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CANADIAN SPACE AGENCY
Ventilation of local 2B-100

Specifications – Mechanical

2022-03-18
Project: 2020-134-1006

CANADIAN SPACE AGENCY

6767 ROUTE DE L'AÉROPORT

SAINT-HUBERT (QUÉBEC)

J3Y 8Y9

VENTILATION OF LOCAL 2B-100

DIVISIONS 20, 21, 22, 23 AND 25

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For tender
March 18, 2022

TABLE OF SECTIONS

- 23 33 00 AIR DUCT ACCESSORIES
- 23 33 15 DAMPERS - OPERATING
- 23 34 00 HVAC FANS
- 23 37 13 DIFFUSERS, REGISTERS AND GRILLES
- 23 37 20 LOUVERS, INTAKES AND VENTS
- 23 44 00 HVAC AIR FILTRATION
- 23 73 00.13 AIR HANDLING UNITS – BUILT UP
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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.

1.14 MATERIALS

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

1.15 PROTECTION OF WORKS AND MATERIALS

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

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

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

1.16 WASTE MANAGEMENT

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

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

.1 Brick and Portland cement concrete.

.2 Corrugated cardboard.

.3 Drywall (unfinished).

.4 Steel.

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

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

.1 Time and date of removal operations.

.2 Description of the material and the quantity.

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

1.17 SHOP DRAWINGS

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

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

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

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

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

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

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

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

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

.10 The drawings must be in French.

1.18 COORDINATION DRAWINGS

.1 General:

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

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

.2 Description:

.1 Coordination drawings consist of dimensioned plans, to scale, indicating the position of the equipment, ducts, piping, valves and other accessories with cuts and details required, complete with piping and duct dimensions, locations of sleeves, openings, anchorages and supports, relative positions with structure, architectural works, mechanical and electrical work, the positioning of the access doors, the clearances required for the maintenance of equipment and all other disciplines.

.2 Each mechanical and electrical section must provide on their coordination drawings the details of their levelling bases and housekeeping pads.

.3 Preparation:

.1 Each relevant section must make their coordination drawings and coordinate them with other disciplines.

.2 All drawings must be coordinated by the Contractor in collaboration with all sections.

.3 The coordination drawings for each sector must be submitted all at once for verification.

.4 The section "VENTILATION – AIR-CONDITIONING" is responsible for coordinating drawings with each section. These sections must provide all the data, diagrams, drawings and diagrams necessary for this coordination work.

.5 The section "VENTILATION – AIR-CONDITIONING" must prepare a drawing with its own work with all data and dimensions necessary and incorporate all the information provided by the other sections.

.4 Collaboration:

.1 Close collaboration must exist between the sections in order to determine the location of their respective work and avoid incompatibilities.

.5 Distribution of coordination drawings:

.1 Before submitting the drawings to the Engineer for verification, the general Contractor and each of the sections must sign the plans.

.2 Submit to the Engineer two paper copies and one emailed digital PDF copy of the scaled coordination drawings signed by the General and Sub Contractors for verification.

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

.4 Once commented on, the drawings will be corrected by the relevant section, and, if required, resubmitted.

.6 Responsibility:

.1 Each section is directly responsible for the placement and exact dimensions of openings, perforations and sleeves, the location of its equipment, pipes and ducts, whether the Engineering drawings are included or not.

.2 The Division 23 (section "VENTILATION – AIR-CONDITIONING") must ensure the full coordination of its work with the coordination drawings.

.3 No compensation will be given for the modifications of the work for the purpose of coordination and integration of the electromechanical systems.

.4 Notwithstanding the responsibility of coordinating the integration, work cannot be implemented without prior verification of the coordination drawings. Each section must redo, at its expense, all work nonconforming to the coordination drawings without any compensation based on a misinterpretation of the scope and limitations of its work. Such misinterpretations do not relieve the relevant section of its responsibilities and obligations to provide complete and duly proven, ready to operate systems in fully integrated and in perfect condition.

.5 Verification of the coordination drawings by the Engineer serves to ensure that the technical requirements appear to be generally met. The Engineer does not check the quality of the coordination carried out by the Contractors.

.7 Pre-existing work:

.1 Coordination drawings should account for existing mechanical, electrical, structural and Architectural installations as well as planned work.

.8 Coordination drawings are required for:

.1 The placement of sleeves, openings and perforations expected in the walls, floors, beams and columns.

.2 Anchors.

.3 Work on the fire sprinkler and fire prevention.

.4 All ventilation work – air conditioning.

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

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

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

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

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

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

.9 Original coordination drawings:

.1 At the end of the work a USB flash drive (containing the "dwg" and "3D Revit model", depending on program used) is to be included with each O&M manual and two paper copies of the as-builts are to be submitted to the Owner, for no additional charge, by each section.

1.19 USING DIGITAL MODELS FOR COORIDNATION

.1 DWG plans:

.1 Where approved by the Owner Representative, the Engineer may provide to the Contractor the digital DWG plans which were used to produce contractual documents.

