manufacturer name, etc.

.2 The lettering stamped, printed, or engraved on the plates must be perfectly legible. Do not paint the identification plates. When units are insulated, provide openings in the insulation for these plates to be legible. The plates supplied by the manufacturer must not be modified in any way.

.3 Provide registration plates for the devices under pressure and the approval plates from certification laboratories and the CSA on the equipment provided, in accordance with the different regulations. These plates must be perfectly legible.

.4 Each unit or device, pump, fan, compressor, breaker, contactor, starter, transformer, and other control point must be clearly identified, according to the application or the specification's appellations, by a white ebonite plate with black engraved lettering, firmly fixed on or near the device. These plates are supplied and installed by the section providing the device.

.5 Place the identification plates visibly.

.6 The plates must have the following minimum dimensions: 90 mm x 40 mm x 2.5 mm minimum thickness.

.7 The characters must be 25 mm high on important devices.

.8 Have the list of plates checked before engraving them.

2.2 IDENTIFICATION OF CONTROLS EQUIPMENT

.1 By Division 25.

.2 For valves, see the article "VALVE IDENTIFICATION".

.3 Devices located outside of a local control panel:

.1 Identify the devices with a white ebonite plate and black lettering, glued and screwed to the device or attached to the device such as described in section "VALVE IDENTIFICATION". The numbering must be alphanumeric with 12 mm lettering and must correspond with the numbering from the controls diagrams.

.4 Devices and accessories installed in the panels:

.1 Identify the devices with "P-Touch" adhesive tape, white lettering on black background. The numbering must correspond with the numbering from the controls diagrams.

2.3 IDENTIFICATION OF STARTERS OTHER THAN THOSE PROVIDED BY DIVISION 26

.1 Each mechanical section providing their starters must identify them as described in the article "DIVISION 26 ELECTRICAL EQUIPMENT IDENTIFICATION".

2.4 IDENTIFICATION OF PIPING, DUCTS, AND VENTILATION UNITS

.1 Perform the identification of piping and ventilation ducts after the insulation work is completed.

.2 Each relevant mechanical section must identify the pipes, the ventilation ducts, and the devices that are part of its installation.

.3 Identify all apparent ventilation ducts, insulated or not, in the mechanical rooms.

.4 For identification purposes, the terms "exposed pipes and exposed ventilation ducts" apply to those located in mechanical rooms and those that are visible.

.5 Perform the identification using letters, numbers, and arrows indicating the direction of the flow of liquids, steam, gas, or air.

.6 Print the numbers, letters, and arrows using rubber stamps and black ink.

.7 Characters:

.1 For piping NPS 2 or smaller, including the insulation, letters and numbers are 25 mm x 6 mm, arrows are 25 mm in height by 150 mm in length.

.8 Piping:

.1 On all non-insulated pipes where no base coat is provided, on the insulated pipes with aluminum exterior finish, apply two coats of white paint at the site of identification prior to the identification. This paint should form a perfect rectangle.

.2 As an alternative for uninsulated pipes, the identifying characters must be aluminum coloured if the pipe is black and not rusty. If the pipe is rusty, it must be painted with a coat of rustproof paint and a coat of black paint before proceeding to the identification with aluminum paint.

.3 As an alternative on insulated pipe with an aluminum exterior finish, apply a canvas with fire retardant coating on a surface forming a perfect rectangle, and identify the piping on this surface.

.9 Ventilation ducts:

.1 On the exposed galvanized surfaces of the ventilation units and the ventilation ducts, apply a special primer on a surface forming a perfect rectangle allowing the adhesion of the finishing paint to the galvanized surface. Apply two coats of white paint, then proceed to the identification.

.2 Alternatively, stick a 0.22 kg canvas, 300 mm x 300 mm, with fire retardant adhesive and apply the identification.

.3 On ventilation ducts thermally insulated on the outside, before applying the two coats of white paint at the point of identification, install a rosin-sized paper, a glued 0.17 kg canvas, and a chemical adhesive ready to receive paint.

.10 Approval and identification legend:

.1 Have the numbers, letters, and arrow characters and the stamps approved. Provide lettering specimens before proceeding to the identification work. It is understood that the characters for the numbers, the letters, and the arrows must be the same for all sections and for the entire project.

.2 The identification legend must be in English and French.

.3 Once the legend is established, each section must get approval for the legend of all its identifications before proceeding to its work.

.11 Identification methods:

.1 The identifications are as follows:

.1 Identify the pipe at each shut-off valve so as to clearly identify its contents.

.2 At each identification, draw an arrow pointing in the direction of the flow.

.3 If the flow can be in two directions, draw an arrow with two heads or two parallel arrows with opposite heads.

.4 Every time a pipe or a duct goes through a wall, floor, or ceiling, identify the pipe or duct on each side with arrows.

.5 Identify every riser and tee with arrows.

.6 On a continuous line, identify the pipe and the ducts with arrows every 16 m.

2.5 OPERATION AND MAINTENANCE MANUALS

.1 Each section should include in its operation and maintenance manuals:

.1 The identification legend for the accesses.

.2 The identification legend for the pipes, the ventilation ducts, the ventilation units, and fans must be separate.

.3 The identification legend for the valves.

.4 The identification legend for the devices.

.2 Each relevant mechanical section must provide the identification tables of all valves, including: the valve number, the service, liquid, gas, or steam, the sector, the floor, the diameter, the model, the make, and the number of the valve located upstream.

.3 Each mechanical section should provide a table showing the main valves of each service and for each sector and floor serviced.

.4 The tables mentioned above must be included in the operation and maintenance manuals and be printed in a sufficient number of copies.

.5 All tables mentioned in previous articles must have the same format.

2.6 IDENTIFICATION CODIFICATION

.1 The codification of mechanical and electrical equipment used on drawings and specifications is intended to simplify the work while being compatible with the codes

used by the centralization microprocessors. Therefore, use this coding for the identification of equipment: pipes, ducts, etc.

.2

2.7 IDENTIFICATION ACCORDING TO THE EXISTING SYSTEM

.1 Identify the added or renovated work according to the existing identification system.

.2 When the existing identification system does not cover the identification of the new work installed, they must be identified in accordance with this section's requirements.

.3 Before starting the work, obtain the Engineer's written approval of the identification system.

Part 3 Execution

3.1 IDENTIFICATION PLATES

.1 Location

.1 The plates must clearly identify the devices and/or piping networks and they must be installed in locations where they are highly visible and easy to read from the work floor.

.2 Spacers

.1 On hot and/or heat-insulated surfaces, provide spacers under the identification plates.

.3 Protection

.1 Do not apply paint, insulation, or any covering on the identification plates.

3.2 PLACEMENT OF THE PIPING AND AIR DUCT IDENTIFICATION ELEMENTS

.1 On long piping in the open areas of the boiler rooms, equipment rooms, and service galleries: at intervals not exceeding 16 m, so that at least one is visible from any point of operating areas or walkways.

.2 At changes in direction.

.3 In each small room through which pipes or air ducts pass (at least one element).

.4 On each side of visual obstacles or where it is difficult to follow the path of the networks.

.5 On each side of separations, such as walls, floors, or partitions.

.6 In places where the piping or air ducts are concealed in a shaft, a ceiling space, a sleeve, a service gallery, or any other confined space, at entry and exit points, and near access openings.

.7 At the starting and ending points of each conduit or duct, and near all pieces of equipment.

.8 Immediately upstream of the main automatic or manual control valves, otherwise, as close as possible, preferably upstream.

.9 Such that the identification can be easily read from the normal operating areas and from all easily accessible points.

.1 Perpendicularly to the best line of vision possible, taking into consideration the area where the operating personnel usually are, the lighting conditions, the reduced visibility of the colours or legends caused by the accumulation of dust and dirt, and the risk of damage.

3.3 LOCATION OF THE VALVE IDENTIFICATION ELEMENTS

.1 Attach the labels by means of chains or closed S hooks made of nonferrous metal on the valves, except for those related to medical devices or those connected to heating radiators, and unless they are near and in sight of the equipment to which they are connected.

.2 Install a copy of the block diagram and the list of valves, framed in anti-reflective glass, at a location determined by the Engineer. Also, insert a copy (in reduced size, if necessary) in each of the operation and maintenance manuals.

.3 Number the valves of each network in order.

END OF SECTION

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Part 1 General

1.1 QUALIFICATION OF TAB PERSONNEL

.1 Submit names of personnel to perform TAB to the Engineer within forty-five (45) days of award of contract.

.2 Submit documentation confirming staff's qualifications and experience.

.3 The testing, adjusting, and balancing operations must be performed in accordance with the requirements of standard governing the qualifications of the company and the staff responsible for the work.

.1 Associated Air Balance Council (AABC) – National Standards for Total System Balance, MN-1-2002.

.2 National Environmental Balancing Bureau (NEBB) TABES, Procedural Standards for Testing, Adjusting, Balancing of Environmental Systems-1998.

.3 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA), HVAC TAB, HVAC Systems – Testing, Adjusting and Balancing of 2002.

.4 Recommendations and suggested practices contained in the TAB Standard: mandatory.

.5 Use TAB Standard provisions, including checklists, and report forms to satisfy Contract requirements.

.6 Use TAB Standard for TAB, including qualifications for TAB Firm and Specialist and calibration of TAB instruments.

.7 Where instrument manufacturer calibration recommendations are more stringent than those listed in TAB Standard, use manufacturer's recommendations.

.8 TAB Standard quality assurance provisions such as performance guarantees form part of this contract.

.1 For systems or system components not covered in TAB Standard, use TAB procedures developed by TAB Specialist.

.2 Where new procedures, and requirements, are applicable to Contract requirements have been published or adopted by body responsible for TAB Standard used (AABC, NEBB, or TABB), requirements and recommendations contained in these procedures and requirements are mandatory.

1.2 PURPOSE OF TAB

.1 Test to verify proper and safe operation, determine actual point of performance, evaluate qualitative and quantitative performance of equipment, systems and controls at design, average and low loads using actual or simulated loads.

.2 Adjust and regulate equipment and systems to meet specified performance requirements and to achieve specified interaction with other related systems under normal and emergency loads and operating conditions.

.3 Balance systems and equipment to regulate flow rates to match load requirements over full operating ranges.

1.3 COORDINATION

.1 Schedule time required for TAB (including repairs, re-testing) into project construction and completion schedule to ensure completion before acceptance of project.

.2 Do TAB of each system independently and subsequently, where interlocked with other systems, in unison with those systems.

1.4 START-UP

.1 Notify the Engineer seven (7) days prior to TAB.

Part 2 Product

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 VENTILATION SYSTEMS

.1 General:

.1 Perform tests, measurements and adjustments to:

.1 Demonstrate the ventilation systems are airtight.

.2 Adjust fans to obtain the specified airflows.

.3 Establish quantitative performance of all equipment installed under this section.

.4 Adjust quantity of air to terminal equipment.

.5 Check the adjustment of certain control components.

.2 Check installations for compliance with this section's requirements.

.3 For each system, establish, measure, and adjust the airflow required to meet the specified quantities.

.4 Record and present the results in the form of a report.

.5 Before starting TAB, TAB firm must be approved. The firm must be a certified member of the National Environmental Balancing Bureau Ontario Inc. (NEBB) or the Associated Air Balancing Council (AABC).

.6 Before starting TAB, submit an outline of the proposed procedures required to comply with this article and a list of equipment and instruments to be used.

.7 The selected firm must, for the duration of the installation work, carry out regular site visits and submit a report indicating corrective measures required in order to

adequately proceed with TAB (minimum one visit per month or more often depending on site conditions).

.8 Take corrective actions submitted by the retained specialized firm.

.9 Supply the equipment and work force required for leak tests.

.10 Perform the tests according to the methods recommended by the Associated Air Balance Council and SMACNA (HVAC Air Duct Leakage Test Manual, second edition, 2012).

.11 Once ducts are installed, but before ceilings, walls, and insulation are installed, check the airtightness of all seals and the condition of all ducts.

.12 Hermetically seal each section undergoing a test and temporarily seal all openings. Run the tests, section by section, on each system, according to the convenience of the location and the established procedure.

.2 Leak tests:

.1 Water tests:

.1 Fill every horizontal duct susceptible of receiving water during standard operation with 25 mm of water and spray the inside vertical ducts subject to the same conditions, sufficiently to check the seals.

.2 This test applies to all sealed ducts requested in this specification, such as fresh air intakes and exhaust air outlets and their plenums, chilled water coil drain pans, heat recovery coils, kitchens hood exhaust, and dishwashers.

.3 Provide connections to drains and screwed drain caps at the low points of these ducts.

.2 Medium pressure ducts:

.1 Conduct 1500 Pa static pressure test on the ducts.

.3 High pressure ducts:

.1 Conduct a 2500 Pa static pressure test on the ducts.

.4 Portable test equipment to include, among other things, a radial blade fan, ventilation duct with calibrated orifice and a U-tube manometer.

.5 Follow recommendations of the American Blower Corporation, the Associated Air Balance Council, or SMACNA. The orifice curve must have been calibrated by an independent laboratory.

.3 Adjustment precision:

.1 Do TAB to the following tolerances of the design values:

.1 Airflow adjustment:

.1 At terminal equipment: 10% ±

.2 In main ducts: 5% ±

.2 Differential pressure:

.1 Positive pressure zones:

.1 Supply: 0 to +10%

.2 Exhaust and return: 0 to -10%

.2 Negative pressure zones:

.1 Supply: 0 to -10%

.2 Exhaust and return: 0 to +10%

.4 General procedure:

.1 Equipment and system verification:

.1 Once leak tests are performed and results are satisfactory, proceed with TAB of the equipment and systems as follows:

.1 Start up fans (supply, return, exhaust).

.2 Verify:

.1 Voltage and amperage of motors to avoid overload.

.2 Motor and fan rotation.

.3 Differential pressure switch (DPD) operation.

.4 Position of motorized dampers.

.5 Temperature control of chilled water, hot water or glycol with controls Contractor.

.6 Any obvious air leaks.

.2 Develop a ventilation system diagram which identifies all devices and equipment that will be used for testing, adjusting and/or balancing flow. Also, identify all locations where measurements will be taken to ensure that sufficient connections are provided on the ductwork. Use this identification as a reference in the balancing report. Ensure that there is no short-circuiting in the ductwork system.

.2 Airflow at main branches:

.1 Using a Pitot tube, measure flow rate in the main branches.

.2 If required, adjust fan speed to obtain design airflow.

.3 Check motor power and fan speed to ensure that operation is within critical limits.

.4 Adjust balancing dampers at main branches until design airflow has been reached.

.5 Refer to each type of system described in this section.

.5 Variable airflow systems:

.1 General:

.1 There are two main types of systems with variable airflows:

.1 Systems that depend on pressure (pressure dependent).

.2 Systems that are independent of pressure (pressure independent).

.2 Pressure dependant systems:

.1 This type of system is composed of terminal units modulated by a thermostat signal.

.2 The supply airflow varies to maintain the temperature in the room, the temperature of the supply air remains constant. The airflow in the system and the pressure constantly vary according to the demand.

.3 Pressure independent systems:

.1 Consists of terminal units that use a signal from the thermostat to vary the airflow and on air velocity controller limits the supply air to a set minimum and maximum.

.2 The supply airflow varies to maintain the temperature in the room, the temperature of the supply air remains constant for the same position of the flow control device.

.4 The main difference between the two types of systems is that for the same flow control device position, the pressure dependant system supplies a different quantity of air in the room in function of the pressure variation upstream of the terminal unit. In the case of a pressure-dependent system, if the thermostats are not properly calibrated, some areas might overcool or overheat. When zones are overcooled and receive more air than required, it reduces the quantity of air available to supply the overheated areas. Whereas the pressure independent system is not affected by the poor calibration of the thermostat because the air speed sensor limits the quantity of air supplied to the room.

.2 Adjustment procedure:

.1 Check maximum airflow rates that must be obtained by the supply and return fans. Diversity implies that the airflow of the fans will be less than the total airflow at grilles and diffusers.

.2 Obtain fan curves and surge data.

.3 Obtain characteristics of VFD or any other airflow control device where applicable.

.4 Obtain minimum and maximum operating pressures of terminal units.

.5 Establish theoretical operating curve of the system.

.6 Adjust terminal units in accordance with maximum airflow.

.7 Adjust fans to required speed, plus 5%.

.8 Check the most representative terminal units.

.1 If the variation of static pressure is significant or if the airflow to the terminal units is below the minimum with a maximum system flow rate, check all terminal units.

.9 At main branches, read airflow with a Pitot tube.

.10 If static pressure or flow is too low, increase fan speed.

.1 If flow is satisfactory, but the static pressure is too high, decrease fan speed.

.2 If static pressure is satisfactory or high, but the airflow is too low, check the fan installation for system effect.

.3 If there is no system effect re-adjust all air terminal units to required airflow.

.11 Repeat procedures 3.6.2.7 to 3.6.2.10 for the return and exhaust fans once the system is adjusted to the minimum outside air quality.

.12 Adjust airflows to the diffusers and verify design airflow when air terminal unit is fully open. Check minimum adjustment.

.13 Set terminal units to the minimum and adjust airflow rate control mechanisms at fans to obtain minimum flow and pressure.

.14 Coordinate with the Division 25 for the adjustment of airflow switches, static pressure sensors, terminal unit airflow regulators, etc.

.15 Verify that the return fan speed is adjusted in synchronization with supply fan to ensure that the correct outside airflow is supplied and that static pressure is maintained in the mixing plenum at all operating conditions.

.16 Operate the system at 100% outside air and check power and static pressure for the supply and return fans.

.6 Ventilation TAB report:

.1 For each balanced system, the balancing report shall include, as a minimum, the following information:

.1 Dated reports:

.1 On the report cover page, and on all pages of the report, clearly indicate dates when measurements and adjustments, at all stages (preliminary, corrections, and revisions) were taken.

.2 Design data:

.1 Airflows:

.1 Supply

.2 Return

.3 Exhaust

.2 Fan static pressure.

.3 Motor power (HP).

.4 Brake horsepower (BHP).

.5 Fan speed (rpm).

.6 Minimum percentage of outside air.

.3 Characteristics of installed equipment:

.1 Manufacturer (model and serial no.)

.2 Unit size and dimensions.

.3 Arrangement.

.4 Construction class.

.5 Motor nameplate:

.1 Power

.2 Voltage
.3 Number of phases
.4 Frequency
.5 FLA
.6 Rotation speed

.4 Tests at main:
.1 Fan speed.
.2 Power readings at the motor terminals (voltage and current on each phase).
.3 Differential pressure across each system component (coils, filters, etc.).
.4 Pressures at suction and discharge of the fan.
.5 Measured airflow.
.6 Fan curve indicating the operating point, based on measurements.
.7 Pressures measured with pressure sensors supplied and installed by the Division 25.

.5 Additional information:
.1 Fans:
.1 Dimensions and number of belts.
.2 Dimensions of pulleys.
.3 Position of adjustable pulleys.
.4 Full load motor speed.
.5 Overload protection adjustment.
.6 Filter type, initial pressure loss at full flow, final pressure loss for filter replacement.
.7 Air speed readings at coil faces, where possible.
.8 Airflow control device type.
.2 Air distribution system:
.1 Pressure reading at main branches.
.2 Pressure reading in ceiling spaces.
.3 Pressure difference between building interior and exterior when building is operating at minimum and maximum outside air.
.4 List of Pitot tube tests with their results.
.5 List of airflows measured at each grille and diffuser. Indicate the required airflows.

.7 Acceptable Contractors:

.1 Comply with article "MANUFACTURER LIST" from Section 20 00 10 - Mechanical and electrical general instructions.

.2 Accepted companies:

.1 Montreal region:

.1 Caltech

.2 Hydraulique

.3 Service de Mise au Point Leblanc Inc.

END OF SECTION

TABLE OF CONTENTS

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 20 00 10 – Mechanical and electrical general instructions.

.2 Section 23 31 13.01 – Metal air ducts – Low pressure to 500 Pa.

1.2 REFERENCES

.1 Definitions:

.1 For the purposes of this section, the following definitions apply:

.1 In this section, the term "insulation" and "thermal insulation" will be considered synonymous.

.2 The acronym "CGSB" stands for the Canadian General Standards Board.

.3 "Concealed" elements: insulated mechanical services and equipment located above suspended ceilings or in inaccessible chases and furred-in spaces.

.4 "Exposed" elements: elements that are not concealed (as previously defined).

.5 Insulation system: systems consisting in particular of the insulation itself, the fasteners, jackets and other accessories.

.2 TIAC acronyms:

.1 CRD: Code Round Ductwork.

.2 CRF: Code Rectangular Finish.

.3 References:

.1 American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE):

.1 ANSI/ASHRAE 90.1-04-SI Edition – Energy Standard for Buildings Except Low-Rise Residential Buildings.

.2 ASTM International Inc.:

.1 ASTM-B209M-07 – Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric).

.2 ASTM-C335-05ae1 – Standard Test Method for Steady State Heat Transfer Properties of Pipe Insulation.