.2 The Contractor must respect the "RESPONSIBILITY WAIVER – DWG PLANS" form included at the end of this section, understanding the limitations of using the digital plans, and complete and sign the form. Submit the duly completed form to the Engineer.

.3 The Engineer reserves the right to not provide the design files to the Contractor and/or related sections.

.4 The Engineer reserves the right to claim fees for the conversion of design files and specifications issued "for tender" to the format or edition requested by the Contractor and/or related section.

1.20 TECHNICAL REQUESTS FOR INFORMATION

.1 The Contractor must submit all requests for information (RFIs) by email.

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

.3 Technical Requests for Information:

.1 Each question must be submitted using a standardized RFI form.

.2 Each PDF RFI form may include only one question.

.3 Each question must be assigned a sequential number to facilitate tracking.

.4 The Contractor is responsible to review questions submitted by other sections to ensure that answers are not present in the contractual documents or previously provided, and to track progress of the RFIs to ensure work is not delayed.

.5 The RFI form must include, at minimum:

.1 Submission date of the question.

.2 Name of the sender and recipient.

.3 Subject line.

.4 Clearly formulated question.

.5 Clips of the plans, specifications and photos relating to the question.

.6 Proposed solutions.

.7 Sufficient space for the engineer to respond to the question on the form.

1.21 UP TO DATE DRAWINGS

.1 Each section must, at its expense, clearly indicate all changes, additions, etc., on a separate copy of the drawings and specifications, so as to have a complete and accurate copy of the work as executed and materials installed when the contract is completed. In particular, any displacement, even minor, of underground piping must be indicated with precision

.2 This copy of the drawings must be kept up to date and be available on site.

.3 Deliver these plans to the Owner at the end of the works

1.22 OPERATION AND EQUIPMENT MAINTENANCE INSTRUCTION MANUALS

.1 Each section must provide the Owner with four copies of manuals with detailed instructions for the operation and maintenance of all equipment and appliances included in his contract. Also provide a USB flash drive.

.2 These manuals must contain:

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

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

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

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

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

.6 A diagram of the controls with explanatory text.

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

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

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

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

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

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

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

.3 The entirety must be written in French.

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

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

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

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

1.23 CONCEALED WORK

.1 Do not conceal any work, material, such as pipes, boxes, etc. before the installation has been verified.

.2 If a section does not comply with this requirement, it will have to pay the cost of all work required to proceed to the examination of the works.

.3 Unless otherwise indicated, all piping and ducts must be concealed in partitions, walls, between floors, in ceilings, etc. The cost of all necessary leveling shall be borne by the Contractor.

.4 Reread the articles "COOPERATION WITH OTHER TRADES" and "TESTING".

1.24 PLACEMENT OF PIPING AND DUCTS

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

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

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

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

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

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

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

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

1.25 MANUFACTURERS' INSTRUCTIONS

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

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

1.26 LAYOUT AND ACCESS TO THE EQUIPMENT

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

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

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

.4 Installation of equipment:

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

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

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

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

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

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

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

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

1.27 PAINTING

.1 Apply a base coat of sealant on any non-galvanized metal equipment or equipment supports. Before leaving the premises, touch up the base coat of all the damaged areas after removing any rust.

.2 The base coat is a sandable grey coloured water based acrylic, this product can be used as a base layer and to paint cut or perforated sections of galvanized apparatus, equipment or equipment supports, Sierra Performance S30 Griptec from Rust-Oleum or Sierra Performance S71 as an aerosol.

.3 Apply one coat of metal mordant and one additional coat of black paint to the soldered joints of uninsulated black steel pipes.

.4 On insulated black steel pipes, apply one layer of metal mordant on the soldered joints.

.5 Ensure that access doors of all kinds, including the opening convector panels, electrical panels, etc., are painted in the open position to ensure freedom of movement.

.6 See section 23 05 53.01 – Identification of systems and mechanical equipment.

1.28 FRAMES, SUPPORTS, AND BRACKETS

.1 Each relevant section must provide and erect all frames and brackets required for the equipment it installs: reservoir tanks, panels, motors, starters, key switches, etc.

.2 Install equipment at the height shown in the drawings, but never less than 75 mm (3") above the floor.

.3 Build the supports and brackets out of welded and grinded steel. If necessary, install hooks, rails, eyelets, etc., to facilitate installation and removal of equipment.

1.29 SLEEVES

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

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

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

.1 General:

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

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

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

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

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

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

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

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

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

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

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

.2 Round, square and rectangular openings in concrete:

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

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

.3 Openings in concrete block walls and drywall:

.1 Sealing of openings by the Contractor.

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

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

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

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

.5 Concrete beams and columns:

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

.6 Steel beams and columns:

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

.7 Steel bridging:

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

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

1.31 SUPERVISOR

.1 Each section must retain and pay for the services of a competent and permanent supervisor or superintendent who must remain on site until the works are accepted, and, having full authority to represent the section. All communications, orders, etc. supplied by the Engineer or Contractor are considered as given directly to the company responsible for the work of the section.

.2 Submit for approval the name, qualifications, and experience of the supervisor or superintendent. Following revisions made at the request by the Owner's representative, a lack of experience and qualifications relevant to the project will result in the mandatory replacement of the Superintendent by one meeting the requirements.