.3 ASTM-C411-05 – Standard Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation.

.4 ASTM-C449/C449M-00 – Standard Specification for Mineral Fiber-Hydraulic-Setting Thermal Insulating and Finishing Cement.

.5 ASTM-C547-07e1 – Standard Specification for Mineral Fiber Pipe Insulation.

.6 ASTM-C553-02e1 – Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.

.7 ASTM-C612-04e1 – Standard Specification for Mineral Fiber Block and Board Thermal Insulation.

.8 ASTM-C795-03 – Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel.

.9 ASTM-C921-03a – Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.

.3 Canadian General Standards Board (CGSB):

.1 Preformed mineral fiber insulation: ONGC 51-GP-9M.

.2 Thermal Insulation, Flexible, Elastomeric, Unicellular, Sheet and Pipe Covering: ONGC 51-GP-40.

.3 Mineral fiber flexible blanket: ONGC 51-GP-11M.

.4 Mineral fiber rigid and semi-rigid boards: ONGC 51-GP-10M.

.5 Hydrated calcium silicate insulation: ONGC 51.2-M88 or 51-GP-2M.

.6 Vapor barrier covering: ONGC 51-GP-52Ma.

.7 PVC jacketing: ONGC 51.53-95.

.4 "k" thermal conductivity factors:

.1 ASTM-C-335 for precast or rigid insulation.

.2 ASTM-C-177 or C-518 for the other types.

.5 Green Seal Environmental Standards (GSES):

.1 Standard GS-36-00 – Commercial Adhesives.

.6 South Coast Air Quality Management District (SCAQMD), California State:

.1 SCAQMD Rule 1168-A2005 – Adhesive and Sealant Applications.

.7 Thermal Insulation Association of Canada (TIAC), National Insulation Standards (2005).

.8 Underwriters' Laboratories of Canada (ULC):

.1 CAN/ULC-S102-03 – Method of test for surface burning characteristics of building materials and assemblies.

.2 CAN/ULC-S701-05 – Standard for Thermal Insulation, Polystyrene, Boards and Pipe Covering.

1.3 SUBMITTALS

.1 Submit the documents and samples required in accordance with section 01 00 10 – Mechanical and electrical general instructions.

.2 Data sheets:

.1 Submit required data sheets, including the manufacturer’s documentation for the insulation. Data sheets must include product characteristics, performance criteria, dimensions, limits and finish.

.1 A description of the devices and materials, including the manufacturer name, type, model, year of fabrication, the strength or the flow.

.2 Details relevant to the operation, usage, and maintenance of the devices and materials.

.3 A list of recommend spare parts.

.3 Samples:

.1 Submit a complete set of each type of thermal insulation (system) proposed, including the insulating material itself, the coating material, and the adhesives with VOC (volatile organic compounds) content.

.2 Mount the sample on a 12 mm plywood panel.

.3 Place a typewritten label under the sample indicating the conveyed system/fluid.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Transport, store and handle materials in accordance with section 20 00 10 – Mechanical and electrical general instructions.

.2 Deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Packing waste management: collect packing waste for reuse/recycling in accordance with section 01 00 10 – Mechanical and electrical general instructions.

1.5 MANUFACTURER'S INSTRUCTIONS

.1 Submit the manufacturers' instructions for the installation of the insulating materials.

.2 The instructions must specify the methods to be used, as well as the required execution quality, particularly in regards to the joints and the overlaps.

1.6 QUALIFICATIONS OF THE WORKFORCE

.1 The installer must be an expert in the field, with at least three years of proven and successful experience in the installation of work in this size, type and scope of work, and possess the qualifications required by the TIAC.

Part 2 Product

2.1 FIRE AND SMOKE RATING

.1 To CAN/ULC-S102.

.1 Maximum flame spread rating: 25

.2 Maximum smoke developed rating: 50

2.2 TYPE C INSULATION

.1 Flexible wrap made of mineral fiber bonded with thermosetting resin with vapor barrier and reinforced aluminum, with a density of 36 kg/m³, maximum service temperature of 121°C.

.2 Maximum thermal conductivity "k": 0.042 W/m.°C at 24°C.

2.3 ADHESIVES

.1 Compliant with the standards ASTM-E-84-76 and CAN/ULC-S102.

.2 Use to secure the canvas, the tabs and all-service jackets, seal the joints, and secure the insulation to the metal surfaces.

2.4 JACKETS

.1 Canvas jackets:

.1 Cotton canvas having a density of 220 g/m² and when exposed and 120 g/m² when concealed, coated with a diluted insulating fire retardant adhesive, compliant with the standards ASTM-C921 and ASTM-E84.

2.5 RIGID SUPPORT MATERIAL

.1 Characteristics:

.1 Permeability: 0.00 perm/cm.
.2 Non-combustible.
.3 Compressive strength: 7.0 kg/cm²
.4 Average density: 128 kg/m³
.5 Coefficient of linear thermal expansion: 8.6 x 10^{-8}/°C
.6 Maximum operating temperature: 482°C
.7 Thermal conductivity: 0.48 W/m.°C.
.8 Foamglas from Pittsburg Corning.

2.6 MANUFACTURER LIST

.1 Comply with "MANUFACTURER LIST" from section 20 00 10.

.2 List of manufacturers, section 23 07 13:

.1 Type C thermal insulation:

.1 Johns Manville: Microlite with a FSK vapor barrier.
.2 Knauf: sleeve for air ducts with FSK.
.3 Alley Wrap with FSK.
.4 Owens-Corning Fiberglas: 454°C (850ºF) with GTU.

.2 Adhesives:

.1 To secure canvas: Bakor No. 120-18, Foster No. 120-09, POL-R from Nadeau, Childers no. CP-52 or 81-42W.
.2 For sealing joints, tabs, and multi-purpose jackets, vapor barrier, flame retardant, and colorless adhesive: Bakor No. 230-06, Foster no. 85-15, or Childers no. CP85.
.3 To stick the insulation to the metal surfaces: Bakor No 230-38, Foster No. 85-23, Childers no. CP89, or Mulco no. 89.

.3 Canvas jackets:

.1 Flexpak (Preston Phipps Inc.)
.2 S. Fattal Cotton Inc.

.4 Thermal insulation protection support:

.1 Insulgard (Master Group)
.2 Steel support (Dispro Inc.)

Part 3 Execution

3.1 PREPARATORY WORK

.1 Only install the insulation once the system has been tested and the results have been certified by the responsible authority who has witnessed the test.

.2 Ensure surfaces to be covered with insulation or with a finish coating are clean, dry, and free of foreign matter.

3.2 INSTALLATION METHOD

.1 The insulation work is considered as:

.1 Concealed: pipes and ducts are installed in suspended ceilings, walls, shafts, and floors.

.2 Exposed: exposed pipes and ducts must be insulated on all sides, even on non-visible sides against walls or ceilings.

.3 Ducts and pipes in mechanical rooms, tunnels, and service spaces are considered exposed.

.2 Install insulation once all tests are complete and accepted, and air inside the building is dry enough and in conditions conforming to the manufacturers standards. Install insulation continuously, without interruption.

.3 All equipment, piping, and ducts must be clean and dry before installing the insulation.

.4 Consult the other mechanical sections to determine the type of ducts, piping, fittings, valves, and other accessories installed by other Contractors. The insulation Contractor must consider that Contractors from Divisions 21, 22, and 23 will use the Victaulic type fittings where allowed, and will tender accordingly.

.5 This section is responsible for the proper installation of insulation in the locations specified.

.6 When insulation is likely to be damaged by impact or crushing near the access doors, doors, access panels, corridors, etc., protect with a 1.3 mm galvanized steel sleeve (18 gauge).

.7 Notify applicable sections and properly adjust the supports and saddles to ensure that saddles remain in place.

3.3 APPLICATION

.1 See section "DUCTWORK INSULATION SCHEDULE" for thicknesses.

.2 Hot ducts and plenums (20 at 65°C):

.1 Rigid insulation:

.1 Preparation:

.1 Secure mechanical fasteners to horizontal and vertical surfaces at approximately 300 mm centre to centre in each direction.

.2 Application:

.1 Cut insulation without integral vapor barrier to the right size and apply to exterior of duct and/or plenum with overlapping ends of horizontal and vertical surfaces and edges tightened together. Secure insulation to mechanical fasteners. Install retaining washers.

.2 Flexible insulation:

.1 Preparation:

.1 On the round and rectangular ducts 740 mm or less in width, no preparation is necessary. On rectangular ducts 762 mm or more in width, secure mechanical fasteners to the lower surface at approximately 450 mm centre to centre.

.2 Application:

.1 Cut insulation without integral vapor barrier of a size leaving 50 mm in overlap at each joint and apply it to exterior of duct. Attach the insulation with either string or wire at about 300 mm centre to centre or by stapling the overlaps.

.3 Mixed temperature, cold ducts and plenums (13 at 65°C):

.1 Rigid insulation:

.1 Preparation:

.1 Secure the mechanical fasteners to horizontal and vertical surfaces at approximately 300 mm centre to centre in each direction.

.2 Application:

.1 Cut insulation with integral vapor barrier to the right size and apply to the exterior of duct and/or plenum, with the vapor barrier towards the exterior and its horizontal surfaces overlapping its vertical surfaces. Tighten the edges firmly. Secure the insulation to mechanical fasteners. Install retaining washers.

.2 In places where mechanical fasteners go through the vapor barrier and at each corner and joint, apply adhesive vapor barrier tape or vapor barrier tape applied with vapor barrier adhesive. If there are raised joints, cover them with an overlapping strip or a flexible insulating material with integral vapor barrier to ensure a complete vapor barrier.

.3 Cover all joints and duct reinforcements with an overlapped strip of flexible insulation material with integrated vapor retarder of the same thickness as the thermal insulation used for the duct. Glue this overlapping strip with a vapor barrier adhesive to ensure integral protection.

.2 Flexible insulation:

.1 Preparation:

.1 On round and rectangular ducts 740 mm or less in width, no preparation is necessary. On rectangular ducts 762 mm or more in width, either secure mechanical fasteners to the lower surface at approximately 450 mm centre to centre, or apply 100 mm wide bands of the insulating adhesive at approximately 300 mm centre to centre.

.2 Application:

.1 Cut insulation with integral vapor barrier to the right size and apply to exterior of duct with the vapor barrier on the outside. In places where the mechanical fasteners go through the vapor barrier and at all joints, apply an adhesive vapor barrier tape or vapor barrier tape applied with vapor barrier adhesive. All joints must overlap by at least 50 mm and be stapled at approximately 100 mm centre to centre. Attach insulation with either string or wire at approximately 300 mm centre to centre.

.2 Cover all joints and duct reinforcements with an overlapped strip of flexible insulation material with integrated vapor retarder of the same thickness as the thermal insulation used for the duct. Glue this overlapping strip with a vapor barrier adhesive to ensure integral protection.

.3 Note: PVC jackets and fittings used outdoors or exposed to fluorescent light must be resistant to ultraviolet rays.

.3 Exceptions:

.1 Unless otherwise stated, when an internal duct liner is specified, external insulation is not required.

.2 For external applications of rigid insulation, where mechanical fasteners are not suitable because of a lack of space, it is possible to substitute them for string or wire, insulation adhesive, or other suitable fastening methods.

.4 Finishes:

.1 Indoor:

.1 Rectangular ductwork with rigid insulation:

.1 Install a continuous metal corner bead at all corners. Apply vapor barrier tape on all vapor barrier joints and breaks and on every corner.

.2 Where exposed, install fire retardant canvas jacket over insulation using fabric adhesive and finish with second layer of adhesive coating.

.2 Round ductwork with rigid or flexible insulation:

.1 Apply vapor barrier tape on all joints and breaks.

.2 Where exposed, install fire retardant canvas jacket over insulation using fabric adhesive and finish with second layer of adhesive coating.

.3 Rectangular ductwork with flexible insulation:

.1 Flexible insulation is not acceptable where ductwork is exposed.

3.4 DUCTWORK INSULATION SCHEDULE

.1 General:

.1 Up to the grilles and diffusers:

.1 Insulation: type C

.2 Thickness: 25 mm

.2 On exhaust air ducts, at the outlet of the exhaust fans, extend the insulation two (2) meters upstream of the motorized dampers.

.1 From the fan to exhaust air outlet, including the motorized damper:

.1 Insulation: type C

.2 Thickness: 50 mm

END OF SECTION

TABLE OF CONTENTS

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 20 00 10 – Mechanical and electrical general instructions.

.2 Section 23 05 29 – Hangers and supports for HVAC piping and equipment.

.3 Section 23 33 00 – Air duct accessories.

1.2 REFERENCES

.1 American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE).

.2 ASTM International:

.1 ASTM A480/A480M-12 – Standard Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet and Strip.

.2 ASTM A635/A635M-09b – Standard Specification for Steel, Sheet and Strip, Heavy-Thickness Coils, Hot-Rolled, Alloy, Carbon, Structural, High-Strength Low-Alloy, and High-Strength Low-Alloy with Improved Formability, General Requirements.

.3 ASTM A653/A653M-11 – Standard Specification for Steel Sheet, Zinc Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-Dip Process.

.3 Green Seal Environmental Standards (GS):

.1 GS-36-11 – Standard for Adhesives for Commercial Use.

.4 National Fire Protection Agency Association (NFPA):

.1 NFPA 90A-12 – Standard for the Installation of Air-Conditioning and Ventilating Systems.

.2 NFPA 90B-12 – Standard for the Installation of Warm Air Heating and Air-Conditioning Systems.

.3 NFPA 96-11 – Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations.

.5 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA):

.1 SMACNA HVAC – Duct Construction Standards - Metal and Flexible, 2005.

.2 SMACNA HVAC – Air Duct Leakage Test Manual, 2012.

.3 IAQ – Guideline for Occupied Buildings Under Construction 2007.

.6 South Coast Air Quality Management District (SCAQMD), California State, Regulation XI. Source Specific Standards:

.1 SCAQMD Rule 1168-A2005 – Adhesives and Sealants Applications.

1.3 SUBMITTALS

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

.2 Product data:

.1 Submit manufacturer's printed product literature, specifications and data sheet for fixtures and equipment.

.1 Shop drawings:

.1 Shop drawings must include the seal and signature of a professional Engineer recognized in Canada, in the province of Québec.

.2 Certificates:

.1 Submit certificates signed by the manufacturer certifying that the products and materials comply with the specified performance and physical requirements.

1.4 CLOSEOUT SUBMITTALS

.1 Submit all document/elements required, in accordance with section 20 00 10 – Mechanical and electrical general instructions.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Transport, store and handle hazardous materials in accordance with section 20 00 10 – Mechanical and electrical general instructions.

.2 Shipping and receiving: deliver material to site in the original packaging, which must bear the name and address of the manufacturer.

.3 Waste management and disposal:

.1 Separate waste materials for recycling in accordance with section 20 00 10 – Mechanical and electrical general instructions.

.2 Remove from site and dispose of packaging materials at appropriate recycling facilities.

.3 Collect and separate for disposal paper, plastic, polystyrene and corrugated cardboard packaging material for recycling in accordance with the waste management plan.

.4 Separate steel, metal and plastic materials in designated containers for recycling in accordance with the waste management plan.

.5 Divert unused metal materials from landfill to metal recycling facility.

Part 2 Product

2.1 GENERAL

.1 Unless otherwise specified, manufacture the ducts in galvanized steel.

.2 Round and oval ducts:

.1 For diameters of up to 150 cm, these ducts must be manufactured from helicoidally wound sheet metal with spiral joints, four-ply lockseam (outside wall) for excellent rigidity, operating pressure up to 2500 Pa, as manufactured by Spiro Mega Inc.

.3 For all cases, the faces of each duct section will have the same thickness. The thickness of the sheet and the dimensions of the transverse seals and the reinforcements are determined by the dimensions of the largest side. Visibly mark the caliber of the sheet on the outer face of the duct for inspection purposes.

.4 To ensure the rigidity to the ducts, the sheet will be marked with transverse ribs (stop beads) when manufacturing the pipes. The spacing between the ribs is 300 mm at most. The method of marking two diagonal plies (cross breaking) on all flat surfaces 200 mm and more in width is also acceptable. For either method, the sheet gauge required will be the same.

.5 In the ducts with dimensions having a greater ratio than 4 to 1, install a sheet division in the center of the longest dimension.

.6 For energy saving needs, seal the joints of ducts conveying treated air.

.7 At the locations shown in the drawings, block the ends of the ducts for future connections. Use galvanized steel sheet metal of the same gauge as the duct. These caps must be airtight and withstand the static pressures of the relevant systems.

.8 Ducts exiting service shafts: installed inside the shaft with a collar securely fastened to the duct and to the shaft wall. Seal the joints.

.9 For each of the types of joint described in this section, provide samples and drawings showing the construction details, as well as the materials used.

2.2 LOW PRESSURE DUCTS

.1 Ducts:

.1 For the sheet thickness, the types of joints, and the reinforcements for rectangular, round, and oval ducts, see the details in the drawings.

.2 Connections:

.1 All branch connections must have 45° angle lateral outlets, 150 mm in length.

.2 For any branch connections serving a supply grille placed within 600 mm of the main duct and any other branch connected at right angles without adaptors, install "extractor" type guide blades with adjustment rod and lock screw inside or outside the duct, depending on the ceiling type. The extractor must be able to completely close off the branch. If the air speeds are greater than 365 m/min., it must be manufactured to withstand these speeds.

.3 For the air supply terminal units and the diffusers, when connected by a flexible duct with adjustable damper, as well as for connecting a duct to a plenum, see the details in the drawings.

.3 Joints:

.1 Round ducts:

.1 See details in the drawings.

.2 Rectangular ducts:

.1 All corners of tee joints will be sealed using butyl tape placed over the joint and held in place by the cover flap of the two metal strips. See details in the drawings.

.4 Access doors:

.1 See details on the drawings.

2.3 PROTECTIVE PAINT

.1 When a steel sheet's galvanization is damaged by electric welding or some other act, apply two layers of cold galvanizing compound containing a maximum of 221 g/L of VOCs and leaving a dry film of 92% zinc. This compound will also be applied to protect any metal surface (galvanized steel, carbon steel, cast iron, and aluminum, when required). Similar to the compound ZRC-221, matte gray finish.

.2 Use two coats of paint (such as epoxy-based) for the protection of galvanized steel sheet for certain special systems described in paragraph "Locations" above. Apply these paint layers after degreasing.

2.4 MANUFACTURER LIST

.1 Comply with the article "MANUFACTURER LIST" in section 20 00 10 – Mechanical and electrical general instructions.

.2 List of manufacturers, section 23 31 13.01:

.1 Rigid ducts:

.1 Alcan (aluminum)

.2 Algoma Steel Inc.

.3 Dofasco

.4 Stelco

.2 Sealant (less than 250 g/l of VOCs):

.1 Duro-Dyne (DDS-181)

.2 Hardcast Carlisle (Duct-Seal 321)

.3 Trans-Continental Equipment Ltd (Multipurpose MP)

.3 Tape:

.1 Duro-Dyne (fibre glass weave FT-2)

.2 Trans-Continental Equipment Ltd (Simple Seal and Simple Tape)

.3 Flexmaster (Duct Bond)

.4 Hardcast Carlisle (Foil Grip)

.4 Gaskets:

.1 Hardcast Carlisle (Flange Gasket 1902)

.2 Multifeutre du Quebec Ltd

.3 3M Ltd (LC-105 Gaskets)

.5 Prefabricated round and oval ducts:
- .1 J.P. Lessard
- .2 Les Industries Mégatube Canada Inc.
- .3 Spiro Méga Inc.
- .4 Spiro Métal Inc.

.6 Flexible ducts:
- .1 Boflex Inc. (types AS and AI)
- .2 Trans-Continental Equipment Ltd (AI-U-Flex)
- .3 Flexmaster Co. Ltd (Triple Lock)

.7 Resilient sealant:
- .1 Minnesota Mining Mfg. from Canada (3M)
- .2 Tremco

.8 Protective paint:
- .1 Sico (Corostop, Crown Diamond)
- .2 ZRC Products Co. (Kerry Industries Ltd)

.9 Bolts and anchors:
- .1 Hilti
- .2 Phillips Red-Head
- .3 Ucan

.10 Seismic restraint systems:
- .1 Racan-Carrier (Vibro)
- .2 Mason Industries Inc.
- .3 Unistrut (Routle Co. Inc.)

Part 3 Execution

3.1 SUPPORTS AND ANCHORS

.1 General:
- .1 Comply with Section 23 05 29 – Hangers and supports for HVAC piping and equipment, and with the tables included in the drawings.
- .2 Adequately support all ducts, equipment, and devices to the structure. These supports include the entire steel structure, the steel beams, the structural irons, the angle irons, the steel rods, the steel plates, the supports from specialized manufacturers and other accessories necessary for the work, and all drilling, anchoring, and welding work required.
- .3 Prior to the manufacturing and the installation, provide shop drawings of all types of supports.

.2 Support rods:

.1 Mild steel rods, diameter according to the table on drawings.

.3 Horizontal ducts:

.1 General:

.1 Securely support the ducts to the structural frame by means of rods and angles.

.2 Firmly affix the steel rods used to secure the supports to the concrete slabs or the steel frame.

.3 Coat all support elements with a layer of aluminium-based paint.

.4 Install additional hangers at every bend, every change of direction, the connections fittings, and any additional steel required to support the pipes in the shafts.

.2 Round ducts:

.1 Construct the supports out of 25 mm wide steel rings with tightening screws and a 6.4 mm steel rods. Before installation, apply a layer of aluminum based paint to all the rings and rods.

.2 Use the external reinforcements as attachment point for the oval ducts having a major axis larger than 580 mm.

.3 For oval ducts without reinforcement, install the supports starting as close as possible to a joint. Construct the supports from a continuous metal strip.

3.2 ELBOWS

.1 Rectangular ducts:

.1 Wherever pipes change direction with an average radius smaller than 1.5 times the dimension of the pipe, install directional vents arranged proportionately to ensure a pressure loss that is not greater than that caused by a change in direction respecting the ratio R/D = 1.5. For square elbows, install double-walled vents, with low-loss blades. Submit manufacturing details, performance details, and samples.

.2 Round ducts:

.1 Construct elbows with a radius of curvature (measured from the center of the pipe) equal to at least 1.5 times the diameter of the duct. Construct them in five sections or more for 280 mm or larger diameters and three sections for 250 mm and smaller.

3.3 SECTION CHANGE

.1 The section changes must have a maximum angle of 15°.

.2 Install ducts as straight as possible.

.3 When there is an obstruction caused by piping and it is impossible to relocate the conduit or the pipe, install a contoured envelope around the pipe passing through the ventilation duct. Install an access door for visual inspection.

.4 If the obstruction is greater than 10% of the duct's section, proportionally increase the dimensions of the duct in order to maintain the effective area.

.5 For circular ducts, use prefabricated transformer sections in medium and high-pressure systems, to allow maximum static regain.

3.4 LEAK TIGHTNESS OF THE JOINTS BETWEEN PIPES, DUCTS, ETC.

.1 Make watertight and airtight the joints between the ventilation ducts and the pipes passing through these ducts, as well as the openings required for all control devices, humidifiers, and electrical conduits going through the ducts.

3.5 LEAK TIGHTNESS OF OPENINGS

.1 Perform the sealing work for the openings required through the slabs and the walls for the passage of ducts and pipes supplying the diffusers or others. See the article "SEALING SLEEVES AND OPENINGS" from section 23 05 05.

3.6 ACCESS AND INSPECTION DOORS

.1 Provide access doors at the locations indicated on the drawings and where required.

.2 Provide inspection doors of 450 mm x 450 mm or of equivalent dimensions, depending on the dimensions of the duct (unless otherwise indicated), close to each motorized or manual damper, control instrument, fire damper, combustion product analyzer, humidifier, intake or exhaust motor, upstream and downstream of each coil and other equipment.

.3 Place the doors for easy access.

.4 Reinforce the opening and align the doors. Seal the doors using a permanently installed flexible rubber seal (foam rubber not accepted).

.5 In insulated walls construct doors out of a double panel with mineral fibre filler between the two panels of a thickness equivalent to the wall insulation.

3.7 GROUNDING

.1 Ensure the complete grounding of all ventilation systems, units, ducts, etc., by a braid-shaped conductor made of stranded tinned copper and end each extremity with flat fixing rings electrically connecting the ducts and the units on each side of the jacketing joints. Conductors similar to the cables manufactured by Continental Cordage Corporation (Anixter Canada Inc.).

END OF SECTION

TABLE OF CONTENTS

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 20 00 10 – Mechanical and electrical general requirements.

.2 Section 23 31 13.01 – Metal ducts – Low pressure to 500 Pa.

1.2 REFERENCES

.1 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA):

.1 SMACNA – HVAC Duct Construction Standards – Metal and Flexible, 2005.

1.3 SUBMITTALS

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

.2 Product data:

.1 Submit manufacturer's printed product literature, specifications and data sheet for fixtures and equipment.

.3 Certificates:

.1 Submit certificates signed by the manufacturer certifying that the products and materials comply with the specified performance and physical requirements.

1.4 CLOSEOUT SUBMITTALS

.1 Submit all document/elements required, in accordance with section 20 00 10 – Mechanical and electrical general instructions.

.2 Operation and maintenance data (O&M): provide instructions with respect to the operation and maintenance, to be incorporated into the O&M manual.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Transport, store and handle hazardous materials in accordance with section 20 00 10 – Mechanical and electrical general instructions.

.2 Shipping and receiving: deliver material to site in the original packaging, which must bear the name and address of the manufacturer.

.3 Waste management and disposal:

.1 Separate waste materials for recycling in accordance with section 20 00 10 – Mechanical and electrical general instructions.

.2 Remove from site and dispose of packaging materials at appropriate recycling facilities.

.3 Collect and separate for disposal paper, plastic, polystyrene and corrugated cardboard packaging material for recycling in accordance with the waste management plan.

.4 Separate steel, metal and plastic materials in designated containers for recycling in accordance with the waste management plan.

.5 Divert unused metal materials from landfill to metal recycling facility.

Part 2 Product

2.1 GENERAL

.1 The accessories must be manufactured according to the SMACNA HVAC Duct Construction Standard.

2.2 LOCAL EXTRACTOR ARM

.1 Local extractor arm, such as Fumex model MEV 1500-75, distributed by Aireau.

.2 Three (3) articulations.

.3 Flow of 33 L/s

.4 Wall mounted, MVK wall attachment console, delivered with arm.

.5 Coordinate the exact location desired with users on site prior to installation.

.6 Flat hood-type tip, designed to maximize the work area without interfering with the user's field of view (no. MEPH-300-75).

2.3 OPENINGS FOR AIR VELOCITY AND AIR TEMPERATURE READINGS

.1 On the insulated ducts, provide openings for instrument ports, with neoprene handles and caps held by chains, for air velocity readings. Install the accesses downstream from a long straight duct with constant section, Duro-Dyne no. IP-1 or IP-2.

.2 On the ducts without insulation and at low velocity, we can use the model IP-4 with screw cap, Duro-Dyne no. IP-4.

.3 Coordination:

.1 To avoid any misunderstanding or error, the location of the openings should be carefully coordinated with the firm responsible for balancing the systems.

2.4 ADJUSTABLE VOLUME EXTRACTORS

.1 Locations:

.1 Install an adjustable extractor at each branch connected at a right angle without adaptor on the main ducts to allow proportional control of the flow in the ducts. See also section 23 31 13.01 – Metal Ducts – Low Pressure to 500 Pa. The extractor must be able to completely close off the branch. Where necessary, the extractor must be manufactured to withstand air velocities greater than 365 m/min.

.2 Construction:

.1 E.H. Price Ltd. no. AE-2 Extractor with adjustment lever.

2.5 MANUFACTURER LIST

.1 Comply with article "PRODUCTS USED FOR TENDERS AND EQUIVALENCES" from section 20 00 10.

.2 List of manufacturers, section 23 33 00:

.1 Openings for air velocity and air temperature readings:

.1 Duro-Dyne

.2 Lawson Taylor Ltd

Part 3 Execution

3.1 NOT USED

END OF SECTION

TABLE OF CONTENTS

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 20 00 10 – Mechanical and electrical general instructions.

.2 Section 23 07 13 – Duct insulation.

1.2 REFERENCES

.1 ASTM International:

.1 ASTM A653/A653M-11 – Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by Hot-Dip Process.

1.3 SUBMITTALS

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

.2 Product data:

.1 Submit manufacturer's printed product literature, specifications and data sheet for fixtures and equipment.

.3 Certificates:

.1 Submit certificates signed by the manufacturer certifying that the products and materials comply with the specified performance and physical requirements.

1.4 CLOSEOUT SUBMITTALS

.1 Submit all document/elements required, in accordance with section 20 00 10 – Mechanical and electrical general instructions.

.2 Operation and maintenance data (O&M): provide instructions with respect to the operation and maintenance, to be incorporated into the O&M manual.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Transport, store and handle hazardous materials in accordance with section 20 00 10 – Mechanical and electrical general instructions.

.2 Shipping and receiving: deliver material to site in the original packaging, which must bear the name and address of the manufacturer.

Part 2 Product

2.1 CONTROL DAMPERS

.1 General:

.1 Provide shop drawings and a sample of each type.

.2 Single-blade dampers (rectangular or butterfly type):

.1 In ducts 300 mm or smaller, a single-blade damper constructed of galvanized steel, 1.006 mm thick (20 gauge), pivot pin of 9.525 mm in diameter, with three lock seams.

.3 Multi-blade balancing dampers:

.1 In ducts 330 mm and larger, use multi-blade dampers, with opposed blade action, galvanized steel construction, 1.613 mm (16 gauge) or larger, oil lubricated bronze bearings, maximum blade length of 1220 mm, blade width of 150 mm minimum, 200 mm maximum.

.2 For most dampers more than 1220 mm in length, construct the dampers of two or more sections of blades with mullions between them and attachment rod interconnections.

.3 Using a mechanism, connect the blades to each other so that they work in unison. Secure the connecting rods to the axles.

.4 Flow diverter dampers:

.1 Construction:

.1 Of the same material and thickness as the ducts in which they are installed (minimum of 0.853 mm, 22 gauge), profiled shape, length at least 1.5 times the width of the smallest branch serviced. Securely fastened with hinges along the oval edge. Mechanism accessible from outside the duct to adjust the damper's position and to anchor it firmly in its permanent position.

.2 Locations:

.1 Install this type of damper to distribute the airflow from a main duct in each branch in the required volumes.

.5 Adjustable and balancing dampers (VMA):

.1 Single-blade or multi-blades with opposed blade action, constructed according to the description of the multi-blade dampers.

.2 Adjustment regulators:

.1 Actuated by manual regulators with minimum leakage, neoprene gasket, indicator handle, locking handle and washer, and cap at the other end of the shaft.

.1 Such as SRS-388 from Duro-Dyne.

.2 On the insulation covered ducts, use of SRST series assembly depending on the thickness of the insulation.

.3 Install where indicated on the drawings and at locations required for the airflow calibration. Coordinate with the company hired to balance the systems.

.6 Motorized dampers – General:

.1 Single-blade or multi-blade.

.2 Frame made of extruded aluminum, 101.6 mm deep x 2.03 mm thick, stainless steel 316 cap screw.

.3 Pivoting rods of each of blade on oil impregnated Celcon or bronze bearings, all permanently lubricated.

.4 Connecting rods, cranks, and motor controls supplied and installed by the Division 25, unless otherwise specified.

.5 102 mm x 25 mm x 2.03 mm frame, aluminum profiles, alloy no. 6063T5. Every corner reinforced for maximum rigidity.

.6 Blades constructed of aluminum profiles, a maximum width of 204 mm, with structural ribs continuous over the entire length of each blade.

.7 Formed silicone or EPDM blade seals.

.8 Square or hexagonal shaft, 13 mm.

.9 Blade rotation: opposed action.

.10 Linkage outside the airflow, zinc-coated aluminum and steel.

.11 Multiple sections: the damper section surfaces must not exceed 0.64 m², 2.2 m², or 4.6 m², depending on the actuator's power. Coordinate with the Division 25. **Exception**: for leak-proof dampers (VME), the area of each section must not exceed 1.86 m².

.12 A set of multi-section dampers must be activated by an intermediate jack shaft. The connecting rods will be connected to the shaft by means of a device secured to it to prevent slippage. The jack shaft must be manufactured from a solid rod, and not with a hollow tube.

.13 Similar to the 1000 series damper from Tamco.

.7 Regular motorized dampers (MD):

.1 See the article "MOTORISED DAMPERS – GENERAL".

.8 Special leak-proof motorized dampers (VME and VMED):

.1 See the article "MOTORISED DAMPERS – GENERAL".

.2 VME dampers:

.1 The blades are made of extruded aluminum, insulated with polyurethane foam and thermal barriers. The blades and the hexagonal rods are made of aluminum.

.2 On the frame, a silicone seal similar to that on the edges of the blades (or stainless steel tabs), ensuring a better seal at the closure of the blades.

.3 Bearings are to be composed of a Celcon type inner bearing fixed to an 11.11 mm hexagonal aluminum rod, which rotates in a polycarbonate outer bearing to eliminate any metal on metal or metal on plastic friction. All aluminum parts part of the linkage will be clear anodized. All steel parts of the linkage will be replaced by 316 stainless steel.

.4 The frame will be profiled aluminum, with double thermal break, with rigid insulation installed on the periphery (four sides) of the frame.

.5 The sealing factor per 0.1 m² of the 750 mm x 750 mm opposed blades will be 0.125 L/s, for a static pressure of 1000 Pa.

.6 The leak tests will be certified by an independent laboratory and conducted according to the AMCA standard 500.

.7 Similar to Tamco 9000 Series.

2.2 MANUFACTURER LIST

.1 Comply with the article "MANUFACTURER LIST" in section 20 00 10 – Mechanical and electrical general instructions.

.2 List of manufacturers, 23 33 15:

.1 Control dampers:

.1 Alumavent
.2 American Warming & Ventilating
.3 Nailor Industries Inc.
.4 Tamco
.5 Trolec Inc.

Part 3 Execution

3.1 INSTALLATION

.1 Install the dampers where indicated.

.2 Install the dampers according to the SMACNA recommendations and the manufacturer's instructions.

.3 Seal the multi-damper module joints with a silicone sealant.

.4 Install an access door near each damper. Refer to section 23 33 00 – Air duct accessories.

.5 Ensure that the dampers are visible and accessible.

3.2 DAMPERS

.1 General:

.1 Determine the exact dimensions on-site, according to the dimensions of the ducts.

.2 Install them where indicated on the drawings and where required.

.3 Install dampers square and plumb to ensure easy operation, free from vibration and clatter, the whole installation of a very solid construction.

.2 Rigidity and airtightness of backdraft or motorized dampers:

.1 On the perimeter of the damper, between the damper’s frame and the ventilation duct, and between the frames of the modular dampers, supply and install a galvanized steel corner with stainless steel bolts. Seal the whole assembly with an elastomeric sealant.

END OF SECTION

TABLE OF CONTENTS

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 20 00 10 – Mechanical and electrical general instructions.

1.2 REFERENCES

.1 American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE).

.2 National Fire Protection Association (NFPA):

.1 NFPA-90A-12 – Standard for the Installation of Air-Conditioning and Ventilating Systems.

.2 NFPA-90B-12 – Standard for Installation of Warm Air Heating and Air-Conditioning Systems.

.3 Sheet Metal and Air-Conditioning Contractors' National Association (SMACNA):

.1 SMACNA HVAC – Duct Construction Standards - Metal and Flexible, 2005.

.2 SMACNA IAQ – Guideline for Occupied Buildings under Construction, 2005.

.4 Underwriters' Laboratories (UL):

.1 UL 181-2005 – Standard for Factory-Made Air Ducts and Air Connectors.

.5 Underwriters’ Laboratories of Canada (ULC):

.1 CAN/ULC-S110-2007 – Standard Methods of Test for Air Ducts.

1.3 SUBMITTALS

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

.2 Product data:

.1 Submit manufacturer's printed product literature, specifications and data sheet for fixtures and equipment.

.3 Certificates:

.1 Submit certificates signed by the manufacturer certifying that the products and materials comply with the specified performance and physical requirements.

1.4 CLOSEOUT SUBMITTALS

.1 Submit all document/elements required, in accordance with section 20 00 10 – Mechanical and electrical general instructions.

.2 Operation and maintenance data (O&M): provide instructions with respect to the operation and maintenance, to be incorporated into the O&M manual.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Transport, store and handle hazardous materials in accordance with 20 00 10 – Mechanical and electrical general instructions.

.2 Shipping and receiving: deliver material to site in the original packaging, which must bear the name and address of the manufacturer.

Part 2 Product

2.1 FLEXIBLE DUCTS

.1 General:

.1 Flexible ducts according to the standards NFPA-90A, NFPA-90B, and ULC.

.2 The pressure loss coefficients listed below are based on a reference coefficient of 1.00 established for metal ducts.

.3 The flame spread index must not exceed 25 and the smoke development index must not exceed 50.

.4 Submit a sample of each type.

.5 When required, use the proper tool to give the end of the flexible duct an oblong shape.

.6 Install a maximum length of 1500 mm.

.2 Low, medium, and high pressure:

.1 Aluminum, single ply, 0.15 mm thick, with mechanical joints, minimum radius of curvature at the center of the duct equal to the diameter of the conduit, minimum operating pressure of 3000 Pa, minimum collapsing pressure of 365 N/linear meter and puncture resistance with 3.175 mm diameter ball, 187 N.

.2 If insulation is required:

.1 In factory covering, 25 mm minimum thickness, fiberglass, density of 12 kg/m^3, with integrated vinyl or PVC envelope having a resistance of 0.2 perm. This envelope must be protected by a sleeve made of galvanized sheet metal with a thickness of 0.551 mm (26 gauge), whenever a flexible duct passes through a wall. The sleeve must extend 100 mm past each side of the wall.

.3 Include fireproof wrapping where required, in accordance with the requirements of the local authorities.

.3 Joints between rigid and flexible ducts:

.1 Attach the flexible ducts to the rigid ducts, air supply terminal units, and diffusers using metal screws or metal clamping bands, make airtight with a sealant, and cover everything with tape. The sealant must have a VOC content below 250 g/L.

2.2 MANUFACTURER LIST

.1 Comply with the article "MANUFACTURER LIST" in section 20 00 10 – Mechanical and electrical general instructions.

.2 List of manufactures, section 23 33 46:

.1 Sealant (less than 250 gr/l of VOCs):

.1 Duro-Dyne (DDS-181)

.2 Hardcast Carlisle (Duct-Seal 321)

.3 Trans Continental Equipment Ltd (Multipurpose MP)

.2 Tape:

.1 Duro-Dyne (fiberglass FT-2)

.2 Trans Continental Equipment Ltd (Simple Seal and Simple Tape)

.3 Flexmaster (Duct Bond)

.4 Hardcast Carlisle (Foil Grip)

.3 Gaskets:

.1 Hardcast Carlisle (Flange Gasket 1902)

.2 Multifeutre du Quebec Ltd

.3 3M Ltd (LC-105 Gaskets)

.4 Flexible ducts:

.1 Boflex Inc. (types AS and AI)

.2 Trans Continental Equipment Ltd (AI-U-Flex)

.3 Flexmaster Co. Ltd (Triple Lock)

.5 Protective paint:

.1 Sico (Corostop, Crown Diamond)

.2 ZRC Products Co. (Kerry Industries Ltd)

Part 3 Execution

3.1 INSPECTION

.1 Conditions verification: prior to proceeding to the installation of flexible air ducts, ensure that the state of the surfaces/supports previously implemented under the constraints of other sections or contracts is acceptable and permits the execution of the work in accordance with manufacturer's written instructions.

.2 Make a visual inspection of surfaces/supports in the presence of the Engineer.

3.2 FLEXIBLE DUCT INSTALLATION

.1 Install flexible air ducts in accordance with CAN/ULC-S110, NFPA-90A and NFPA-90B.

END OF SECTION

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Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 20 00 10 – Mechanical and electrical general instructions.

.2 Section 23 05 13 – Common motor requirements for HVAC equipment.

1.2 REFERENCES

.1 American National Standards Institute/Air Movement and Control Association (ANSI/AMCA):

.1 ANSI/AMCA – Standard 99-2010, Standards Handbook.

.2 ANSI/AMCA – Standard 210-2007/(ANSI/ASHRAE 51-07), Laboratory Methods of Testing Fans for Aerodynamic Performance Rating.

.3 ANSI/AMCA – Standard 300-2008, Reverberant Room Method for Sound Testing of Fans.

.4 ANSI/AMCA – Standard 301-1990, Methods for Calculating Fan Sound Ratings from Laboratory Test Data.

.2 The Master Painters Institute (MPI):

.1 Architectural Painting Specification Manual – latest edition.

.1 MPI no. 18 – Primer, Zinc Rich, Organic.

1.3 SUBMITTALS

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

.2 Product data:

.1 Submit manufacturer's printed product literature, specifications and data sheet for fixtures and equipment.

.3 Certificates:

.1 Submit certificates signed by the manufacturer certifying that the products and materials comply with the specified performance and physical requirements.

1.4 CLOSEOUT SUBMITTALS

.1 Submit all document/elements required, in accordance with section 20 00 10 – Mechanical and electrical general instructions.

.2 Operation and maintenance data (O&M): provide instructions with respect to the operation and maintenance, to be incorporated into the O&M manual.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Transport, store and handle hazardous materials in accordance with section 20 00 10 – Mechanical and electrical general instructions.

.2 Shipping and receiving: deliver material to site in the original packaging, which must bear the name and address of the manufacturer.