.3 This supervisor cannot be removed from the work site without a valid reason and prior written approval.

.4 Facilitate site inspections for the Owner and the Engineer at any time. During these visits, the supervisor must be available to them.

1.32 INSPECTIONS

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

1.33 TESTING

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

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

.3 General requirements:

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

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

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

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

.4 Special requirements:

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

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

.5 Factory tests:

.1 The Engineer and the Owner reserve the right to examine the equipment in the factory and attend factory trials described in this specification.

.2 Notify the Engineer and the Owner at least one week in advance of the date, time and place where the factory testing will take place.

.3 Submit two certified copies of the factory test reports to the Engineer.

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

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

1.35 FINAL TESTING

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

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

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

1.36 EQUIPMENT CALIBRATION AND OPERATION

.1 General:

.1 Vibration tests are required to ensure that:

.1 The equipment operates within acceptable levels of vibrations.

.2 That vibrations or noises is not transmitted to the building structure.

.2 The company in charge of the work of each relevant section must use the services of a firm specialized in vibration analysis to conduct verifications and the work required by this article.

.3 Before proceeding to any work, have the selection of the specialized firm, which must be retained to perform the analyses, approved. Submit the qualifications of the firm and the methodology to be used to perform the work.

.4 The work must be performed by a qualified Engineer or Technician.

.5 Provide a list of personnel who will be assigned to the project and a list of equipment and devices that will be used to perform the analyses.

.2 Analyses:

.1 Fans with a 1 HP or stronger motor must be analyzed.

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

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

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

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

.6 Minimum criteria:

.1 The amplitude parameter is the velocity (mm/sec.). The frequency range used must cover 600 cycles/min. (CPM) (10 Hz) to 600 000 cycles/min. (10 000 Hz).

.1 Overall value (unfiltered) for the entire frequency band of the device: maximum velocity of vibrations of 4 mm/sec.

.2 Filtered value (by frequency band): peak maximum velocity of 2 mm/sec.

.3 General procedure:

.1 General:

.1 All analyses should be performed only when the system is adjusted, calibrated, and functioning according to design requirements. The analyses can be performed during the running-in period.

.2 Provide a coordinated schedule with the Contractor's intervention and the Owner's activities for the testing of each piece of equipment.

.3 During the execution of the works, prepare and present to the Contractor and the Engineer preliminary reports for later discussion about the tests.

.2 Complete a visual check of all equipment to detect any obvious installation error correctable on-site.

.3 Ensure the freedom of movement of vibration isolators and that there are no short circuits caused by any obstruction, whether between the equipment or the anti-vibration equipment base and the structure of the building.

.4 Operate the equipment and check by hearing for any apparent malfunction.

.5 Check the bearings with a stethoscope. Defective bearings must be replaced immediately to avoid damaging the shaft or any other component.

.6 Adjust and calibrate the equipment and the system so that the equipment vibration tests are performed at operating conditions.

.7 Perform vibration tests.

.4 Vibration testing procedure:

.1 The following steps must be followed to ensure that the tests are adequate.

.2 Determine the operating speed of the equipment. Using a tachometer or stroboscope, measure the rotational velocity of the driven equipment, as well as that of the motor.

.3 Determine and report the acceptable criterion in the report.

.4 Ensure the freedom of movement of vibration isolators.

.5 Operate the equipment and perform a visual and auditory verification to detect any apparent malfunctioning. Check bearings using a stethoscope. Defective, misaligned, and malfunctioning bearings must be corrected before continuing the test. If corrections are not made, the equipment will be considered unacceptable.

.6 Measure and record the bearing vibrations from the driven components as well as of the motors in horizontal, vertical and, if possible axial directions. There must be at least one axial measurement for each rotating equipment.

.7 Take a "Spike Energy" reading for each engine to determine its condition.

.8 Perform an analysis with respect to time on each engine to detect the probability of an electrical fault.

.9 Analyze the results and determine probable causes of the vibration.

.10 Proceed to the corrections required for operation within acceptable standards.

.11 Perform a new analysis to demonstrate that the equipment is operating within acceptable standards.

.5 Analyses reports:

.1 Submit three (3) copies of the final report.

.2 The report should contain, among other things, the following information:

.1 For each analyzed system, a diagram identifying the measurement points.

.2 The vibration curves generated by the analyzer, indicating the date on it, the measuring range, the multiplier, the filter used, the identification of the analyzed equipment, and the measurement point.

.3 A table showing the velocity measurements in inches/s, as well as the "Spike Energy" for each of the reading points of the equipment.

.4 Conclusions from the data collected in relation to vibration criteria and the likely causes of the vibrations.

.5 Description of corrective actions done on each device.

.6 Accepted companies:

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

1.37 INSTRUCTIONS TO THE OWNER

.1 Give to the representative of the Owner all the details on the operation of the equipment specified and installed under this contract. Provide qualified personnel to operate this equipment until the Owner's representative is adequately qualified to take charge of the operation and maintenance of said equipment.

.2 This training can be combined with the final testing period provided that the Owner’s team is available.