.3 Waste management and disposal:

.1 Separate waste materials for recycling in accordance with section 20 00 10 – Mechanical and electrical general instructions.

.2 Remove from site and dispose of packaging materials at appropriate recycling facilities.

.3 Collect and separate for disposal paper, plastic, polystyrene and corrugated cardboard packaging material for recycling in accordance with the waste management plan.

.4 Separate steel, metal and plastic materials in designated containers for recycling in accordance with the waste management plan.

.5 Divert unused metal materials from landfill to metal recycling facility.

Part 2 Product

2.1 GENERAL

.1 For specifications, see the fan tables.

.2 The construction of the fans, the diameter of the shaft, the base dimensions, the angle irons, the gauge of the sheet metal, etc., must meet the requirements of the Air Moving & Conditioning Association (AMCA).

.3 Self-aligning precision ball bearings, submerged in the grease reservoir of a pillow block bearing, securely supported. Resistant to the suction of the lubricant by the air located in the air intake. Install them at the ends of the shaft even if there are several wheels on the same shaft in order to be able to easily replace them without removing the drive shaft. Designed for heavy duty service and must have an average life of 200,000 h at maximum rotational speed of the fan class, according to ANSI L-50 from AFMBA.

.4 Statically and dynamically balance the wheels of all fans. Particular attention should be paid to balancing the variable speed fans.

.5 Paint the fans with a coat of primer.

.6 For each fan:

.1 Provide the performance curves certified by the manufacturer for the specified operating conditions.

.2 Provide a curve indicating the air flow variations, in function of the air flow control system.

.3 Provide shop drawings including a description of the operating conditions.

.4 Provide the noise data, in accordance with the standard AMCA 300.

.7 If the fans installed are not compliant with the requirements, submit them to tests, in accordance with the AMCA requirements, and if necessary, replace them. The replacement, if necessary, will be considered part of this section's work, at no additional charge.

.8 See section 23 05 13 – Common motor requirements for HVAC equipment and section 23 07 14 – Thermal insulation for equipment.

2.2 CENTRIFUGAL FANS

.1 Cold-rolled steel housing, reinforced to eliminate all vibration, can be disassembled into two or more parts when the fan wheel is larger than 1016 mm in diameter, flanges suitable for connecting and fastening the ducts, air inlets with profiled cones.

.2 Steel wheel with airfoil blades curved backwards or forwards, as indicated. Provide an identification plate indicating the diameter and the width of the wheel.

.3 For drive force and base, see section 23 05 13 – Common motor requirements for HVAC equipment. Mount the motors on the adjustment rails permitting movement in both directions. Install the rails on a common metal base for the fan and the motor. When installed on the centrifugal fan, support the motor with the aid of a reinforced housing part of the fan.

2.3 ROOF FANS AND VENTS

.1 Centrifugal type with the general characteristics mentioned in the article "CENTRIFUGAL FANS" and backward curved blades.

.2 Aluminum housing with aluminum cap, aluminum bird screen, backdraft damper, fuseless switch, latch for quick access to the motor compartment.

.3 Direct or belt drive, ball bearings, permanently lubricated.

.4 For motor force and base, see Section 23 05 13 – Common motor requirements for HVAC equipment. Install motor, shaft, bearings, and fan wheel on a support plate and reinforce it to eliminate all vibration. Mount the fans on rubber dampers.

.5 Provide and install with wall-mounted adapter.

2.4 COUPLINGS

.1 Direct:

.1 General:

.1 Fan wheel with width and diameter adjusted when required to meet specified characteristics.

.2 When the fan speed listed in the tables is less than the speed of the motor, this means that the fan can operate at a higher air flow rate and static pressure when the latter is at the speed of the motor.

.2 The fan's maximum characteristics can be determined as follows:

$$\mathrm{cfm}_{\max} = \left[\frac{\mathrm{rpm}_{\mathrm{mot}}}{\mathrm{rpm}_{\mathrm{vent}}}\right] \times \mathrm{cfm}_{\mathrm{vent}} \qquad \mathrm{PS}_{\max} = \left[\frac{\mathrm{rpm}_{\mathrm{mot}}}{\mathrm{rpm}_{\mathrm{vent}}}\right]^2 \times \mathrm{PS}_{\mathrm{vent}}$$

.1 Fan power at maximum characteristics must not exceed motor's power.

.2 The maximum speed of the fan class must be at least 10% above the motor's rated speed.

.3 Provide with the shop drawings, the operating characteristics and the performance curves for specified and maximum conditions.

.3 Directly to the motor:

.1 Aluminum wheel with steel hub, TEFC motor type with cast iron housing.

.4 Direct with flexible fittings:

.1 Coupling type with cord or rough flexible membrane. Do not use the type of couplings with dowel pins or rubber sleeves.

.2 With belts:

.1 Unless otherwise indicated, connect the fans to the motors with V-belts, with a minimum force of 150% of the motor's starting torque. Pay special attention to the type of motor connected.

.2 Multigroove V-belt pulleys. Fan pulley with fixed diameter. For motors of 7.5 kW (10 HP) or more, fixed diameter drive pulley. In these cases, provide an additional set of pulleys for the adjustment of each system.

.3 The variable diameter pulleys must allow a variation of 10% more or less than the rated speed.

.4 Statically and dynamically balance all pulleys. Use at least two belts to drive units having motors exceeding 0.38 kW (½ HP) or for units having fan wheels with a diameter of 406 mm or larger.

.5 Use adjustable engine supports so as to maintain a proper tension in the belts.

2.5 LUBRICATORS

.1 For motors and fans with ball bearings, fit the equipment with pressure lubricators. Choose lubricators of the same type and from the same manufacturer.

.2 For bearings located within a plenum, a duct, or poorly accessible areas, extend the grease cups outside the plenum or the duct, drive side, by means of copper tubes with seals and grease fitting (Zerk fitting).

2.6 MANUFACTURER LIST

.1 Comply with article "PRODUCTS USED FOR TENDERS AND EQUIVALENCES" from section 20 00 10.

.2 List of manufacturers, section 23 34 00:

.1 Roof fans and vents:

.1 Acme
.2 Carnes
.3 Cook
.4 Greenheck
.5 Penn
.6 Twin City

.2 Bearings:

.1 Link Belts
.2 Seal Master

.3 SKF

Part 3 Execution

3.1 GENERAL

.1 Install the fans as shown in the drawings.

3.2 OIL AND GREASE

.1 For each device requiring oiling or greasing, provide and attach to the device a metal plate bearing an engraved inscription indicating the manufacturer's recommendations:

.1 The quality of oil or grease required.

.2 The frequency of oiling or greasing.

.2 Lubricate the bearings of fans and the motors, as recommended by the manufacturer and the AMCA.

FAN CHARACTERISTICS							
Identification		**E-07**					
Location		Roof					
Manufacturer		PennBarry					
Model		FX16RGP					
Arrangement		VD					
Build Class		II					
Rotation		CW					
Suppression		---					
Airflow (cfm)		950					
Static pressure (in wg)		0.7					
rpm		1284					
O.S. (ft/s)		---					
Motor	kW (HP)	1/3					
	rpm	1284					
	Volt/Phase	120/1					
	Position	---					
Notes – Accessories		VG, 1					

Notes:

SD: see drawing
DD: direct drive
FP: fixed diameter pulley
VP: variable diameter pulley
FCI: flexible connection type I
FCII: flexible connection type II
GD: gravity damper
SP: static pressure
D: drain
GF: gravity flap
PL: protective layer
TI: thermal insulation
OS: outlet speed
TC: transistorized control
N: not variable
AF: airfoil blades
BI: backwards blades
FC: forwards blades
VFC: inverter (variable frequency speed controller)

END OF SECTION

TABLE OF CONTENTS

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 20 00 10 – Mechanical and electrical general requirements.

.2 Section 23 05 53.01 – Mechanical identification.

.3 Section 23 33 46 – Flexible ducts.

1.2 REFERENCES

.1 American National Standards Institute/Air Movement and Control Association (ANSI/AMCA):

.1 ANSI/AMCA – Standard 210-2007/(ANSI/ASHRAE 51-07), Laboratory Methods of Testing Fans for Aerodynamic Performance Rating.

.2 International Organization for Standardization (ISO):

.1 ISO 3741-2010 – Acoustics – Determination of sound power levels and sound energy levels of noise sources using sound pressure – Precision methods for reverberation test rooms.

.3 National Fire Protection Association (NFPA):

.1 NFPA 90A-12 – Standard for the Installation of Air Conditioning and Ventilating Systems.

.4 Underwriter's Laboratories (UL):

.1 UL 181-2005(R2008) – Factory-Made Air Ducts and Air Connectors.

1.3 SUBMITTALS

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

.2 Product data:

.1 Submit manufacturer's printed product literature, specifications and data sheet for the products. Data sheets must include product characteristics, performance criteria, dimensions, limits and finish.

.3 Certificates:

.1 Submit certificates signed by the manufacturer certifying that the products and materials comply with the specified performance and physical requirements.

1.4 CLOSEOUT SUBMITTALS

.1 Submit all document/elements required, in accordance with section 20 00 10 – Mechanical and electrical general instructions.

.2 Operation and maintenance data (O&M): provide instructions with respect to the operation and maintenance, to be incorporated into the O&M manual.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Transport, store and handle hazardous materials in accordance with section 02 81 01 – Hazardous materials.

.2 Shipping and receiving: deliver material to site in the original packaging, which must bear the name and address of the manufacturer.

.3 Waste management and disposal:

.1 Separate waste materials for recycling in accordance with section 20 00 10 – Mechanical and electrical general instructions.

.2 Remove from site and dispose of packaging materials at appropriate recycling facilities.

.3 Collect and separate for disposal paper, plastic, polystyrene and corrugated cardboard packaging material for recycling in accordance with the waste management plan.

.4 Separate steel, metal and plastic materials in designated containers for recycling in accordance with the waste management plan.

.5 Divert unused metal materials from landfill to metal recycling facility.

Part 2 Product

2.1 STANDARDS

.1 All units are pressure independent type.

.2 The standards and the norms to be respected are given in the component descriptions.

.3 The recorded data must be certified by an independent laboratory, member of the ADC (Air Diffusion Council).

.4 NC data to be obtained according to standard AHRI 885-2008 (or most recent version).

.5 Units must have the ARI seal.

2.2 DOCUMENTS TO BE PROVIDED

.1 Shop drawings:

.1 For each type of supply air terminal units, provide shop drawings specifying the following:

.1 Models.

.2 Dimensions and construction details of each model.

.3 Minimum operating pressure required at the inlet of the unit.

.4 Sound power transmitted and radiated to each of the frequency bands from 2 to 7 inclusively.

.5 Curves modulating the amount of air.

.6 Air leak curves when the unit is closed.

.7 Characteristics of the thermal acoustic insulation and protection against erosion.

.8 Controls diagram, component characteristics, and description of operation for each type of unit.

.2 List of supply air terminal units:

.1 The list of supply air terminal units must provide the following information:

.1 Identification on drawings and unit as per article "DENTIFICATION CODIFICATION" in section 23 05 53.01 – Mechanical identification, and identification of this section.

.2 Model of the unit.

.3 For each unit: air flow in L/s (cfm), for units with variable airflow: minimum and maximum airflows.

.4 Orientation (left or right) for dual air intake units.

.5 Static pressure loss through the unit.

.3 Samples:

.1 Provide a sample of each type of unit to be able to demonstrate the quality of the construction.

2.3 CONSTRUCTION

.1 Rigid galvanized steel construction, 0.853 mm (22 gauge) minimum. The construction of the joints, the gaskets, and the dampers must ensure a maximum leakage of 2% of the unit's rated capacity when a pressure of 750 Pa is applied at the input of the unit and according to the ASHRAE test method 130.

.2 Heavy gauge galvanized steel air flow control damper with self-lubricating steel or brass shaft and bearings, shaft with position indicator, damper stops with neoprene gaskets to minimize air leakage.

.3 Operating pressure of 75 to 1000 Pa.

.4 The dimensions of the air inlets and outlets must allow for air speeds to be effectively measured using flow sensors.

.5 Ensure easy access to the modulation and control mechanisms.

.6 Protect the controls using an easily removable steel sheet.

.7 See the article "CALIBRATION".

.8 Interior covering:

.1 Acoustical fiberglass insulation (standard covering).

.2 Adhesive approved by UL or ULC, having been tested according to ASTM-E-84-814, and meeting the following maximum levels:

.1 Flame propagation: 25

.2 Fuel supply: 50

.3 Smoke emission: 50

.3 On the interior walls of the end unit, rigid acoustic insulation 25 mm (1") thickness with protective coating (acrylic polymer) resistant to dust, dirt, and microbial growth, meeting the requirements of NFPA-90A and UL 181.

2.4 TERMINAL UNIT TYPES

.1 See the articles "CONSTRUCTION" and "CONTROLS".

.2 Types:

.1 B03 – Double inlet, constant air flow

.1 Acoustic insulation: see article "INTERIOR COVERING".

.2 The arrangement of flaps or airflow control mechanisms shall be designed to ensure minimum air turbulence and a perfect mix of hot and cold.

.3 The temperature of the air mixture shall not vary by more than ½° C (1°F) on average for each 6° C (10°F) difference in temperature between hot and cold air.

.4 The unit will be equipped with two multiport speed sensors, similar to Price model SP300, one at the cold air inlet and one at the exit of the unit.

.5 Similar to Price model DDS.

2.5 CONTROLS

.1 The supply air terminal unit controls are digital and compatible with the building management and control system. These controls are for: digital controllers, actuators, flow transmitters, flow sensors.

.2 The flow sensors supplied and installed in the unit by the manufacturer shall be located at locations representative of the air velocity and where the flow is turbulence free to have a reliable and accurate measurement.

.3 When the sensor controller must control the total air flow of a dual air input unit, the location of the sensor and the dimensions of the unit must be such that the controller can readjust the air flow modulating mechanism(s) to obtain the amounts of air within the limits prescribed by supply air terminal unit tables.

2.6 ACCESS DOORS

.1 When required, install an access door on the ATU, such as Acudor access door no. CD-5080 for low and medium pressures.

.2 Galvanized steel, 24 gauge.

.3 Galvanized steel frame, 24 gauge.

.4 Micro-Airc, 25 mm (1") M/F insulation, type 475.

.5 Closed-cell neoprene sealing gasket ,3 mm (⅛") thick x 13 mm (½") de between the door and the frame, and 1.6 mm (1/16") thick x 38 mm (1½") wide between the frame and the duct.

.6 Self-tightening manual cam latch.

2.7 CALIBRATION

.1 Adjust and calibrate the units in factory so as to obtain the specified air quantities.

.2 To allow field calibration after installation, provide a barbed fitting tee on the tubes that transmit the probe readings to the controller.

2.8 CHOICE OF AIR SUPPLY TERMINAL UNITS

.1 The Contractor is responsible for the final selection of supply air terminal units so that the following requirements are met:

.1 Noise level in the rooms supplied.

.2 Supplied air quantity.

.3 Modulation of the amounts of air according to the variables indicated in the diagrams.

2.9 MANUFACTURER LIST

.1 Comply with article "PRODUCTS USED FOR TENDERS AND EQUIVALENCES" from section 20 00 10.

.2 List of manufacturers, section 23 36 00:

.1 Air supply terminal units:

.1 Carnes

.2 Carrier

.3 Krueger

.4 Metal Aire

.5 Nailor Industries

.6 Price

.7 Titus

.8 Tuttle Bailey

Part 3 Execution

3.1 INSTALLATION

.1 At the inputs of each unit, install the flexible ducts as described in 23 33 46 – Flexible air ducts, according to the manufacturer’s recommendations.

.2 The installation will be done so as to facilitate access to the control devices and the access doors.

.3 Use separate supports from those used for the ducts.

.4 Directly upstream of each terminal member, provide a straight length of section equal to at least four (4) times the diameter of the duct used, which must have the same diameter as the entry of the element.

.5 Install the terminal elements so as to facilitate access to controls/regulation devices, dampers, and access doors.

CHARACTERISTICS OF TERMINAL AIR SUPPLY UNITS							
Identification		**BV-1**					
Label		---					
Type		B03					
Model (*)		DDS					
Air flows and dimensions	Total (L/s)	450					
	Cold (L/s)	450					
	Collar (in)	14					
	Hot (L/s)	315					
	Collar (in)	14					
Reheat (kW)		---					
Type		---					

Notes :

(*): Price model.

EL: heating with electric coil, voltage at ___ V and SCR or SSR controls.

EC: reheat with coil in hot water.

END OF SECTION

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Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 20 00 10 – Mechanical and electrical general instructions.

1.2 EQUIPMENT TO BE RETURNED

.1 Also provide the following:

.1 Keys for flow volume control.

.2 Keys for air pattern adjustment.

1.3 SUBMITTALS

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

.2 Product data:

.1 Submit manufacturer's printed product literature, specifications and data sheet for the products. Data sheets must include product characteristics, performance criteria, dimensions, limits and finish.

1.4 CLOSEOUT SUBMITTALS

.1 Submit all document/elements required, in accordance with section 20 00 10 – Mechanical and electrical general instructions.

.2 Operation and maintenance data (O&M): provide instructions with respect to the operation and maintenance, to be incorporated into the O&M manual.

Part 2 Product

2.1 GENERAL

.1 Grilles and diffusers to conform to the dimensions, the diffusion patterns, and the type indicated on the drawings. The dimensions are calculated so as to have sufficient air projection and a low noise level and can not be changed without authorization. When two or more grilles and diffusers are connected to the same unit and do not have integrated balancing dampers, supply and install a balancing damper in a branch.

.2 When installed on the ceiling, baked enamel finish, white color.

.3 Provide shop drawings and a sample of each type of grille and diffuser used.

.4 All grilles and diffusers must be equipped with seismic restraint systems.

2.2 LINEAR SUPPLY DIFFUSERS IN CEILINGS

.1 Type ALM:

.1 Construction:

.1 The entire construction will be made of stainless steel.

.2 The perforated panel will be easily removable.

.3 Removable grilling with a quarter-turn mechanism.

.4 Grilling with two steel safety fastener cables and hook with spring closure mechanism.

.5 The air speed at the operating table should not exceed 0.2 m/sec.

.6 It will be complete with interior deflectors and chicanes to ensure a uniform air distribution.

.7 The diffuser plenum will be covered with 13 mm (½") of thermal insulation.

.8 Frame for a surface installation (gypsum ceiling).

.9 Such as the LFD2SS (1220 mm x 610 mm) model by E.H. Price Ltd.

2.3 RETURN GRILLES IN CEILINGS

.1 Type RL:

.1 Construction:

.1 Extruded aluminum frame.

.2 Center with 13 mm x 13 mm square pattern in aluminum.

.2 Model: such as 80-F from E.H. Price Ltd.

2.4 MANUFACTURER LIST

.1 List of manufacturers, section 23 37 13:

.1 Grilles and diffusers:

.1 Anémostat (Ventilation Dollard-des-Ormeaux Inc.)

.2 Carnes

.3 E.H. Price Ltd

.4 Krueger (Les Distributions Bruno Valois Inc.)

.5 Nailor Industries Inc. (Q.A.T)

.6 Titus (Technovent)

.7 Tuttle & Bailey

Part 3 Execution

3.1 INSTALLATION

.1 Install grilles, grilles with dampers, and diffusers according to manufacturer's instructions.

END OF SECTION

PART 1 GENERAL

1.1 SUMMARY

1.2 DEFINITIONS

1.3 DESIGN REQUIREMENTS

1.4 ACTION AND INFORMATIONAL SUBMITTALS

1.5 CLOSEOUT SUBMITTALS

1.6 COMPLETION OF COMMISSIONING

1.7 ISSUANCE OF FINAL CERTIFICATE OF COMPLETION

1.8 ACCEPTABLE MATERIALS OR PRODUCTS

PART 2 PRODUCTS

2.1 EQUIPMENT

PART 3 EXECUTION

3.1 PROCEDURES

3.2 FIELD QUALITY CONTROL

3.3 ADJUSTING

3.4 DEMONSTRATION

Part 1 General

1.1 SUMMARY

.1 Related Requirements

.1 Section 20 00 10 – Mechanical and electrical general instructions.

.2 Section 25 05 01 – EMCS: General Requirements.

1.2 DEFINITIONS

.1 For additional acronyms and definitions, refer to Section 25 05 01 - EMCS: General Requirements.

.2 AEL: ratio between total test periods less any system downtime accumulated within that period and test period.

.3 Downtime: results whenever EMCS is unable to fulfill required functions due to malfunction of equipment defined under responsibility of EMCS contractor. Downtime is measured by duration, in time, between time that Contractor is notified of failure and time system is restored to proper operating condition. Downtime not to include following:

.1 Outage of main power supply in excess of back-up power sources, provided that:

.1 Automatic initiation of back-up was accomplished.

.2 Automatic shut-down and re-start of components was as specified.

.2 Failure of communications link, provided that:

.1 Controller automatically and correctly operated in stand-alone mode.

.2 Failure was not due to failure of any specified EMCS equipment.

.3 Functional failure resulting from individual sensor inputs or output devices, provided that:

.1 System recorded said fault.

.2 Equipment defaulted to fail-safe mode.

.3 AEL of total of all input sensors and output devices is at least [99] % during test period.

1.3 DESIGN REQUIREMENTS

.1 Confirm with Departmental Representative that Design Criteria and Design Intents are still applicable.

.2 Commissioning personnel to be fully aware of and qualified to interpret Design Criteria and Design Intents.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submittals in accordance with Section 25 05 02 - EMCS – Submittal and Review Process.

.2 Final Report: submit report to Departmental Representative.

.1 Include measurements, final settings and certified test results.

.2 Bear signature of commissioning technician and supervisor.

.3 Report format to be approved by Departmental Representative before commissioning is started.

.4 Recommend additional changes and/or modifications deemed advisable in order to improve performance, environmental conditions or energy consumption.

1.5 CLOSEOUT SUBMITTALS

.1 Provide documentation, O&M Manuals, and training of O&M personnel for review of Departmental Representative before interim acceptance in accordance with Section 25 05 02 – EMCS – Submittal and Review Process, Article “Closeout Documentation”.

1.6 COMPLETION OF COMMISSIONING

.1 Commissioning to be considered as satisfactorily completed when objectives of commissioning have been achieved and reviewed by Departmental Representative.

1.7 ISSUANCE OF FINAL CERTIFICATE OF COMPLETION

.1 Final Certificate of Completion will not be issued until receipt of written approval indicating successful completion of specified commissioning activities including receipt of commissioning documentation.

1.8 ACCEPTABLE MATERIALS OR PRODUCTS

.1 When materials or products are given by their trademarks, consult the instructions to tenders in order to know the procedure concerning the request for approval of materials or substitutes.

Part 2 Products

2.1 EQUIPMENT

.1 Provide sufficient instrumentation to verify and commission the installed system. Provide two-way radios.

.2 Instrumentation accuracy tolerances: higher order of magnitude than equipment or system being tested.

.3 Locations to be approved, readily accessible and readable.

.4 Application: to conform to normal industry standards.

Part 3 Execution

3.1 PROCEDURES

.1 Test each system independently and then in unison with other related systems.

.2 Debug system software.

.3 Optimize operation and performance of systems by fine-tuning PID values and modifying CDLs as required.

3.2 FIELD QUALITY CONTROL

.1 Pre-Installation Testing.

.1 General: consists of field tests of equipment just prior to installation.

.2 Configure major components to be tested in same architecture as designed system.

.2 Completion Testing.

.1 General: test after installation of each part of system and after completion of mechanical and electrical hook-ups, to verify correct installation and functioning.

.2 Final Operational Testing: to demonstrate that EMCS functions in accordance with contract requirements.

.1 System will be accepted when:

.1 EMCS equipment operates to meet overall performance requirements. Downtime as defined in this Section must not exceed allowable time calculated for this site.

.2 Requirements of Contract have been met.

.2 In event of failure to attain specified AEL during test period, extend test period on day-to-day basis until specified AEL is attained for test period.

.3 Correct defects when they occur and before resuming tests.

3.3 ADJUSTING

.1 Final adjusting: upon completion of commissioning as reviewed by Departmental Representative, set and lock devices in final position and permanently mark settings.

3.4 DEMONSTRATION

.1 Demonstrate to Departmental Representative operation of systems including sequence of operations in regular and emergency modes, under normal and emergency conditions, start-up, shut-down interlocks and lockouts in accordance with Section 01 91 13 – General Commissioning (Cx) Requirements.

END OF SECTION

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3.5 START-UPS

3.6 TRAINING

Part 1 General

1.1 RELATED SECTIONS

.1 All sections of Division 01.

.2 Section 20 00 10 – General mechanical and electrical instructions.

.3 Section 20 01 11 – EMCS – Start-up, verification and commissioning.

.4 All Division 23 sections.

.5 All Division 26 sections.

1.2 GENERAL CONDITIONS

.1 All mechanical and electrical general requirements of Division 20 apply to Division 25.

.2 All of Division 25 sections complement each other to form a whole.

.3 All mechanical and electrical drawings apply to Division 25.

.4 Division 25 must have knowledge of scope of work of Section 20 91 13 – Start-up – General requirements. Division 25 must supply the services of a qualified technician possessing the required competencies to change and modify the software programs of the control system during commissioning and start-ups periods.

1.3 DESIGNATED SUPPLIER

.1 Hire the services of **Procetech inc.** of its authorized representative to complete the work of all EMCS Sections.

1.4 ACRONYMS AND ABBREVIATIONS

.1 Acronyms used in this section:

.1 AEL – Average Effectiveness Level.
.2 BACnet - Building Automation and Control Network.
.3 BTL – BACnet Testing Laboratories.
.4 CDL - Control Description Logic.
.5 COSV - Change of State or Value.
.6 CPU - Central Processing Unit.
.7 HVAC - Heating, Ventilation, Air Conditioning.
.8 VFD – Variable Frequency Drive.
.9 DDC – Direct Digital Control.
.10 I/O – Input/Output.
.11 HMI – Human Machine Interface.
.12 LAN - Local Area Network.
.13 NC – Normally Closed.

.14 NO – Normally Open.
.15 O&M - Operation and Maintenance.
.16 OWS - Operator Work Station.
.17 PC - Personal Computer.
.18 MCU(s) – Master Control Unit(s).
.19 LCU(s) – Local Control Unit(s).
.20 TCU(s) – Terminal Control Unit(s).
.21 PID – Proportional, Integral and Derivative.
.22 DP – Differential Pressure.
.23 SP – Static Pressure.
.24 RAM - Random Access Memory.
.25 ROM - Read Only Memory.
.26 EMCS – Energy Management and Control System.
.27 NMC(s) – Network Management Controller(s).
.28 USB - Universal Serial Bus.OS - Operating System.
.29 UPS - Uninterruptible Power Supply.
.30 VAV – Variable Air Volume.
.31 WAN – Wide Area Network.

1.5 REFERENCES

.1 Electronic Industries Alliance (EIA)/Telecommunications Industries Association (TIA) :

.1 EIA/TIA-568 – Commercial Building Telecommunications Cabling Standards Set, Part 1 – General Requirements, Part 2 – Balanced Twisted-Pair Cabling Components, Part 3 – Optical Fiber Cabling Components Standard.

.2 EIA/TIA-569 – Commercial Building Standard for Telecommunications Pathways and Spaces.

.2 American Society of Heating, Refrigerating and Air-Conditionning Engineers, Inc. (ASHRAE):

.1 ASHRAE Standard 135, BACnet – Data Communication Protocol for Building Automation and Control Network.

1.6 DEFINITIONS

.1 Point: may be logical or physical.

.1 Logical points: values calculated by system such as setpoints, totals, counts, derived corrections and may include, but not limited to result of and statements in CDL's.

.2 Physical points: inputs or outputs which have hardware wired to controllers to measure physical properties, to provide status conditions of contacts or relays or to provide interaction with related equipment (system start/stop, modulation control, etc.).

.2 Point object type: points fall into following object types:

.1 AI (analog input).

.2 AO (analog output).

.3 DI (digital input).

.4 DO (digital output).

.5 Pulse input.

1.7 WORK ORDER

.1 Perform the work in steps, so that the owner can use the majority of the premises during the work.

.2 Coordinate the timetable for the progress of the work according to the occupation of the site by the owner during the construction work.

.3 Ordering and regulation services should not be interrupted without prior agreement with the Department's Representative and technical services.

.4 To ensure continuity of services at the hours required by the Department's Representative, Division 25 must perform all required temporary work, including manpower and materials.

.5 Scheduling: Work must be completed within seven (7) weeks following the signing of the general contractor's contract. To meet this time frame, day, evening and weekend work is permitted.

.6 The work will have to be done section by section. The contractor will have to ensure that everything is functional at the end of each section's work and the end of the work shift.

.7 Before leaving each morning, it is important to rehabilitate the laboratories, as they were when the work began.

.8 Perform the work in steps to allow the continuous use of the premises by the public. Maintain access to the premises to the public as long as the status of the work prevents an alternative.

1.8 SAMPLES TO SUBMIT

.1 See section 20 00 10 – General instruction for mechanical and electrical.

1.9 DOCUMENT SUBMITTAL

.1 Make submittals in accordance with Section 25 05 02 – EMCS: Document Submittals.

.2 Quality Control:

.1 Unless otherwise noted, provide new equipment and material from manufacturer's regular production, CSA and ULC certified, manufactured to standard quoted plus additional specified requirements.

.2 Submit proof of compliance to specified standards with shop drawings and product data in accordance with Section 25 05 02 – EMCS: Document Submittals. Label or listing of specified organization is acceptable evidence.

1.10 QUALITY ASSURANCE

.1 See article "LAWS, REGLEMENTATIONS AND PERMITS" of section 20 00 10 – General instructions for mechanical and electrical.

.2 All wiring must be completed in accordance with manufacturer's recommendations and the Régie du Bâtiment du Québec (RBQ) for all electrical work.

.3 The system must include all the devices, control and monitoring equipments as well as all the devices, accessories and equipment installed remotely, the software, the interlock wiring and wiring required to obtain a fully functional system, as described in this section. The system must meet all newest local and national codes. If a conflict between the two reference codes appears, the most recent and most severe local codes must be applied.

1.11 MISCELLANEOUS WORK

.1 Must comply with article in "MISCELLANEOUS WORK" of section 22 00 10 – Mechanical and electrical general instructions.

.2 Are included in control work:

- .1 Supply and installation of field control devices, conduits, wiring and system connections for controls of all sections, unless specified as being part of another section.
- .2 Provide instructions, monitor work and retain complete responsibility for all field control devices and equipment (e.g. control valves, thermowells, flow meters, meters, etc.) provided by Division 25, but installed by others.
- .3 Air handling:
  - .1 Provide and install all wiring, equipment and electrical conduits required for controls in this contract.
- .4 Coordinate required signal types between all equipment suppliers for all sections.

1.12 WARRANTY

.1 Regardless of the warranty period stipulated in article "WARRANTY" of section 20 00 10 – General instructions for mechanical and electrical, the complete control system must have a two (2) year warranty period from the final acceptation date.

1.13 SYSTEM LIST

.1 Emergency gas evacuation for Room 161:

- .1 E-07 exhaust, supply, low voltage connection installation and torque training start-up and variable frequencies.
- .2 Delivery, installation and connection of the shutter engine and end-of-race switch.
- .3 Supply, installation and connection of two (2) wall oxygen transmitters.
- .4 Supply, installion and connection of a reporting station with an emergency button, a visual and audible alarm and a silence button.
- .5 All necessary connections and inter-dams.

.2 Volumetric and thermal control:

.1 The dismantling of the controls and accessories of the double sheath box that supplies air to the room through the ceiling.

.2 The replacement of the double sheath box is done by others.

.3 The reinstallation of the dismantled controls and accessories on the new double sheath box.

1.14 OVERALL FLAT-RATE PRICE

.1 Provide in the quote, a global lump sum that includes all the work covered in Division 25.

.2 If the bidder would like to submit an alternate or substitution, he must include in the quote, an alternate lump sum for more or less to the base quote, references to the sections and items and all documentations pertaining to the proposed alternative. See section 20 00 10 – General instruction for mechanical and electrical, article "QUOTES AND EQUIVALENCIES".

1.15 MATERIALS OR ACCEPTABLE PRODUCTS

.1 When materials or products are prescribed by their trademarks, consult the instructions to bidders to find out how to apply for approval of materials or alternatives

Part 2 Product

2.1 MATERIALS

.1 A **SmartStruxure** system from **Schneider Electric** is presently installed in the building. All materials must be selected in order to ensure complete compatibility with the existing **Schneider Electric - SmartStruxure** system.

.2 Given the level of complexity of the work and for reasons of compatibility with the operating methods of existing laboratories, only the company already mandated for maintenance to the system can carry out the work of Division 25. Maintenance of the energy management system (EMS) and existing control equipment is currently provided by Procetech Inc.

2.2 ENERGY MANAGEMENT AND CONTROL SYSTEM (EMCS)

.1 Building controllers and the centralized management system shall be from the same manufacturer and product line.

.2 The BAS shall have the capability of interfacing with third party control systems including pump packages, air-handling units, energy metering systems and other control systems provided they comply with open protocols such as ASHRAE BACnet, Echelon Lonworks or Modbus.

Part 3 Execution

3.1 GENERAL

.1 All controls shall be installed and adjusted by specialized technicians, regularly employed by the EMCS manufacturer. All costs related to adjustments form part of this contract. All controls components must be easily accessible for maintenance and calibration. Install all control devices in unitized cabinets.

.2 Install all capillary tube cleanly and support them in a steady fashion, either inside a copper tubing or onto a galvanized metal support.

.3 Attach the bulb and capillaries with copper hooks inside the air handling ducts. An access door on the ductwork is included by another section to facilitate maintenance.

.4 Any control device installed on an insulated ductwork must be install on an appropriate metal support, supplied by Division 25.

.5 Any piping or tubing going through an obstacle must be protected by a sealed nylon bushing.

.6 Unless specified otherwise, install static pressure sensor 2/3 of the longest duct run.

.7 Install the high limit pressure sensor in the discharge plenum, before the fire dampers.

.8 In finished room, enclose the controls in metal boxes with frames covering the joint between the box and the adjacent construction. The box must be of approved construction.

.9 The location of the thermostats on the drawing is approximate and is given as a reference only.

.10 Under any circumstances, the space thermostat should be affected by the sun or any other heat source, cold source or air draft. When it has to be installed on a hot or cold wall, the thermostat must be installed on an insulated base, supplied by Division 25.

.11 Install the space thermostat at 1.5 m (5’) from the floor covering.

.12 Never install the thermostats above switches, rheostats, dimmers or any other heat generating control equipment.

.13 The control panel cannot have any unprotected openings.

.14 Protect all cables and tubing from abrasion when passing through openings.

3.2 ELECTRICAL WIRING

.1 Division 25 must supply and install the panels, the controls, etc., and others specialized control devices. In addition, it must supply and install conduit, wiring and junction boxes required to connect all the control devices.

.2 Must comply with the requirements of Division 26 for the install of conduits, wiring, junction boxes, etc.

.3 Notwithstanding the conductor gage mentioned in Division 26, the wire gage for conductors being used for control only are as follow:

.1 120 V: minimum gage 14 AWG.

.2 24 V : minimum gage 18 AWG.

.4 Unless otherwise noted, all wiring must be installed in EMT type metal conduit.

.5 Using Plenum type wires:

.1 The use of FT-4 plenum type cables is authorized **only on room ceilings when the cables remain accessible**, for connecting space sensors, for secondary communication and for supplying 24 v power to application specific controllers (TCUs, fan coils, etc.).

.2 When using FT-4 cables without conduits, the cables must align with the building lines and be **neatly tied every 1.5 m using hooks or velcros** (similar to the ones used by IT installers) made for this purpose.

.3 In the room walls where the cables are accessible in the ceiling space (for connecting thermostats, sensors or other accessories), the FT-4 cables must be installed in a conduit up to the ceiling space.

.4 For the plenum cables, provide protection against abrasion at the end of the conduits. When cable is not in conduit, provide “cord-fitting” type of connectors for connection to local control panels.

.6 For secondary network cables, use a twisted or armoured cable, in accordance with the manufacturer's instructions for the building controllers.

.7 Control cables identification must be performed in accordance with section 25 05 54 – EMCS – Identification.

.8 Complete electrical installation including conduits, cables, junction boxes, etc. required for control systems, automation and the BAS, as shown on drawings and described in these specifications, as well as all electrical connections required to motor control centers and starters, interlocks for fans, pumps or other controls (e.g. device, panels).

.9 Division 25 is solely responsible for providing a complete and fully operational Energy Management and Control System (EMCS) utilizing Direct Digital Control (DDC) technology as shown on drawings and described in these specifications. It must verify all electrical control sequences, all electrical safeties, all overloads and all starter diagrams to provide the right number of auxiliary contacts or other, as require din the control drawings.

.10 Grounding systems required for all systems and devices provided under Division 25, in accordance with manufacturer’s instructions and requirements of Division 26.

.11 All electrical connections to 600/347 V are the responsibility of Division 26.

.12 Provide utility power (120V/1/60) and emergency power to EMCS components, local monitoring panels and control cabinets from local 120/208V distribution panels. Dedicated circuits for use by Division 25 will be reserved in local distribution panels.

3.3 ELECTRICAL INSTALLATION

.1 The installation includes: electrical diagrams, factory and on-site wiring, workmanship, surveillance, calibration, start-up and verification for a fully operational system.

.2 Complete electrical installation including conduits, cables, junction boxes, etc. required for control systems, automation and the EMCS, as shown on drawings and described in these specifications, as well as all data transmission “bus”, all electrical connections required to motor control centers and starters, interlocks for fans, pumps or other controls (e.g. device, panels).

.3 All wiring must comply with the requirements of the local authorities as well as article "ELECTRICAL CONNECTION".

3.4 MEASUREMENTS, VERIFICATION, CALIBRATION

.1 Calibration:

.1 Calibrate all control devices, sensors and transmitters.

.2 The controls of each section or contract must be verified and adjusted and proven to be in working condition.

.3 For each system of each section, for each year of the warranty in summer and winter, in order to prove functionality and adequate calibration; perform with the use of a printer.

.1 A trend log of each points every 3 hours for a 24 hour period.

.2 A trend log of each temperature and humidity every 30 minutes for a 24 hour period.

.3 For humidity controlled space and system, a trend log for each temperature and humidity every 3 hours for a period of seven days.

.2 Simulate all freeze condition and verify the controlled action. These same controls must be verified when the exterior temperature is below -18.0°C (0°F).

.3 Simulate all control panel alarms and record results.

.4 Division 25 must provide great support in the testing and commissioning of the equipment and systems of the other contracts.

3.5 START-UPS

.1 Follow the requirements of Section 20 01 11 – EMCS – Start-up, verification and commissioning.

.2 The control Contractor, once installation is completed, must proceed with the start-up of the system. In order to proceed in a safe environment, the start-up is divided in the following phases: verification of the control systems and start-up of the control systems with the electromechanical equipment operational.

.3 During the control system verification, the control Contractor must include, but not limited to, the following activities:

.1 Verify and calibrate all transmitter’s signals.

.2 Verify the operation of all actuators.

.3 Verify the operation and feedback of all controlled devices.

.4 Simulate all alarms.

.5 Simulate all control loop and adjust parameters.

.6 Simulate a power fail and ensure proper restauration of the control system.

.4 The final phase of the start-up must be witness by the Owner. During this phase, the systems are functional, under the supervision of the Owner. The control Contractor will make the necessary modifications and adjustments (fine tuning) in order to have a functional and safe system. The control Contractor must perform these changes, at no cost, to optimize the system operation.

.5 Once the start-up is completed, demonstrate the control system operation.

3.6 TRAINING

.1 Provide competent instructors for a period of eight hours (8 h) to provide instruction to Owner on operation and maintenance of the EMCS.

.2 The training must be performed in a classroom environment and the content of the training must be approved prior to the training taking place.

.3 Provide 5 copies of all training documentation.

END OF SECTION

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Part 1 General

1.1 RELATED SECTIONS

.1 Section 20 00 10 – General Mechanical and Electrical Instructions.

.2 Section 25 05 01 – EMCS – General Requirements.

.3 Section 25 01 11 – EMCS – Start up, Verification and Commissioning.

1.2 SUBMITTALS

.1 Provide all submittals required in accordance with Section 20 00 10 – General mechanical and electrical instructions.

.2 In addition to submittals required in Section 20 00 10, provide all shop drawings and closeout documentation in accordance with the requirements of this section.

.3 Shop Drawings: provide two (2) printed copies of shop drawings.

.4 Closeout documents:

.1 Following the review, make corrections as requested and provide (3) hard copies and (1) "back-up" copy (PDF – multipage format) on DVD of the closeout documents. Closeout documents must also be entered on the facility OWS and laptop.

1.3 SHOP DRAWING REVIEW

.1 Before starting the installation, submit detailed shop drawings and include following:

.1 For each system under control of the EMCS, provide control and wiring schematics showing: all controllers involved in the regulation of local control loops, all field devices, control elements schematic diagrams of system controlled, sequences of operation, etc. Label all control points, control elements, terminals, etc.

.2 List and description of software programs and applications provided. Supply manufacturer’s technical sheets.

.3 Specification sheets for each item. To include manufacturer's descriptive literature, manufacturer's installation recommendations, specifications, drawings, diagrams, performance and characteristic curves, catalogue cuts, manufacturer's name, trade name, catalogue or model number, nameplate data, size, layout, dimensions, capacity, other data to establish compliance.

.4 Detailed network architecture showing DDC control units, components of the Centralized Management System, communication interfaces, control networks, communication protocols used and cable types.