.3 It is understood that such tests are not an automatic acceptance of equipment by the Owner.

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

1.38 WARRANTY

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

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

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

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

1.39 OBLIGATIONS DURING THE WARRANTY PERIOD

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

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

1.40 MAINTENANCE DURING THE CONSTRUCTION PERIOD

.1 This article applies only in cases where the equipment is used during the construction period.

.2 In addition to the responsibilities and obligations of each section, as to the temporary or permanent use of its installations and the use of equipment by the Owner or any other section during construction and before final acceptance of the work, the relevant section still remains as responsible for the operation, preventive maintenance, or other, of its equipment during the same period.

.3 For these purposes, each relevant section should, in general manner, use its own labour and its own equipment and administer the direct supervision of these tasks.

.4 However, the relevant section does not have the responsibility to provide the staff required for the equipment's operation during the construction period and before final acceptance of work. However, it remains responsible for the equipment during testing, the adjustment period, calibration, and maintenance of this equipment.

.5 Supply of spare parts, such as filters, pump belts, fans, compressors and others, as well as providing the energy required for the equipment's operation during the construction period, are the Owner's responsibility.

1.41 TEMPORARY SERVICES

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

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

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

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

1.42 RENOVATIONS

.1 Continuous service:

.1 The following services are not to be interrupted without prior agreement with the Owner: telephone, electricity, lighting, intercom, fire alarms, sprinklers, fire protection water, aqueduct water, domestic water, sanitary plumbing, storm drainage, external drainage systems, ventilation – air-conditioning, etc.

.2 To ensure the continuity of services at during the hours required by the Owner, each relevant section must do all temporary works required, including labour and equipment.

.3 All major service cuts must be performed outside the occupancy hours of the building. For example: electricity, water, etc.

.2 Demolition:

.1 All demolition work is the responsibility of each concerned mechanical and electrical section.

.3 Occupied rooms:

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

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

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

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

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

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

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

.4 Noise:

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

.5 Other restrictions:

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

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

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

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

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

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

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

.4 Follow the Owner's sterility standards.

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

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

.2 No device should be reused.

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

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

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

1.43 EQUIPMENT TO BE HANDED OVER TO THE OWNER

.1 Provide the Owner with the following items:

.1 Maintenance products and portable equipment indicated in the specification.

.2 The replacement materials indicated in the specification.

.3 The keys of all supplied equipment with locks.

.2 Obtain receipts from the Owner for each of the items mentioned above and give them to the Engineer.

1.44 CERTIFICATION OF COMPLIANCE

.1 At the end of the work, each section must submit to the Engineer a certification of compliance stating that all work was performed following the drawings and specifications, and all applicable standards and codes. Refer to example form at the end of this section.

.2 Submit the certificate to the Engineer at the same time as the request for an attestation of successful work completion.

.3 Have an administrator from the company sign this form and affix their seal to it.

1.45 CLEANLINESS OF THE SYSTEMS

.1 Take every necessary measure and precaution to keep the inside of all of the ventilation systems' components and ducts clean. Otherwise, duct cleaning and sample analysis may be required at the Contractor's expense to ensure that the dust level does not exceed 0.75 mg/100 cm² in order to comply with the NADCA-ACR standards.

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

1.46 CLEANING

.1 Clean the work area as work progresses. At the end of each workday, or more often if the Owner sees fit, remove the trash, carefully arrange the equipment to be used, and do the work site cleanup.

.2 Once the work is completed, remove the scaffolding, temporary protective equipment, and surplus materials. Repair any defects observed at this stage.

.3 Clean and polish glass, mirrors, hardware parts, ceramic tiles, chrome or enamel surfaces, laminated surfaces, aluminum, stainless steel or porcelain-enamel parts, floors and sanitary fixtures. Clean manufactured items in accordance with manufacturer's written instructions.

.4 Clean the areas used for the execution of works and put them in a state at least equivalent to that which existed before the work began, the cleaning must be approved by the Owner.

1.47 SECURITY SCREENING

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

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

1.48 SECURITY ESCORT

.1 All personnel involved in the execution of the work will be required to be accompanied by a security officer when performing work in areas prohibited to the public during normal working hours. They must be accompanied in all areas when working during unoccupied times.

.2 Submit all requests for escorts at least fourteen (14) days in advance. Where requests are made within the prescribed period, the cost of the security escort will be covered by the Departmental Representative. In the case of late requests, the cost will be the responsibility of the Contractor.

.3 All requests for escorts may be cancelled, without penalty, if notice is give at least four (4) hours before the time. In the case of late requests, the cost will be the responsibility of the Contractor.

1.49 BREAKDOWN OF COSTS

.1 Before submitting a request for first payment, provide a detailed breakdown of costs relative to the contract, indicating also the overall price of the contract, as per the Engineer’s instructions. Once approved by the Engineer, the breakdown will serve as a reference for payment installment calculations.