.5 Detailed layout of the conduit network dedicated to the Ethernet communication.

.6 Single line diagrams showing the Ethernet TCP/IP network, including all active components, cable types and length and a bill of materials list, etc.

.7 Detailed layouts of each control panel including a bill of materials and system schematics.

.8 Equipment List Summary indicating manufacturer and model number of equipment to be used and the associated equipment ID.

.9 Floor plans showing location of main controllers (NMCs, MCUs), monitoring panels and auxiliary control cabinets.

.10 Wiring schematics for low voltage power supply network showing local distribution panels, transformers and other equipment. Provide load calculations for control transformers and power supplies.

1.4 CLOSEOUT DOCUMENTATION

.1 In addition to the required documents listed in articles "UPDATED DRAWINGS" and "OPERATIONS AND MAINTENANCE" of Section 20 00 10, provide the following documents, once the start-ups and adjustments are completed:

.1 Corrected and updated version of all information requested in the shop drawings reviews, in accordance with the as-built system.

.2 All testing and commissioning reports, in accordance with Section 25 05 01 – EMCS – General requirements.

.3 Copy of all system programs and documentation for their use.

.4 Copy of all software programmed including database, graphics, parameters, etc.

.5 List of alarm limits programed (high and low for each type - critical and cautionary, maintenance).

.6 List of points assigned to schedule and event programs.

.7 A data base list.

.8 Updated floor plans showing location of all main controllers (NMCs, MCUs), EMCS workstations and/or servers, monitoring panels, auxiliary control cabinets and local controllers (TCUs, LCUs).

.9 Training documentation.

Part 2 Product

2.1 NOT USED.

.1 Not used.

Part 3 Execution

3.1 NOT USED

.1 Not used.

END OF SECTION

TABLE OF CONTENTS

Part 1 General

1.1 RELATED SECTIONS

.1 Section 25 05 01 – EMCS – General Requirements.

.2 Section 25 05 02 – EMCS – Submittals and Review Process.

.3 Section 25 30 02 – EMCS – Field Control Devices.

1.2 RÉFÉRENCES

Canadian Standards Association (CSA)/CSA International :

.1 CSA C22.1-02, Electrical Canadian Code, first part (19e édition) – Electrical safety standard.

1.3 NAMEPLATES

.1 All devices must have nameplates indicating size, name of the device all other general information such as serial number, voltage, frequency, number of phases, capacity, manufacturer's name, etc.

.2 The lettering stamped, printed or engraved on the nameplate must be legible. Do not paint the nameplates. When the devices are insulated, leave openings in the insulation to keep the nameplate legible. The manufacturer's nameplate must not be modified in any way.

.3 Provide certification nameplate for pressure appliances and laboratories insurance certification and CSA on all supplied equipment, as per regulation requirements.

.4 Submit to Consultant for approval samples of nameplates, identification tags and list of proposed wording.

1.4 MATERIALS OR ACCEPTABLE PRODUITS

.1 When materials or products are prescribed by their trademarks, consult the instructions to bidders to find out how to apply for approval of materials or alternatives.

Part 2 Product

2.1 NAMEPLATES FOR PANELS

.1 Panels include: control panels, controller enclosures, monitoring panel and auxiliary control cabinets.

.2 Identify by white plastic laminate, 3 mm thick black core, glued and screwed to the panel front door.

.3 Sizes: 90 x 40 mm (3½" x 1½") minimum.

.4 Lettering: minimum 25 mm (1") high.

2.2 TCU PANEL – LOCATION INDICATORS

.1 Identify controller with a printed 12mm, black on white self-adhesive "P-touch" ribbon.

.2 Controller access identification:

.1 Identify the location of application-specific control units (TCU) that are installed in the ceiling space with an orange sticker (25mm x 25 mm). Sticker to include the panel's ID number.

.2 Access door: Apply sticker on visible side.

.3 Locate sticker on the T-Bar assembly or on extremity of the access panel.

2.3 NAMEPLATES FOR CONTROL APPLIANCES

.1 Identify control appliances with metallic tags (or plastic token) with rounded edges, with contrasting engraved numbers and letters. Attach the tags with heavy steel wire or glue and screw them to the appliances.

.2 Sizes: 25 x 40 mm (1" x 1½") minimum.

.3 Lettering: minimum 12 mm (½") high.

.4 The indication must be alphanumerical and must correspond to the control diagrams.

2.4 APPLIANCES AND ACCESSORIES INSTALLED IN PANELS

.1 Identify controller with a printed, white on black self-adhesive "P-touch" ribbon. The indication must be alphanumerical and must correspond to the control diagrams.

2.5 NAMEPLATES FOR ROOM SENSORS

.1 Identify each device with pre-printed electronically generated self-adhesive vinyl labels.

.2 Coordinate the characteristics and lettering size with the Owner.

2.6 WIRING

.1 Color tracking compliant with CSA C22.1.

.2 Power wiring:

.1 Power wiring: identify circuit breaker number and panel ID inside each control panel.

.2 Supply and install numbered tape markings on wiring at panels, junction boxes, splitters, cabinets and outlet boxes.

.3 Distribution panels: Identify breaker for controls and EMCS.

.3 Energy Management and Control System (EMCS):

.1 Identify field device and network wiring end-to-end with plastic rings printed with indelible number markings. Alternatively, use pre-printed labels specifically designed for wiring identification.

.2 Inside control panels, label terminals of terminal blocks with the same identification used on wiring schematics.

.3 Use distinctive colour coded wiring for communications cables, matched throughout system. Color to be coordinated with the Owner.

2.7 CONDUIT

.1 Colour code EMCS conduits and boxes using paint or tape, in 25 mm wide, fluorescent orange stripes

.2 Conduits must be identified by painting all connectors and anchors. Pre-paint box covers and conduit fittings.

.3 Have the owner's representative confirm the means of identification when reviewing the preliminary definition documents.

Part 3 Execution

3.1 NAMEPLATES AND LABELS

.1 Ensure that manufacturer's nameplates, CSA labels and identification nameplates are visible and legible at all times.

.2 Install nameplate to be visible.

3.2 ELECTRICAL PANELS

.1 Correct panel schedules to reflect changes made during work.

END OF SECTION

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Part 1 General

1.1 RELATED SECTIONS

.1 Section 25 05 01 – EMCS – General Requirements.

.2 Section 25 30 01 – EMCS – Building Controllers.

1.2 REFERENCES

.1 Electronic Industries Alliance (EIA)/Telecommunications Industries Association (TIA):

.1 EIA/TIA-568- Commercial Building Telecommunications Cabling Standards Set, Part 1 - General Requirements, Part 2 - Balanced Twisted-Pair Cabling Components, Part 3 - Optical Fiber Cabling Components Standard.

.2 EIA/TIA-569- Commercial Building Standard for Telecommunications Pathways and Spaces.

.2 American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE):

.1 ASHRAE STD 135, BACnet – Data Communication Protocol for Building Automation and Control Network.

1.3 SYSTEM DESCRIPTION

.1 Data communication takes place at two levels:

.1 A primary Ethernet TCP/IP network allows high-speed communication between NMCs, MCUs and OWS's (hereby identified as nodes) and ensures reliable data transfer between all system components.

.2 Secondary network buses (RS-485 MS/TP) link LCUs, TCUs and third-party controllers (e.g. VFDs, pump packages, etc.) to network management controllers (NMCs or MCUs).

.2 Connection points:

.1 Within the facility, a connection point must be provided to each IP-based components part of the EMCS including: control units (NMCs, MCUs), operator workstations (OWSs), integrated third-party panels (lighting, meters, etc.), for connection to the primary Ethernet TCP/IP network.

.2 In addition a service connection point must be provided at each main panel (NMC, MCU) to connect a laptop. In locations where several panels are grouped in proximity, a single service connection can be provided.

1.4 DESIGN REQUIREMENTS

.1 General:

.1 Every building controller is accessible from any location on the primary network (Ethernet TCP/IP) with the full capability to read/write properties in controller's operating software and programming.

.2 Complete access to system data is possible from any location on the primary network (Ethernet TCP/IP).

.3 The communication is handled the master controller unit (MCU) internal communication controller or by the network management controller (NMC).

.4 All controller have the same value ("peer bus") and communicate in the same fashion in the event of controller failure.

.2 Primary level network:

.1 High speed, high performance, local area network over which computers communicate with each other directly on peer to peer basis in accordance with the Ethernet standard and TCP/IP.

.2 EMCS communication at this level is performed in BACnet/IP protocol in compliance with the ASHRAE BACnet standard 135, annex J.

.3 Transparent "peer to peer" network operation: detection and accommodation of single or multiple node failures. Defective nodes are automatically off-loaded the network without causing any network interruption. New nodes are automatically detected and integrated to the network.

.4 In the event a network segment fails, the two resulting networks are reconfigured into two separate networks, both ensuring transparent "peer to peer" communication between their associated nodes.

.5 The NMCs, MCUs and OWS are considered nodes on the network.

.6 Dynamic data access:

.1 All controllers on the main Ethernet TCP/IP network must work at managing the nodes to ensure coordinated functionality of all the network components, including OWSs. One of the components acts as the main coordination node and dispatches common information such as time of day and access codes.

.2 This dedicated node continuously monitors the states of the other nodes and notifies the operator of any communication issues. It updates all the nodes when schedules are modified, holidays are added and new password assigned.

.3 If the management node becomes faulty, another component on the main network takes over the duties. If the Ethernet network is divided in two, both parts of the network have a component that takes over the role of management so that the local communications remains between the controllers and the OWS, linked to each other.

.3 Secondary level network:

.1 Secondary networks interconnect LCUs and TCUs to main controllers (NMCs, MCUs), ensuring communication between controllers and management controls.

.2 Communication module: the secondary network control modules reside in management controllers (NMCs) or master control units (MCUs)which enables

communication between the network control module and the other electronic modules (MCU or NMC) as well as the remote DDC controllers (LCU, TCU or third party controllers).

.4 Network characteristics:

.1 Main Ethernet TCP/IP network, communication speed of 10 and 100 Mbps. Communication protocol is BACnet (annex J).

.2 Secondary network shall operate under the ASHRAE-BACnet MS/TP protocol compatible with MCU and NMC controllers. Communication rate of 76.8 Kbps.

1.5 PRIMARY NETWORK – AUTHORIZED INSTALLER

.1 The installation of the primary network (Ethernet TCP/IP) shall be done by a specialized telecommunication installer.

.2 The installer shall be certified by the manufacturer for the supply and installation of the complete structured cabling system (copper cables, fibre optic, connectors, interface, etc.) to ensure the final system is certified and done in compliance with the manufacturer's requirements and guarantees.

.3 Provide documentation certifying that the installer is a manufacturer-certified installer.

1.6 MATERIALS OR ACCEPTABLE PRODUITS

.1 When materials or products are prescribed by their trademarks, consult the instructions to bidders to find out how to apply for approval of materials or alternatives.

Part 2 Product

2.1 SWITCHES

.1 All Ethernet switches shall ensure a network operation at 100 Mbps.

.2 Depending on the types of cable used, switch connection points will be fibre optic or copper.

.3 Provide 10% free space at each switch.

.4 All active components must be from Cisco.

.5 For mounting inside control panel, industrial grade Ethernet switch, complete with DIN-rail mounting, as per EDS series from Moxa or approved equivalent from Hirschmann or Cisco.

2.2 NETWORK WIRING

.1 Primary network:

.1 Depending on distances, noise and interference requirements, cables shall be copper Category 6 (EIA/TIA-568-B.2-1) or fibre optic. Refer to drawings.

.2 Secondary network:

.1 Twisted pair or shielded cable in accordance with recommendations from the building controller's manufacturer.

2.3 ACCEPTABLE MANUFACTURERS

.1 Manufacturers list, section 25 10 01

.1 Structured cabling system (primary network):

.1 Anixter
.2 Belden
.3 Panduit
.4 Siemon

.2 Ethernet switch:

.1 Cisco
.2 HP
.3 Juniper

.3 Ethernet switch – Industrial grade:

.1 Cisco
.2 Hirschmann
.3 Moxa

Part 3 Execution

3.1 PRIMARY NETWORK

.1 Except for connection points to switches (maximum 3 m) or inside panel, network wiring shall be run in conduits. Installation must comply with the manufacturer's standards and installation recommendations.

.2 Installation must comply with all applicable EIA/TIA standards.

.3 After completion of the installation, telecommunication installer to provide a verification report in accordance with applicable EIA/TIA standards and the system certification.

.4 Prior to the installation, submit the following for review: floor plans indicating cable runs, datasheets of proposed network cables and active components to be used, installation procedures, etc. The installer must provide documentation stipulating that he is an authorized installer and can provide an installation that will meet the specifications and performances of Ethernet 100 Mbps.

.5 Connection points:

.1 Inside the control panel enclosure, provide space for the installation of a small patch box with RJ45 module(s). Patch box to be provided and installed by the telecommunications installer.

.2 Cables and terminations to be tested and certified end-to-end by the telecommunications installer.

.3 Provide, CAT-6 pre-certified patch cables (1-3'), for connection of controllers (NMCs, MCUs) or other IP-based components (e.g. lighting controller) to the RJ45 patch box inside the panel enclosure.

3.2 IDENTIFICATION

.1 Identification of network cabling, equipment and enclosures in accordance with Section 25 05 54 – EMCS – Identification.

END OF SECTION

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Part 1 General

1.1 RELATED SECTIONS

.1 Section 25 01 01 – EMCS – General Requirements.

.2 Section 25 10 01 – EMCS – Automation Networks.

.3 Section 25 30 02 – EMCS – Field Control Devices.

.4 Section 25 90 01 – EMCS – Site Requirements, Applications and Systems Sequences of Operation.

1.2 GENERAL

.1 Provide and install a distributed type Energy Management and Controls System (EMCS), utilizing Direct Digital Control (DDC) technology to perform building management, including the control and supervision of equipment related to heating, cooling, energy management, etc., as specified in the current section.

.2 Complete and fully operational system including all equipment required for data processing, operator devices, sensors, control field devices, software, cabling, electrical connections, communication cables and interfaces, and all auxiliary equipment required for the proper operation of the system. The Contractor is also responsible for the system's verification, calibration and fine-tuning.

.3 The EMCS must be provided and installed by the manufacturer or its authorized distributor. Work to be executed by staff under employment of the EMCS Contractor, which are trained and qualified for this type of installation. Ensure qualified supervisory personnel continuously direct and monitor work.

.4 Network Management Controllers (UGR) and other IP-based devices communicating on the primary network must reside on the facility's Ethernet TCP/IP network. This network is not dedicated to controls systems, and can be shared with other applications. Device addressing will be determined in coordination with the client's IT Department.

.5 The communication protocol used for devices residing on the primary network must comply with the Ethernet standard and the IP protocol suite and must be able to operate under Windows' latest platform.

.6 All components residing on the facility's Ethernet TCP/IP network must be configured under the supervision of the client's IT Department and in accordance with their standards and security policies.

.7 All equipment must be standard and regularly manufactured for this type of installation. Provide materials and equipment, which have been carefully tested and approved for this type of installation.

.8 System architecture must be scalable and permit future hardware expansion and software add-ons without requirements to modify EMCS communication and management equipment.

.9 Provide products from the manufacturer's latest generation and product line at the time of the installation, that complies with the performance and device profile (BTL-Listing) indicated in these specifications and on the drawings.

.10 All Network Management Controllers (UGR), hybrid standalone controllers (Master Control Units – PCM), local standalone controllers (Local Control Units – PCL) and application specific controllers (Terminal Control Units – PCT) to be **BTL Listed** by the BACnet Testing Laboratories.

.1 All building controllers and management devices must be from the same manufacturer and product line and be **BTL-Listed** by the BACnet Testing Laboratories. BTL listing for each type of control unit to be in accordance with the following. BTL Listing to be clearly indicated on the control unit technical sheet.

.1 UGR – Listed B-BC (BACnet Building Controller).

.2 PCM – Listed B-BC (BACnet Building Controller).

.3 PCL – Listed B-AAC (BACnet Advanced Application Controller).

.4 PCT – Listed B-ASC (BACnet Application Specific Controller).

.2 All control functions must be perform by a control unit residing on the local area network (UGR, PCM or PCL). The use of components located outside the facility, or a personal computer to perform control is prohibited.

1.3 SYSTEM DESCRIPTION

.1 Distributed DDC type automation system, which includes:

.1 Network management controllers (UGR) for the integration of local DDC control units (PCL, PCT) and third-party controls systems and for their operation on the primary-level network (Ethernet TCP/IP), in accordance with the BACnet protocol.

.2 A primary-level communication network in accordance with Ethernet and TCP/IP, including cabling, network interfaces and Ethernet switch(es).

.3 Secondary communication networks in accordance with the BACnet MS/TP protocol.

.4 Instrumentation ("field devices").

.2 The number and type of controller (UGR, PCM, PCL or PCT) assigned to each controlled system must comply with the architecture shown on drawings.

.3 Two levels of communication:

.1 Primary level Ethernet network ensures communication between supervisory controls (UGR, PCM) and operator workstations.

.2 Secondary level between supervisory controllers (UGR, PCM) and other control units (PCL, PCT) and third-party control systems, such as power metering.

.4 System Operation:

.1 The system uses a number of DDC type control units (PCM, PCL and PCT) to provide reliable operation of local control loops on a standalone basis while allowing easy system expansion.

.2 High level control is accomplished through a human-machine interface (HMI) allowing complete control and monitoring of all DDC units.

.3 Each module composing the system is connected to other modules via transmission buses, which are used for inter-module communication.

.4 To ensure control integrity, each module includes the necessary logic to control its associated process without need to interact with other system components.

.5 All I/O points, control loops and programmed logic related to a system must reside on a single control unit. Unless otherwise noted, data sharing between two controllers for the control of a single system is prohibited.

.5 Power supply:

.1 All equipment must be designed so that memory and control operation are unaffected by possible voltage variations or by wireless communication systems. Refer to item "INSTALLATION" of the current section.

1.4 SYSTEM CAPACITY

.1 DDC type control system, using transparent "peer to peer" communication in accordance with the Ethernet standard, the IP protocol suite and the BACnet communication protocol (ASHRAE 135-1, Annex J), between Master Control Units (PCM), management controllers (UGR) and the software for the centralized management system (OWS, servers). Control units are located strategically with the necessary memory, data and software to control their associated equipment: PCM and PCL (mechanical rooms, electrical rooms), TCUs (ceiling space - mounted directly on or near the equipment for local control with access door for maintenance).

.2 DDC controllers and user interfaces (HMIs) are equipped with the necessary memory, software and operating programs to execute their specified functions.

.3 Failure of a management controller (UGR), a digital control unit (PCM, PCL or PCT) or an HMI shall not affect the EMCS overall operation and shall only affect the data and functions associated with the device in question.

.4 Each DDC control unit (PCM, PCL or PCT) shall control its associated system on a standalone basis, independently of other control units (PCM, PCL or PCT), management controllers (UGR) and operator workstations (OWS).

.5 All these units include the necessary memory and logic to collect data, report alarms (analog or digital), execute commands (manual or automatic), perform scheduling and event functions and execute energy optimization routines.

.6 System allows control units (PCM, PCL) and management controllers (UGR) to be brought online on a step-by-step basis, enabling operation from the operator workstation (OWS). In other words, controller data becomes readily available at the OWS, as connections are established.

.7 For each standalone control units (PCM, PCL), allow for a spare capacity of at least 25% of each point type and a minimum of 25% spare memory capacity for future modifications to the EMCS.

.8 When using expansion modules (or cards) to increase a controller I/O base capacity or for controllers using this type of architecture (modular I/O), the number of I/O points will be limited to the most stringent of the following conditions:

.1 Maximum use of 50% of the theoretical point capacity published in the manufacturer's datasheet.

.2 Maximum of 48 points per controller.

.9 Supervisory controllers (UGR, PCM) shall be configured and provided in sufficient quantity to allow for a 50% spare capacity on each data bus (connecting PCL, PCT and third-party control panels) for future additions and to optimize performance for communication, management control and local archiving.

.10 With each standalone control unit (PCM, PCL), provide a local interface to view input/output values (with engineering units), set point parameters, scheduling programs, alarm status, etc. An interactive keypad allows the user to navigate and perform control functions via the interface display screens.

.11 When a number of standalone control units (PCM, PCL) are installed in a mechanical room, a single local interface (display, keypad) for data display and manual control overrides can be installed, provided the following conditions are met: distance between the interactive panel and the panel without interface is less than 18 m and the panels are located within the same room.

.12 If an interactive display is not available, all controllers (PCM, PCL) are to include built-in hand-off-auto (HOA) switches and status lights for all outputs and include potentiometers for overriding analog outputs. On-board overrides to be detected and displayed at the centralized management system.

.13 **For each** system, provide a **single control unit** (PCM – or PCL when authorized on the network architecture diagram). Unless otherwise noted, the use of a single controller for the control of multiple systems is prohibited.