.2 Where applicable, include the following lines, as well as the related amounts, in the monthly statements of each of the specialized Contractors:

.1 Mobilization.
.2 Insurance and surety bonds.
.3 Erection drawings.
.4 One line per activity per sector, floor or phase.
.5 Tests and trials.
.6 Preliminary balancing reports (aeraulics and hydraulics).
.7 Final balancing report.
.8 Alignment of equipment (pumps, fans, etc.).
.9 Equipment start-up.
.10 Commissioning of systems.
.11 Seismic measurement compliance report.
.12 Demobilization.
.13 Operation and maintenance manual.
.14 Training.
.15 Drawings "as annotated by the Contractor".

Part 2 Product

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

COMPLIANCE CERTIFICATE

Project: _____

Project address: _____

Discipline: _____

Specification section: _____

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

Company name: _____

Address: _____

Telephone number: _____

Signatory name: _____

Signature: _____

Signatory title: _____

COMPANY SEAL

RESPONSIBILITY WAIVER – DWG PLANS

The _____

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

Project: _____

Subject: _____

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

We also recognize and agree that:

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

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

Signature: _____

Name (in print): _____

Address: _____

Telephone: _____

Email: _____

END OF SECTION

TABLE OF CONTENTS

3.6 TESTING

3.7 PAINT

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 05 – Installation of pipework.

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

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

.6 Section 23 05 53.01 – Mechanical identification.

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 The work includes, but is not limited to:

.1 Dismantling and installation of new automatic sprinklers, including all required piping and accessories.

.2 Testing of the fire protection system and test reports.
.3 Necessary data to conduct hydraulic calculations.
.4 Hydraulic calculations.
.5 Payment of all fees, permits, inspection fees and other costs.
.6 Installation drawings.

.2 Work excludes:

.1 In general, the following work is excluded:

.1 The temporary fire protection system during construction.
.2 The detection system and fire monitoring system.

1.5 STANDARDS

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

.1 Construction Code of Québec (2015).
.2 Standards of the National Fire Protection Association, last edition: NFPA-13.

1.6 AUTHORITIES HAVING JURISDICTION

.1 The authorities having jurisdiction are: Régie du bâtiment du Québec.

1.7 APPROVAL

.1 The company in charge of the work of this section must be recognized/specialized for performing this kind of work.

.2 All materials must be UL/ULC listed and FM and meet the latest published requirements.

.3 Inspect the facility before the plaster and ceilings are completed so that the inspection is easy and thorough.

.4 During final inspection by the Consultant and expensing of this section, make any necessary changes to obtain final acceptance.

1.8 SPECIAL CONNECTIONS

.1 Automatic sprinkler drainage connections over to the closest funnels provided. The supply and installation of funnels are the responsibility of the section carrying out the plumbing work.

1.9 REQUIRED DOCUMENTS

.1 Provide the following documents:

.1 Inspection certificates from the competent authorities.
.2 Certificates of guarantee see the article "GUARANTEE", section 20 00 10 – Mechanical and electrical general instructions.

1.10 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 Product

2.1 GENERAL – PIPING

.1 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.

.2 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.

.2 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.

.3 Bolting:

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

2.3 DIELECTRIC SEALS

.1 Making connections between two pipes of different metals such as copper and steel, by means of dielectric unions or flanges with gaskets between the flanges and insulating sleeves to the bolts, in order to avoid contact between the two metals, UL approved connections, union and Epco flange.

2.4 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

2.5 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 Bull Moose Tube
.4 Grinnell
.5 Nova Tube
.6 Steel of Canada
.7 Stelco

.2 Mechanical Joints:

.1 Anvil
.2 Victaulics
.3 Tyco

.3 Threaded connections:

.1 Anvil
.2 Central
.3 Ward

.4 Dielectric seals:
- .1 Epco
- .2 Victaulic

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 articles "TEST" and "FINAL TEST" 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.

3.7 PAINT

.1 Apply a metal mordant layer on all exposed pipes.

.2 Ensure that no sprinkler head is painted. Protect the heads with plastic bags or polythene securely held in place by a string or wire prior to painting.

.3 Once the painting is completed, remove the temporary protection from the heads. All painted or damaged heads will be replaced and expensed.

END OF SECTION

TABLE OF CONTENTS

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.

.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.

.10 Flow intended for outdoor nozzles:

.1 Provide the feed rate of external nozzles in the hydraulic calculations.

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 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.

1.5 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.

1.6 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 The location of heads in the same room should be symmetrical to 6 mm.

.5 Sprinklers of the following type:

.1 Ordinary straight: Viking: Microfast, with glass fuse, bronze finish.

2.3 SPRINKLER REPLACEMENT

.1 Provide a metal cabinet with shelves, door hinges and hardware, and capacity as indicated in the NFPA-13, and containing:

.1 Sprinklers of each type and of each melting temperature used, in accordance with NFPA-13. Quantity: according to the applicable standards.

.2 Two keys to facilitate emergency changes.

.2 Install the cabinet at the entrance of the water sprinkler room.

2.4 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.

2.5 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 ELECTRICAL CONNECTIONS

.1 Electrical work related to the work covered by this section shall be performed in accordance with section 26 05 00 – Common work results for electrical.

3.5 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 RELATED REQUIREMENTS

.1 The special requirements for mechanical and electrical work, Division 20, apply to this section.