1.5 MATERIALS OR ACCEPTABLE PRODUITS

.1 When materials or products are prescribed by their trademarks, consult the instructions to bidders to find out how to apply for approval of materials or alternatives.

Part 2 Product

2.1 MASTER CONTROL UNIT (PCM)

.1 General:

.1 Hybrid network management controller combining the functions of a management controller (UGR) with on-board inputs/outputs (I/Os). Performs control and supervision of its associated electromechanical systems, which is installed in proximity, while providing the capability to integrate other control units (PCL, PCT) and/or third-party control panels.

.2 **Fully programmable**, microprocessor based, standalone controller including the following components:

.1 Power supply modules: one for each electronic module.

.2 A 32 bit Central Processing Unit (CPU) for multi task operation and real-time digital control.

.3 Network control module supervising control execution and access on the primary Ethernet TCP/IP network. **Communication protocol** on the primary **Ethernet TCP/IP** network in accordance with the latest **ASHRAE – BACnet standard** (Annex J) – BACnet IP.

.4 Communication interface to supervise and control data communication on its secondary network.

.5 Sufficient non-volatile memory (Flash or EEPROM) to support the operating system, application programs and subprograms. External memories are prohibited.

.6 Sufficient internal rewritable memory (RAM) to support the system database, data trending and archiving, management of local scheduling, alarm programs and permission access control and store the following data: control variables and constants, operating data and settings, scheduling objects, alarm limits, etc.. Memory-resident data to be protected from voltage fluctuations or power loss using a battery back-up or supercapacitor (72 hour minimum capacity).

.7 Real-time running operating system with a battery-backed (battery or supercapacitor) internal clock accurate to plus or minus 5 secs/year.

.8 I/O module with plug-in electronic circuits.

.3 Plug-in terminals to facilitate installation, modification and commissioning of the system.

.4 Master Control Units (PCM) to operate on a standalone basis or in network with other network controllers (PCM, UGR) with no additional equipment required.

.5 Sufficient memory to ensure system operation and store database, including:

.1 Automatic control process.

.2 Energy management applications.

.3 Operator interface.

.6 Controller modules to allow the connection of an operator interface to, perform the following functions, at minimum:

.1 Temperature display.

.2 Display of system status.

.3 Display of setpoints.

.4 Display of parameters.

.5 Control of digital outputs.

.6 Analog setpoint adjustments.

.7 Modification of loop gain and reset constants.

.7 All set points, proportional bands, control algorithms and system's programmable parameters are memory-resident in the controller to avoid module re-programming after a power failure.

.2 Power Supply Module:

.1 Includes a power supply module for each electronic module. Module to distribute power to all interfaces and filter the input signal. Includes the necessary logic to conduct a step-by-step start-up and shutdown to protect data integrity. In cases where the input power module does not include a filter function for the input power, the supply and installation of a UPS unit, as described in Section 25 30 02 – EMCS: Field Control Devices, to connect the PCM power supply will be accepted as an alternative.

.3 Network Control Module:

.1 The network control module is fully programmable by the user. The module communicates, through the secondary level bus with DDC control units (PCL, PCT) to supervise controller actions.

.2 The network controller is microprocessor based and includes a memory bank with battery back-up to store application software, the user database and historical data. Programming in the module is memory-resident.

.4 Base module with Inputs/Outputs (I/Os):

.1 Module consisting of a plug-in electronic circuit board. Plug-in terminal blocks are used to connect I/O equipment. For each PCM controller, provide a connection point for a portable OWS (operation and maintenance). Connection point to provide access to all PCM controllers, management controllers (UGR) and local controllers (PCL).

.2 Minimum Inputs/Outputs requirements:

.1 Inputs/Outputs (minimum for each PCM):

.1 Minimum resolution for analog inputs: 10 bits.

.2 Minimum resolution for analog outputs: 8 bits.

.2 Four analog inputs, type as per following:

.1 Thermistor, 10,000 ohms.

.2 0-10 V D.C.

.3 0/4 – 20 mA.

.3 Eight digital inputs: dry contact.

.4 Seven numerical ouputs: Triacs 24 V C.A.

.5 Four digital outputs: 0-10 V D.C., 0/4 - 20 mA.

.6 Four analog outputs: 0-10 V D.C., 0/4 - 20 m, TRIACS 24 V C.A.

.5 As per model NCE from Johnson Controls, or approved equivalent with BTL Listing as a **B-BC** device.

2.2 LOCAL CONTROL UNIT (PCL)

.1 General:

.1 Performs control and supervision of smaller electromechanical systems. Installed in proximity of their associated system.

.2 **Fully programmable**, microprocessor based (32 bits), standalone controller for multi task operation and real-time digital control, including the following components:

.1 Network control module to supervise and control data communication on its secondary network. Access to the primary Ethernet TCP/IP network is done via a network controller (UGR, PCM). Data communication in accordance with the latest **ASHRAE – BACnet standard**.

.2 Sufficient non-volatile memory (Flash or EEPROM) to support the operating system, application programs and subprograms. External memories are prohibited.

.3 Sufficient internal rewritable memory (RAM) to store operating parameters, control variables and constants, operating data and settings, scheduling objects, alarm limits, etc.. Memory-resident data to be protected from voltage fluctuations or power loss using a battery or supercapacitor (72 hour minimum capacity).

.3 Sufficient memory to ensure system operation and store database, including:

.1 Automatic control process.

.2 Energy management applications.

.3 Operator interface.

.4 Controller modules to allow the connection of an operator interface to, perform the following functions, at minimum:

.1 Temperature display.

.2 Display of system status.

.3 Display of setpoints.

.4 Display of parameters.

.5 Control of digital outputs.

.6 Analog setpoint adjustments.

.7 Modification of loop gain and reset constants.

.5 All set points, proportional bands, control algorithms and system's programmable parameters are memory-resident in the controller to avoid module re-programming after a power failure.

.2 Description:

.1 Controller consisting of a power supply, base module, plug-in electronic circuit board. Plug-in terminal blocks are used to connect I/O equipment. For each PCM controller, provide a connection point for a portable OWS (operation and maintenance). Connection point to provide access to all PCL controllers, management controllers (UGR) and master controllers (PCM).

.2 Inputs/Outputs (minimum for each PCL):

.1 Minimum resolution for analog inputs: 10 bits.

.2 Minimum resolution for analog outputs: 8 bits.

.3 Four analog inputs, type as per following:

.1 Thermistor, 10,000 ohms.

.2 0-10 V D.C.

.3 0/4 – 20 mA.

.4 Four digital inputs : dry contact.

.5 Three digital outputs : Form C relay, 110/220 V A.C.

.6 Six analog outputs : 0-10 V D.C., 0/4 - 20 mA.

.3 As per model FEC from Johnson Controls, or approved equivalent with BTL Listing as a **B-AAC** device.

2.3 APPLICATION SPECIFIC CONTROLLER (PCT)

.1 PCT – Terminal Control Unit – Air Terminal Unit, Terminal Equipment:

.1 Architecture :

.1 Microprocessor based, digital controller including a regulated power supply, a communication interface and an input/output module, all mounted on a digital card and protected by a cover.

.2 All programming in the TCU resides on a non-volatile type memory (EEPROM) in the controller to avoid module re-programming after a power failure.

.3 Application-specific controllers **must be fully programmable**. The use of configurable controllers is prohibited.

.4 Each terminal control unit PCT can operate on a standalone basis or in network with a management controller (UGR) and/or master controllers (PCM), thus providing full transparency of data available at application specific controllers.

.2 The use of application specific controllers PCT with i**ntegrated actuators is prohibited, unless the control card allows the dismantlement of the actuator**. Minimum actuator requirements in accordance with these specifications.

.3 Installed directly on unit (PCT) or in proximity of the unit in the ceiling space in a proper enclosure.

.4 Each PCT, must have the capability to properly execute the operating sequence, as described in Section 25 90 01- Site Requirements Applications and Systems Sequences of Operation.

.2 Minimum Requirements – Terminal units control:

.1 Controller provides DDC type control for local space control applications.

.2 Operating sequence, in accordance with Section 25 90 01- Site Requirements Applications and Systems Sequences of Operation.

.3 Power supply: 20-30 V A.C., 60 Hz, 3.5 to 5 A, 24 V A.C.

.4 Inputs/Outputs:

.1 Provide all analog inputs required for the connection of points shown on drawings and to properly execute the operating sequence, as described in Section 25 90 01- Site Requirements Applications and Systems Sequences of Operation, including the following elements (when applicable):

.2 Analog inputs:

.1 One room thermostat with the characteristics described in these specifications.

.2 One room humidity sensor with 4 to 20 mA signal.

.3 One room temperature sensor (c/w blank cover).

.4 Auxiliary supply air temperature sensor (when applicable).

.5 One or two airflow sensors (pitot station) with electro-pneumatic transducer (EPT) – if required.

.3 Digital inputs :

.1 Two dry contact, for future interlock connection – required for all terminal control unit PCT.

.4 Outputs :

.1 Five digital outputs, 24 V A.C., Triac type, 25 to 500 mA, for on/off or pulsed applications. Used for electric reheat coils (PWM application), start/stop command (unit heaters) or auxiliary heat (electrical convectors).

.2 Two proportional outputs to modulate airflow control dampers. Floating-point control is acceptable if actual position feedback is provided at the controller.

.3 Minimum Requirements – Heat pumps control:

.1 Controller provides DDC type control for local space control applications.

.2 Operating sequence, in accordance with Section 25 90 01- Site Requirements Applications and Systems Sequences of Operation.

.3 Power supply: 20-30 V A.C., 60 Hz, 3.5 to 5 A, 24 V A.C.

.4 Inputs/Outputs:

.1 Provide all analog inputs required for the connection of points shown on drawings and to properly execute the operating sequence, as described in Section 25 90 01- Site Requirements Applications and Systems Sequences of Operation, including the following elements (when applicable):

.2 Analog inputs:

.1 One room thermostat with the characteristics described in these specifications.

.2 One room humidity sensor with 4 to 20 mA signal.

.3 One room temperature sensor (c/w blank cover).

.4 Auxiliary supply air temperature sensor (when applicable).

.5 One or two airflow sensors (pitot station) with electro-pneumatic transducer (EPT) – if required.

.3 Digital inputs :

.1 Two dry contact, for future interlock connection – required for all terminal control unit PCT.

.4 Outputs :

.1 Five digital outputs, 24 V A.C., Triac type, 25 to 500 mA, for on/off or pulsed applications. Used for electric reheat coils (PWM application), start/stop command (unit heaters) or auxiliary heat (electrical convectors).

.2 Two proportional outputs to modulate airflow control dampers. Floating-point control is acceptable if actual position feedback is provided at the controller.

.4 Minimum Requirements – Fancoil control:

.1 Controller provides DDC type control for local space control applications.

.2 Operating sequence, in accordance with Section 25 90 01- Site Requirements Applications and Systems Sequences of Operation.

.3 Power supply: 20-30 V A.C., 60 Hz, 3.5 to 5 A, 24 V A.C.

.4 Inputs/Outputs:

.1 Provide all analog inputs required for the connection of points shown on drawings and to properly execute the operating sequence, as described in Section 25 90 01- Site Requirements Applications and Systems Sequences of Operation, including the following elements (when applicable):

.2 Analog inputs:

.1 One room thermostat with the characteristics described in these specifications.

.2 One room humidity sensor with 4 to 20 mA signal.

.3 One room temperature sensor (c/w blank cover).

.4 Auxiliary supply air temperature sensor (when applicable).

.5 One or two airflow sensors (pitot station) with electro-pneumatic transducer (EPT) – if required.

.3 Digital inputs :

.1 Two dry contact, for future interlock connection – required for all terminal control unit PCT.

.4 Outputs :

.1 Five digital outputs, 24 V A.C., Triac type, 25 to 500 mA, for on/off or pulsed applications. Used for electric reheat coils (PWM application), start/stop command (unit heaters) or auxiliary heat (electrical convectors).

.2 Two proportional outputs to modulate airflow control dampers. Floating-point control is acceptable if actual position feedback is provided at the controller.

.5 As per model FEC from Johnson Controls, or approved equivalent with BTL Listing as a **B-ASC or BTL-AAC** device.

2.4 BUILDING CONTROLLER SOFTWARE

.1 General:

.1 Software and application programs reside on each individual controllers and cannot be subservient to a computer with higher-performance.

.2 Software consists of discrete programs, which are combined to satisfy a specific controls sequence, by using input data (sensors, detectors), programming the required operating sequence and executing the adequate commands to output devices.

.2 Programming:

.1 Control loops must be programmable to satisfy operating sequences.

.2 Energy management and Events programs must have the ability to interrupt operating sequences to optimize operation.

.3 Software to provide the ability to program priority levels for individual programs.

.4 Logical points (pseudo points) can be created to provide access to calculated points, scaled conversions, setpoint deviations, etc.

.3 Control Logic:

.1 Building controllers (UGR, PCM, PCL and PCT) to be able to perform the following control algorithms:

.1 Two position control.

.2 Proportional constant.

.3 Proportional Integral and Derivative (PID) control.

.4 Automatic loop constant adjustment.

.5 Boolean Logic.

.6 Mathematical functions (addition, subtraction, multiplication, division, square root extraction, n-root extraction, etc.).

.2 Control software to provide ability to define time between successive starts for each piece of equipment to reduce cycling of motors.

.3 Provide protection against excessive electrical-demand situations during start-up periods by automatically introducing time delays between successive start commands to heavy electrical loads.

.4 Power Fail Restart: upon resumption of power, NMC or MCU to analyze status of controlled equipment, compare with normal occupancy scheduling, turn equipment on or off as necessary to resume normal operation.

.4 Energy management:

.1 NMC, MCU to provide for the following energy management routines:

.1 Time of day scheduling.

.2 Calendar based scheduling.

.3 Holiday scheduling.

.4 Temporary schedule overrides.

.5 Optimal start

.6 Optimal stop.

.7 Night setback control (± 1.5 °C , adjustable).

.8 Enthalpy (economizer) switchover.

.9 Peak demand limiting.

.10 Temperature compensated load rolling.

.11 Fan speed/flow rate control.

.12 Heating/Cooling Lockout.

.13 Setpoint reset based on a separate variable.

.14 Equipment sequencing.

.2 Programs to be executed automatically without need for operator intervention and be flexible enough to allow customization.

.5 Scheduling and Event Programs:

.1 Provides the ability to generate commands such as “on/off”, setpoint reset, based on the following schedules: time of day, day of the week, calendar date, summer/winter.

.2 For each equipment, a minimum of four (4) start-up schedules and four (4) shut-down schedules per day can be programmed.

.3 Programming of start/stop schedules, holidays, etc. must be simple and user-friendly (calendar and scheduling table format required).

.4 A UGR (or master controller PCM) can automatically switch between schedules based on a specific date or an event, for example: outdoor air temperature fluctuations near a seasonal setpoint.

.5 Holiday schedules can be programmed to override normal operation schedules (weekday). Thirty (30) holidays can be programmed, up to a year in advance, each with an adjustable period of one (1) to thirty-one (31) days.

.6 An exception program can be scheduled up to a year in advance. This program has priority over normal programs for the day that it has been assigned.

.6 Historian and Trending:

.1 Historical data collection and trending programs log change in point values over time, with the intent to assist the user in troubleshooting issues that could potentially arise in the system. Network Management Controllers (UGR), Master Control Units (PCM) or Local Control Units (PCL) with capabilities to perform the following data logging:

.2 Continuous Historical Data:

.1 Continuous storing of point historical data for the previous forty-eight hours (48h) with a 15 minutes sampling rate and recording of change of state/value for each digital input and all output points. Historical data can be transferred to an operator workstation for long-term storage. Historical data collection is automatically available for all points.

.2 Other types of trend logs allow the user to select specific points and create custom trends to collect data.

.3 Performance Trending:

.1 System to allow high-resolution sampling rates, through Master Control Units (PCM) or Network Management Controllers (UGR) to evaluate performance of control loops. Sampling rates to be operator-selectable between 10 to 300 seconds, with a resolution of 1 second.

.4 Trend Data Sampling:

.1 User-defined trend objects to collect real or calculated point values at an operator selectable rate of 10 seconds to 60 minutes. Each Master Control Unit (PCM), or Network Management Controller (UGR) – when applicable, to store collected trend data on a buffer memory with minimum capacity to store forty-eight hours (48h) of trend data considering all connected points at a sampling rate of 15 minutes or 5,000 sampling values.

.5 Storing and Archiving:

.1 Trend data to be stored on Network Management Controller (UGR) or, when applicable, at Master Control Unit (PCM) or Local Control Unit (PCL). Trend data can be downloaded to a different media for archiving purposes.

.2 Trend data can be downloaded at regular intervals, as set by the operator, or automatically when buffer memory for trending is at full capacity.

.3 Trend data can be exported in file format, which can be used by other programs on a microcomputer.

.7 Totalization:

.1 Run-time:

.1 UGR (or PCM and PCL – when applicable) to automatically accumulate and store run-time data for user-selected digital input and digital output points. Totalization to have sampling resolution of one (1) min or less. Run-time limits can be configured to automatically generate alarm notifications and user-defined messages, when limit is reached.

.2 Analog and Pulsed Values:

.1 UGR (or PCM and PCL – when applicable) to automatically collect, calculate and store consumption totals on daily, weekly or monthly basis for user-selected analog or digital pulse input-type points. Totalization to provide calculations and storage of accumulations up to 99,999 units (eg. kWH, litres, tonnes, etc.).

.2 Totalization routine to have sampling resolution of one (1) min or less. Warning limits can be configured to automatically generate alarm notifications and user-defined messages, when limit is reached.

.3 Events:

.1 UGR (or PCM and PCL – when applicable) to store event totalization records (e.g. totalized equipment start/stops) on daily, weekly or monthly basis. Totalization to accumulate and store up 20,000 events before reset.

.2 Warning limits can be configured to automatically generate alarm notifications and user-defined messages, when limit is reached.

.8 Demand Response:

.1 Demand response programs to supervise meter and forecast energy demand. When forecasted value exceeds the energy target, system to drop non-essential loads to limit demand. A load alternator program also cycles the operation of equipment to reduce energy consumption.

.2 The two programs are coordinated so that load shedding and equipment cycling functions are distributed equally within the facility. Additionally, space temperatures or other comfort indicators are continuously supervised to ensure equipment shutdowns do not affect the comfort of occupants.

.3 Each building controller residing on the network can supervise up to (4) meters. However, load shedding can be performed at any building controller linked to the network.

.9 User-defined programs:

.1 Allow users to program additional control functions in management controller (UGR) or master controller (PCM) – when applicable, such as: optimized start, night setback setpoint reset, economizer mode, etc.

.2 These energy management programs are configured from an operator workstation (OWS) and then downloaded into management controls (UGR or PCM) via the primary communication network.

.10 Access Control:

.1 The network control module embedded in the Network Management Controller (UGR) or Master Control Unit (PCM) – when applicable, provides password access protection. A password (minimum 4 characters) is assigned to each user, along with an authorization level, which can limit access to certain functions and or group pf points.

.2 A minimum of three (3) levels of password protection are supported at the UGR controller, or PCM master controller – when applicable. Authorization levels format as per the following:

.1 Operator Level: display only.

.2 Intermediate Level: limited operational commands including automatic override.

.3 Supervisory Level: full operational commands including automatic override and system administration of authorization levels.

.3 Up to fifty (50) user accounts can be programmed.

.11 Special Processes:

.1 Network Management Controller (UGR) or Master Control Unit (PCM) – when applicable, to be capable of executing specific special processes, as required by the user, calculations and subprograms.

.2 Process inputs and variables:

.1 Following items to be available for use in special processes:

.1 Any state or value measured in the system.

.2 Any calculated value.

.3 Any result from another process.

.4 User-defined constants.

.5 Arithmetical functions (+, -, *, /, exponent).

.6 Boolean logic operators.

.7 Time functions.

.8 Coordination or transfer functions between building controllers.

.3 Program branching:

.1 Special processes can be executed based on any of the following branching conditions: time interval, time of day, date, other processes, scheduling programs, events (alarms, etc.).

.4 Dynamic data:

.1 Each process can use measured or calculated values from other UGR or master controllers PCM – when applicable, connected on the network or send commands to control points (physical or logical) resident on any building controller (UGR, PCM, PCL, PCT).

.5 Messages:

.1 Processes to generate user-specific messages at operator interfaces.

.6 Documentation:

.1 All programming performed for special processes to be self-documenting with programming flowcharts.

.12 Alarm Management:

.1 Alarm management program to supervise, store and push alarm reports to operator interfaces and memory files.

.2 Each UGR or master controller PCM analyzes and filters alarms to limit traffic on the communication network caused by non-critical alarms, while preventing any alarms from being supressed.

.3 Alarm reporting capabilities of UGR or master controllers PCM are not affected by user activity on workstations (OWS) or by inter-communication with other building controllers on the network.

.4 Point - change of state:

.1 Any alarm report or point change of state to include the point description and the date and time at which the event occurred.