.2 The following sections are part of the scope of the plumbing work and complement each other to form a whole:

- .1 Section 20 00 10 – Mechanical and electrical general instructions.
- .2 Section 22 13 19 – Drainage waste and vent piping.
- .3 Section 22 15 00 – General service compressed air systems.
- .4 Section 23 05 05 – Installation of pipework.
- .5 Section 23 05 13 – Common motor requirements for HVAC equipment.
- .6 Section 23 05 17 – Pipe welding.
- .7 Section 23 05 19.01 – Thermometers and pressure gauges – Piping systems.
- .8 Section 23 05 29 – Hangers and supports for HVAC piping and equipment.
- .9 Section 23 05 48 – Vibrations and seismic controls for HVAC piping and equipment.
- .10 Section 23 05 53.01 – Mechanical identification.
- .11 Section 23 05 93 – Testing, adjusting and balancing for HVAC.
- .12 Section 23 07 14 – Thermal insulation for equipment.
- .13 Section 23 07 15 – Thermal insulation for piping.

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 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 Openings for instrumentation:
    - .1 In piping and ducts, create the openings necessary for the measurement instruments and the control instruments for temperature, pressure, flow, etc., where required by the Division 25.
    - .2 Install wells in the piping for thermometers and the temperature readings.

.3 Specialties:

.1 The redevelopment of the existing compressed air network following the installation of the new ventilation unit, including the relocation of the accessories.

.2 The special connections.

.3 The structural steel supports and components.

.4 The testing.

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

.6 The acoustic and vibration works described in the Division 23 related to this section.

.7 The thermal insulation works described in sections 23 07 14 and 23 07 15 related to this section.

.4 Seismic measures:

.1 All seismic measures for plumbing work, in accordance with section 23 05 48 – Vibration and Seismic Controls for HVAC piping and equipment.

.2 Works excluded:

.1 In general, the following activities are excluded:

.1 Control works, except those specifically requested in the tender.

.2 Electrical connections, except those specifically requested in the tender.

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.

.2 When special connections are made by others to their fixtures, each relevant section should be monitoring these connections and is solely responsible for the proper functioning of their own equipment.

.3 Each section is responsible for any damage it may cause to the fixtures to which it makes connections.

.4 Part of the plumbing contract:

.1 All plumbing connections and all points of connections to the various fixtures shown in the drawings and/or described in the specification.

.2 Ventilation:

.1 All drain connections for units with drains to the funnel drains and all drainage piping funnel drain vents. Bevel at 45° and grind the end of the piping that flows into the funnel drains.

.2 Each above mentioned drainage pipe is fitted with a screw-capped siphon as shown in the equipment drainage and ventilation duct detail.

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.

.4 Certificates of compliance from an approved body for all plumbing appliances and equipment.

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 29 – Hangers and supports for HVAC piping and equipment.

1.2 REFERENCES

.1 ASTM International Inc.:

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

.2 ASTM-A88-1931 – Standard Specification for High Test Gray Iron Castings.

.3 ASTM-B32-08(2014) – Standard Specification for Solder Metal.

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

.5 ASTM-A105/A105M 14 – Standard Specification for Carbon Steel Forgings for Piping Applications.

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

.7 ASTM-A312/A312M – Standard Specification for Seamless, Welded and Heavily Cold Worked Austenitic Stainless Steel Pipes.

.8 ASTM-B306-13 – Standard Specification for Copper Drainage Tube (DWV).

.9 ASTM-C76 13a – Standard Specification for Reinforced Concrete Culvert, Storm Drain and Sewer Pipe (Metric).

.10 ASTM-C428/C428M-05(2011)e1 – Standard Specification for Asbestos-Cement Non-pressure Sewer Pipe.

.11 ASTM-C564-14 – Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings.

.12 ASTM-D2235-04(2011) – Standard Specification for Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings.

.13 ASTM-D2564-12 – Standard Specification for Solvent Cements for Poly(Vinyl-Chloride) (PVC) Plastic Piping Systems.

.2 Canadian Standards Association (CSA International):

.1 CSA B67-1972(R1996) – Lead Service Pipe, Waste Pipe, Traps, Bends and Accessories.

.2 CSA B70-12 – Cast Iron Soil Pipe, Fittings and Means of Joining.

.3 CSA B125.3-12 – Plumbing Fittings.

.4 CSA B181.2-M87 – PVC Drain, Waste, Vent Pipe and Pipe Fittings.

.5 CSA B602-16 – Mechanical Couplings for Drain, Waste, and Vent Pipe and Sewer Pipe.

.6 CSA B1800-15 – Thermoplastic Non-Pressure Pipe Compendium.

.3 Green Seal Environmental Standards (GSES):

.1 Standard GS-36 – Adhesives for Commercial Use, Edition 2.1, July 12, 2013.

.4 South Coast Air Quality Management District (SCAQMD), California State:

.1 SCAQMD Rule 1168-A2005 – Adhesive and Sealant Applications.

1.3 SUBMITTALS

.1 Submit documents in accordance with 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 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 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 MATERIAL

.11 Hard L type copper:

.1 ASTM-B88.