.5 Priorities:

.1 A system specific action can be defined by the user for each point. A priority alarm table can be set to minimize reporting of non-essential alarms and quicken response time to annunciate critical alarms to operators. System to classify a minimum of three (3) alarm levels.

.2 UGR or master controller PCM, to prevent reporting of selected alarms during start-up or shut down of systems. For each point, the operator can manually disable alarm reporting functions.

.3 Conditions for which an alarm (of change of state) can be acknowledged and/or filed for follow-up (for future recovery or analysis) can be defined by the operator.

.6 Alarm reporting:

.1 Alarm reports, messages and notifications must be routed to an alarm storage system for proper archiving. Alarms must be automatically rerouted to a backup system in the event of a communication failure with the primary storage system.

.7 Alarm messages:

.1 System to allow a minimum of (250) operator-editable messages, each with (65) characters, to provide a description of the alarm condition and a secondary message for any action required in response to the alarm. Each message can be assigned to any number of points in the system.

Part 3 Execution

3.1 GENERAL

.1 All wiring must be done in accordance with manufacturer's recommendations and applicable codes and standards.

.2 Provide all devices and equipment required for control and supervision as well as all remote devices, accessories and equipment, software, interlock wiring and conduits, which are required to obtain a complete system, as described in these specifications.

3.2 INSTALLATION

.1 Design and install system so it operates in "fail-safe" mode in event of loss of power.

.2 Use uninterruptible Power Supply (UPS) and emergency power to connect controllers (UGR, PCM and PCL) and network equipment.

.3 UPS units provide a regulated power supply (filtered input) and ensures operation of equipment for thirty minutes in the event of a power loss.

END OF SECTION

TABLE OF CONTENTS

General

1.1 RELATED SECTIONS

.1 Section 20 00 10 – Mechanical and electrical general instructions.

.2 Section 25 05 01 – EMCS – General Requirements.

.3 Section 25 05 02 – EMCS – Submittals and Review Process.

.4 Section 25 05 11 – EMCS – Start-up, Verification and Commissioning.

.5 Section 25 05 54 – EMCS – Identification.

.6 Section 25 90 01 – EMCS – Site Requirements, Applications and Systems Sequences of Operation.

1.2 REFERENCES

.1 National Electrical Manufacturer's Association (NEMA):

.1 NEMA 250 – Enclosures for Electrical Equipment (1000 V Maximum).

.2 International Electrical Commission (IEC):

.1 IEC 60529 – Classification of Degrees of Protection Provided by Enclosures (IP Code).

1.3 SUBMITTALS

.1 Submit shop drawings, technical sheets and manufacturer's installation instructions in accordance with Section 25 05 02 – EMCS – Submittals and Review Process. The shop drawings and technical sheets must include the following:

.1 All specified information for each device.

.2 Detailed manufacturer’s installation instructions.

.3 Identify each technical sheet submitted for verification with the acronym used in the plans and specifications.

.4 If the technical sheet shows more than one model or options, indicate with an arrow which is selected.

.2 Testing prior to installation:

.1 Provide a random sample from the delivered material, based on the Engineer's requirements, which will be tested prior to installation is to begin. Replace the equipment which performance do not meet the specified requirements.

1.4 INSTALLATION INSTRUCTIONS

.1 Provide manufacturer’s shop drawings, technical sheets and instructions relating to the installation of the devices.

.2 Install devices according to manufacturer’s recommendations.

1.5 EXISTING CONDITIONS

.1 Cutting, adjustment and phasing: as required in Section 20 00 10 - Mechanical and Electrical General Instructions.

.2 If necessary, repair surfaces that have been damaged during the course of the work.

.3 Give the client's representative removed materials that cannot be recovered.

1.6 ACCEPTABLE MATERIALS OR PRODUCTS

.1 When materials or products are prescribed by their trademarks, consult the instructions to bidders to find out how to apply for approval of materials or alternatives.

Part 2 Product

2.1 GENERAL

.1 Control devices of each category to be of same type and manufacturer.

.2 Operating conditions: 0 – 40ºC with 10 – 90% RH (non-condensing) unless otherwise specified.

.3 Terminations: use standard conduit box with slot screwdriver compression connector block unless otherwise specified.

.4 Transmitters and sensors to be unaffected by external transmitters including walkie-talkies.

.5 Account for hysteresis, relaxation time, maximum and minimum limits in applications of sensors and controls.

.6 Outdoor installations: use weatherproof construction in NEMA-4 enclosures.

.7 Control devices to satisfy the following requirements:

.1 Linearity: relationship between control device measurement (temperature, humidity, pressure, etc.) and output signal to be linear type.

.2 Control limits: control devices to maintain their controlled variable within the following set point limits:

.1 Temperature:

.1 ± 0.8°C (1.5°F) in spaces.

.2 ± 0.3°C (0.5°F) for chilled water, cooling tower water and hot water systems.

.3 ± 0.5°C (1.0°F) in all other applications.

.2 Humidity:

.1 ± 5% in all cases.

.3 There must be no hysteresis.

.4 Controls must react to changing conditions.

.8 All control equipment and field devices provided under this section must meet or exceed the level of performance, the operational requirements and the fabrication characteristics of the equipment described in these specifications. Equipment with any variation from these specifications in terms of quality, performance, construction, operating sequences or system features must be reviewed and approved as an equivalent by the Consultant.

.9 The control Contractor is responsible for the supply, installation, submitted drawings and warranty of all accessories included in the plans and specifications, even if it is not manufactured by the control manufacturer.

2.2 ELECTRICAL CONTROL DEVICES

.1 R – Electrical relay:

.1 4PDT or DPDT, with silver or nickel alloy contacts, LED status indicators, and self-maintained test button.

.2 Plug-in type with termination base. In applications where relay is subject to vibration, provide hold-on clip.

.3 Complete with enclosure when installed outside panels.

.4 When used for switching, use appropriate contact rating.

.5 As per Omron model MYxIN or approved equivalent from Magnecraft.

.2 TR – Transformer:

.1 Single phase transformer, enclosed type complete with fuse holder and fuse. Transformer capacity in VA to be at least 20% greater than the rated charge to be connected. Use of transformers with integrated thermal protection or with intrinsic limitation as an alternative to fuses is prohibited.

.2 As per MC series from Marcus or approved equivalent from Hammond.

.3 ES – End switch:

.1 Heavy duty end switch with position indicator, water proof metallic box and stainless steel adjustable roller lever switch.

.2 IP67 certified.

.3 Contacts: SPDT, 600 V A.C., 10 A, continuous (NEMA-A600)

.4 As per series 9007, type C, from Square D (Schneider Electric) or approved equivalent from Siemens or Allen-Bradley.

.4 Local monitoring panel – Accessories:

.1 PB – Push-button:

.1 Momentary type, normally closed (N.C.) or normally opened (N.O.) as per application, NEMA-4X enclosure rating, dimension: 22 mm.

.2 PL - Pilot Light:

.1 LED type light indicator, for 24 or 120 V supply, NEMA-4X enclosure rating, dimension: 22 mm.

.3 SS - Selector Switch:

.1 Two (2) or three (3) position, as indicated on drawings, NEMA-4X enclosure rating, rated for 120V, dimension: 22 mm.

.4 As per type XB4 from Schneider Electric or approved equivalent from Klockner-Moeller, Siemens or Allen-Bradley.

.5 AA – Audible alarm:

.1 Piezoelectric type.

.2 As per Sonalert from Mallory.

.6 Strobe – Visual alarm:

.1 Industrial quality visual alarm, stroboscopic light type, for wall mounting, NEMA-4X enclosure rating, cUL certified, complete with mounting accessories.

.2 Colour: red

.3 Power: 120 V A.C.

.4 As per series 105 from Edwards Signaling or approved equivalent.

2.3 EM – ELECTRICAL MOTORS

.1 General:

.1 When materials or products are prescribed by their trademarks, consult the instructions to bidders to find out how to apply for approval of materials or alternatives.

.2 Selection of the type and number of engines to achieve 50% more power than the theoretical power required.

.3 Such as Belimo, type NF and AF, or approved equivalent of Siemens, Johnson Controls, Honeywell or an addendum approved replacement product, in accordance with instructions to bidders.

.2 For use on terminal air units:

.1 Proportional modulant type only.

.2 Selecting the type of engines to achieve 20% more power than the theoretical power required.

.3 Such as Belimo, type LMB24-SR and CMB24-SR or approved equivalent of Siemens, Johnson Controls, Honeywell or an addendum approved replacement product, in accordance with instructions to bidders.

2.4 GAS DETECTORS

.1 General:

.1 Arrangement and number of detection points:

.1 The number and location of detection points are shown in the plans as a reference. The manufacturer will have to provide drawings showing the exact location of these points.

.2 Verification and calibration:

.1 The work includes the provision and services of a technician, accessories and standard gas cylinder for verification and calibration for a period of two (2) years of gas probes/transmitters every six (6) months (four (4) times) from the date of acceptance of the work.

.2 Following each visit of the technician, a verification and calibration report will have to be given to the owner's representative certifying the proper functioning of the system.

.2 O_2 Oxygen Detector:

.1 Provide and install where indicated to the plans, the autonomous O_2 detection device with analog probe.

.2 BACnet MS/TP single-system gas detection device for wall mounting to detect oxygen (O_2).

.3 The transmitters will be designed to selectively analyze toxic gas concentrators. The detecting cells will be electrochemical.

.4 Transmitters must be installed at a height capable of effectively detecting toxic gases. The transmitters for O_2 detection will be installed at the next height;

.1 DG-1 – 30cm under the ceiling.

.2 DG-2 – 30cm above the floor.

.3 DG-3 – Installation next to the nitrogen cylinder.

.5 The complete system will be provided with two-level data processing panel.

.6 The stand-alone device is equipped with an audible and visual alarm for locally signalling alarms.

.7 The device is equipped with two (2) directional bipolar relays.

.8 As Vulcan no E3SA - E3O2 for surface mounting or approved equivalent of MSA.

2.5 LOCAL MONITOR PANNELS

.1 General:

.1 Unitized Cabinet TYPE, NEMA-1, 610 mm x 815 mm x 205 mm (24” x 32” x 8”) with front door mounted on easily removable concealed hinges for inside access, key lock. Install them on rigid supports for mounting on the wall, floor, ceiling or on ventilation ducts.

.2 Provide a minimum of 20% open space at the bottom of the panel for future additions.

.2 Location:

.1 Locate them according to the convenience of the premises with 100 mm (40") open space at the front of the cabinet.

.2 All components with an adjustment or display must be located at a height accessible from the ground.

.3 Accessories

.1 Install all control equipment inside the panels, including all relays, switches, fuse carriers and fuses, identified boundaries, UPS, transformers, differential pressure detectors, differential pressure sensors, etc.

.2 Insert push buttons, control lamps, filter differential pressure gauges and/or probes into the panel door, 70 mm (2½") pressure gauges, temperature meter and humidity meter, etc.

.3 Install all cables in gutters of sufficient size for a filling rate of up to 50%.

.4 Identification:

.1 Inside the panel, identify all accessories at The Dymo.

.2 All pneumatic tubes with the same colour code for all panels.

.3 Identify all electrical wiring at both ends.

.4 Identify all pneumatic tubes.

.5 Power source:

.1 Some panels must be with a separate 120V source connected to a switch, close to the panel, all by this section.

.2 Switches must be from the same manufacturer as rail plug-in terminal blocks or the industrial type mounted on a 50 mm x 100 mm (2"x4") electrical box.

.6 Junction block for electrical connections:

.1 All joints or connections must be made on screw terminals. The use of twisted cables attached with electrical tape is prohibited.

.2 Screw terminal blocks must be snapped on a DIN rail with color code, separators for different voltage or voltage sources, identifiers.

.3 Provide 10% (minimum 10 terminals) of free connection terminals per panel.

.4 Such as the SAK type of Weldmoller or approved equivalent of Entrelec.

.5 Control panels should have a minimum of 20% free space for the installation of future components. This space must be continuous in the upper part of the control panels.

.7 Schematic:

.1 Permanently install a schematic design on the panel door that explains the arrangement of the system.

.2 This design must be sealed in a transparent plastic type that does not deteriorate.

Part 3 Execution

3.1 INSTALLATION

.1 Install the equipment and components so that the manufacturer's and CSA's label are clearly visible and readable once commissioning is complete.

.2 Install local instrumentation in accordance with the procedure, instructions and methods recommended by manufacturers.

.3 Place temperature and humidity transmitters, current/air pressure transducers, solenoid valves, regulators and relays in NEMA I cases or in another type of case or envelope,

depending on the needs of the work. Protect contiguous elements of different materials from electrolytic action.

.4 Mount local panels, sensors and transmitters on support pipes or on console profiles.

.5 Allow space for fire protection and maintain the nominal fire-resistance characteristics.

.6 Electrical connections:

.1 Complete the entire electrical installation in accordance with Section 26 05 00 - Electricity - General Requirements for the results of the work.

.2 Change existing starters to reflect the EMCS, as indicated and based on E/S summaries.

.3 Connect conductors to screw connectors that are suitable for the size of the screws and the number of terminations planned.

3.2 CONTROL/REGULATION TABLES

.1 The conduits and tubes must enter the cabinets of the paintings from the top, under side or sides.

.2 Place the wiring and tubes inside the cabinets in cable paths, or staple them individually to the bottom of the cabinets.

.3 Properly identify cables and conduits.

3.3 EQUIPMENT IDENTIFICATION

.1 Properly identify the control devices in accordance with section 25 05 54 - EMCS - Identification of equipment.

3.4 TESTING AND COMMISSIONING

.1 Calibrate local instrumentation and then test it for accuracy and performance in accordance with section 25 01 11 - EMCS - Start-up, verification and commissioning.

END OF SECTION

TABLE OF CONTENTS

Part 1 General

1.1 PROGRAMMING

.1 The sequences, procedures and programs described in the part "EXECUTION" of this section represent the minimum operation criteria's, excluding the fine details required for tuning of the systems. The supplier of the current section is responsible for system programming and must, as an expert in configuring and commissioning this type of installation, provide all control stratagems, including: delays, ramps, reset functions, interlocks, cascade loops, etc., in order to obtain a system operation that is safe, simple and efficient.

.2 Any modification, addition or refinements to operating sequences, as required or requested by the Consultant, to improve system stability or equipment protection, will be executed without additional costs.

1.2 CONFIGURATION AND CUSTOMIZATION

.1 System configuration and customization must be executed in collaboration with the Owner, in order to allow an easy transfer to operation team.

.2 Messages, descriptors, equipment keywords, etc., must be submitted for approval.

.3 Choice of colors, graphic layouts (displays), system breakdown, tree structure (level of intrusion) and graphic configuration must be done in coordination with the Owner.

.4 Creation of reports, headers, information displayed and its layout, printing frequency and periods, etc., are done in coordination with the Owner.

.5 Further to the dynamic graphic of each systems, a dynamic architectural floorplan for each floor, showing the location of all terminal units, thermostats and lighting statuses. The operator must be able to (by selecting the terminal unit or the thermostat) display all the parameters, statuses, damper positions and all measured variables of the unit with the possibility to modify all the parameters and functions relating to the unit.

.6 The graphics creation must be done to Owner's standards and specifications, as shown in appendix.

Part 2 Product

2.1 NOT USED

.1 Not Used

Part 3 Execution

3.1 GENERAL

.1 Setpoints, parameters and constants:

.1 All setpoints, compensation rates and limits, calendars and schedules are adjustable by the operator, provided he has an authorization level. Similarly, all parameters, constants, programmed delays can be adjusted by an operator with the proper access authorization.

.2 Constants and control modes:

.1 All control loops shall be proportional and integral (PI) type except for flow and pressure control loops which shall be proportional, integral and derivative (PID) type and limit loops, which are proportional only.

.2 On-site, the operator must be able, without making programming modifications, to delete (or add) any type of control mode, modify constants or parameters, etc.

.3 Adjust all control loops in order to obtain a system that will provide a stable operation during extreme conditions, with minimum access time.

.4 Program filters to stabilize analog readings, more specifically on pressure and flow readings used in control loops.

.5 For each start-stop command, provide a minimum “On” and minimum “Off” time to eliminate cycling.

.3 Analytical data transfer:

.1 The data trending and analytical calculation strategy must ensure that the data transfer on the associated network is minimized as much as possible. Therefore, the result of a calculation, instead of the data required for the calculation, will be transmitted directly.

.4 Analog alarms:

.1 For each analog measurement point, program high and low limit alarms.

.2 Allow for the programming of four (4) alarm limits: two low-limits and two high-limits.

.3 Each of these alarm setpoint can be modified or supressed, as required by the operator.

.4 Unless otherwise noted, alarms originating from sensors located in a system duct (or piping) will be interlocked with their corresponding fan (or pump) in order to supress alarms when a system is not running.

.5 Critical alarms:

.1 When the status is available, program critical alarms for the following points:

.1 Unauthorized "on-off" for fans, pumps, etc.

.2 Freeze risk.

.3 High or Low pressure.

.4 Fault (equipment).

.5 Abnormal control state (level, pressure, temperature).

.6 Main electrical phase loss.

.6 Maintenance alarms:

.1 When the status is available, program maintenance alarms for the following points: System stopped, dirty filter, running time.

.2 When a status is available, provide cumulative running time of the equipment.

.7 Analog current transmitter analysis:

.1 For each analog current transmitter, provide real time consumption percentage of the associated motor or equipment by comparing the actual current reading with the full load current consumption.

.2 For all belt driven motor, remove the belts to measure the current with no load, then reinstall the belts. Alarm when the no load value is detected.

.8 Setpoint ramping:

.1 On system start-up or following a set point modification, an ascending (or descending) ramp must be implemented to increase (or decrease) progressively a set point towards its final value, thus preventing risks such as freezing, low-pressure, high-pressure, etc. Ramp rates must be adjustable.

.9 Starting after a power failure:

.1 Once power is restored, every electro-mechanical equipment (i.e. fans, pumps) is started in accordance with a predefine sequence to avoid a power overload and control peak demand. Provide a programmable start-up delay for each equipment controlled.

.10 Starting manually:

.1 Upon detection of a non-start signal or a non-authorized stop (manually commanded at the starter), a maintenance alarm is issued and the system is controlled as per the normal sequence of operation.

.11 Optimized start:

.1 For each system, provide an optimized start algorithm.

3.2 SEQUENCES OF OPERATION – GAS URGENT EVACUATION ROOM 161

.1 General:

.1 The offices are supplied with air via the VV-xx double sheath terminal units and are controlled according to the type of control described below for informational purposes.

.2 The VV-xx s terminal units are powered by S-1 air central.

.3 The E-07 exhaust works at all times at low speeds.

.2 At shutdown:

.1 E-07 exhaust is at off.

.2 The VME-E07 isolation component is closed.

.3 At Start-up:

.1 The VME-E07 isolation component opens.

.2 E-07 exhaust starts upon receipt of proof of flap opening.

.4 Normal operation:

.1 The E-07 exhaust operates at the minimum speed established during the balancing (adjustable).

.5 On detection:

.1 When one of the oxygen detection probes detects a low oxygen level 19.5% (adjustable) the E-07 exhaust accelerates to reach its balancing emergency evacuation point.

.2 A visual and audible alarm is activated in the room.

.1 A silence button stops the sound alarm.

.3 An alarm is sent to the DDC

.6 Emergency Control:

.1 By pressing the emergency button inside Room 161, the operator starts the following emergency sequence:

.1 The E-7 fan starts and accelerates to reach its swaying emergency evacuation point.

.2 A visual and audible alarm is activated in the room

.3 A visual alarm appears at the DDC

.7 Signage and alarms:

.1 The following alarms are generated at the DDC plant:

.1 Low oxygen level.

.2 Very low oxygen level.

.3 Unintended shutdown of E-07 exhaust.

.8 Terminal dual sheath power unit with variable air volume:

.1 The probes in the premises are blind. There may be several probes present in the same room. In such a case, the room temperature in this sequence will correspond to the average probe in the room. The room temperature set point must be adjustable from the control centre.

.2 See the room temperature control diagram on the plans in this section.

.3 "Unoccupied" mode:

.1 Same as busy.

.4 "Occupied" mode:

.1 The terminal air supply unit is continuously in "busy" mode.

.2 T:

.1 The digital controller calmly increases or decreases (ten minutes) from room temperature to its value in "busy" mode (P.C.: 21°C, adjustable).

.2 The digital controller sequences the shutter of the terminal boxes in unison, then the shutters of the other terminal boxes in the area in unison, adjusting the modulation signal of the cold deck shutter and the warm deck to maintain the room temperature at the "busy" mode.

.3 If the set temperature is not reached, the power rate of each box gradually increases by 10% at 5-minute intervals until the desired temperature is obtained.

.3 TA:

.1 The digital controller adjusts the shutter modulation signal according to the TA probe, which serves as a high and low limit for the power temperature. The low limit is 13°C in cooling and the high limit is 35°C in heating.

END OF SECTION