2.2 LOCATIONS

.1 Equipment and ventilation device drainage:

.1 NPS 1 or smaller: hard type L copper.

2.3 FITTINGS AND ACCESSORIES

.1 Equipment venting and device drains:

.1 NPS 1 and smaller: soldered joints.

.2 For piping made of other materials, use fittings of the same material and the same class as the pipe on which they are used.

2.4 JOINTS

.1 Copper:

.1 Unless otherwise specified, joints are welded with 50% tin and 50% lead solder.

.2 Fittings between copper pipes and cast iron pipes:

.1 Cooper to black iron connections are permitted, but no connection is allowed between copper and galvanized steel.

2.5 MANUFACTURER LIST

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

.2 Manufacturer list, section 22 13 19:

.1 Drainage piping and vent:

.1 Copper piping:

.1 Mueller

.2 Wolverine

Part 3 Execution

3.1 GENERAL

.1 Comply with requirements of section 23 05 05 – Installation of pipework and section 23 05 29 – Hangers and supports for HVAC piping and equipment.

.2 General layout of the works:

.1 The layout of the pipe network, the position of sanitary fixtures, special equipment, etc., mentioned in the specification or shown on the drawings give the general layout of the equipment. This section must execute this installation while complying with provincial and municipal health regulations while respecting the architectural and structural arrangement of the building.

.2 Apply extra caution to avoid any interference of plumbing pipes with other disciplines.

3.2 SLOPES

.1 Drainage piping:

.1 The drainage and horizontal vent piping must slope in the direction of flow. Unless otherwise indicated, an incline of 2% for NPS 3 pipes and under and 1% for NPS 4 or larger pipes.

3.3 TESTS, ADJUSTMENTS AND CLEANING

.1 General:

.1 Perform all the tests specified below.

.2 All tests must have been performed successfully prior to being performed in the presence of the Engineer.

.3 Any piping or part thereof must be proven before being covered with insulation or be concealed in partitions, ceilings or walls. Prior to pressure testing systems remove or protect devices such as control devices, air valves, or any equipment that is not designed to be subjected to pressures corresponding to those used in the tests.

.4 During hydrostatic testing ensure that the piping is completely filled with liquid and purged of all the air.

.5 In cold weather use an antifreeze for hydrostatic tests, and at the end of the tests drain the piping completely to prevent any risk of freezing.

.6 Send for analysis, comments, and approval three copies of the final report of all tests and adjustment. Enter the results on 8½ "x 11" format sheet by noting the name of the system, the device, the requested specifications and those obtained.

.2 Drainage piping testing:

.1 Perform hydrostatic testing on the drainage and vent piping by sections of a maximum height of 15 m. Completely fill each section of water to a height of 2.1 m above the highest lateral branch of each section. The water level should remain stable for a period of two hours.

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 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 GENERAL

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

.2 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: 50/50 tin-lead solder.

.3 Flanges:

.1 Copper: Slip-on 125 lb, ASTM-A182 FCU, flat face, wrought bronze.

.4 Pipe connections:

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

.2 Valves:

.1 Ball valve:

.1 NPS 2 or smaller: brass body, threaded ends, EPDM seat, memory stop, Crane no. F9202.

2.3 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 Piping accessories:

.1 Flange gaskets:

.1 Albion

.2 Garlock

.3 John Crane

.2 Copper fittings:
- .1 Anvil
- .2 Emco
- .3 Mueller

.3 Valves:

.1 Valves:
- .1 Anvil
- .2 Crane
- .3 Kitz Corp.
- .4 Milwaukee
- .5 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 At the bottom of all vertical piping, install drip leg with water drain vents.

.4 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 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 Install a compressed air, purge and a pressure equalizing pipe at the point of condensed water collection, as well as a drain pipe connected to the nearest floor drain.

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

.8 Install a compressed air drain trap at the bottom of descending feed stations and at the low points of the main line, and pipe to the nearest floor drain. The distance between the drain connections/traps must in no case exceed 30 m.

3.4 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

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Part 1 General

1.1 RELATED REQUIREMENTS

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

1.2 PAYMENT FOR TEST LABORATORY SERVICES

.1 Retain the services of an independent testing laboratory and assume the costs.

1.3 REFERENCES

.1 Definitions:

.1 HVAC installation: collection of devices and components associated with a network of air ducts connecting outdoor air intakes to the furthest terminal distribution elements, notably consisting of:

.1 Rigid supply and return air ducts.

.2 Flexible ducts.

.3 Mixing boxes.

.4 Return air plenums, including ceiling distribution chambers.

.5 Heating and cooling coils.

.6 Condensate pans, drip separators and humidifiers.

.7 Fans, including their blades and casings.

.8 Filters, including their casings and frames.

.9 Duct acoustical lining.

.10 Diffusers, register grilles and other terminal elements.

.11 Registers and control/regulator devices.

.2 References:

.1 National Air Duct Cleaners Association (NADCA):

.1 ACR Standard, 2006 edition: Assessment, Cleaning and Restoration of HVAC Systems.

.2 North American Insulation Manufacturers Association (NAIMA):

.1 NAIMA 2005 – Cleaning Fibrous Glass Insulated Duct Systems – Recommended Practices.

.3 United States Environmental Protection Agency (US EPA):

.1 US EPA 1999, 40 CFR, parties 152 and 156.

1.4 SUBMITTALS

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

.2 Submit the detailed video controlled cleaning plan following a site visit.

.1 Ensure that the plan clearly indicates the sequence of operations, the camera and cleaning device insertion points, as well as the work calendar.

.3 Product data:

.1 Submit the required data sheets, as well as the manufacturer documentation relating to antimicrobial agents used in the work. Data sheets must list the product characteristics, performance criteria and limitations.

.2 Submit, for antimicrobial agents and coatings, the MSDS required by WHMIS.

.4 Testing laboratory: provide the name and address of the testing laboratory whose services are retained for the work.

.1 Submit the report for the analysis of the collected particles, which must contain the following:

.1 Location that particles were collected.

.2 Type of particles.

.3 Dimensions of the particles.

.4 Percentage of concentration of each type of particle in each sample.

.5 EPA registration: submit documentation certifying that the anti microbial agent proposed for use is EPA registered.

.6 Submit a document proving that the dangerous or toxic material removed from the system were sent to a facility for contaminated waste, according to the paragraph "Waste management" in article "CLEANING" in part 3.

1.5 CLOSEOUT SUBMITTALS

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

.2 Post-cleaning inspection report: submit two (2) copies of the final inspection report, which must include data on collected particles, observations and recommendations, as well the following information and elements:

.1 Name and address of installation.

.2 Name and address of cleaning Contractor.

.3 Description of different HVAC systems, with drawings and sketches marking systems cleaned.

.4 Identification scheme for the various parts of the systems that have been inspected, with notes describing the methods of inspection or analyses performed.

.5 Identification of sampling points and type of analysis performed for each sample.

.6 Identification of every sample collected.

.7 Commentary and photographs of each sampling location and all other system characteristic observations made.

.8 Identification of systems tested, observations, suggestions for measure to be put in place and recommendations for maintenance activities to be carried out in the future.

.9 The seal and signature of the chemist responsible for preparing the report, which is from a testing laboratory independent of the company carrying out the cleaning work.

.3 Post-cleaning video survey: submit two (2) copies of video survey on USB key, which must include the following:

.1 Parts of the systems subjected to particle analysis and an evaluation of microbial growth.

.2 Parts of the system of particular interest and their location.

.3 Special internal characteristics.

.4 Problems such as damaged elements or control/regulation devices.

.5 Systems subjected to analysis, observations, measure put in place and recommendations made verbally or in writing in [English] [and French].

.4 Submit a document proving that the dangerous or toxic material removed from the system were sent to a facility for contaminated waste.

1.6 STANDARDS AND BIBLIOGRAPHICAL REFERENCES

.1 IRSST – Institut de Recherche en Santé et Sécurité au Travail.

.2 WHMIS (Workplace hazardous materials information system) rules for all chemical products and liquid cleaners used on site.

.3 National Air Duct Cleaners Association (NADCA) – ACR 2002, Assessment, Cleaning and Restoration of HVAC Systems, latest edition.

.4 National Air Duct Cleaners Association (NADCA) – Understanding Microbial Contamination in HVAC Systems, latest edition.

.5 National Air Duct Cleaners Association (NADCA) – Introduction to HVAC System Cleaning Services, latest edition.

.6 National Air Duct Cleaners Association (NADCA) – Standard 05 "Requirements for the Installation of Service Openings in HVAC Systems", latest edition.

.7 Underwriter's Laboratories (UL) – UL Standard 181.

.8 Environmental Protection Agency (EPA) – Building Air Quality, latest edition.

.9 Sheet Metal and Air Conditioning Contractor's National Association (SMACNA) – HVAC Duct Construction Standards – Metal and Flexible, latest edition.

.10 North American Insulation Manufacturers Association (NAIMA) – Cleaning Fibrous Glass Insulated Air Duct Systems, latest edition.

1.7 CONTRACTOR QUALIFICATIONS

.1 Contractor must be a member of the National Air Duct Cleaners Association (NADCA).

.2 The company must have been incorporated for five (5) years, shown that it has five (5) years of experience cleaning ventilation systems at provide proof when submitting its tender.

.3 That contactor will have in their employment a qualified workforce with at least two (2) years experience in cleaning ventilation systems and in the performance of work required for the completion of projects.

1.8 SITE SURVEY

.1 Refer to instructions in tender documents to see date and time for the site visit, as well as general instructions.

.2 If the project includes existing systems:

.1 Perform a visual survey of the systems to clean to establish the type of work, tools and equipment required to properly clean the systems.

.2 Verify the exactitude of the plans and specifications.

.3 The site survey must not disrupt normal operation of the space nor have an environmental impact.

1.9 SCHEDULE OF WORK

.1 Before starting work, the Contractor must supply a timeline, as the sections where they will start their work, all in coordination with the Owner.

.2 Consult the general conditions to establish the relation with the other work and prospective times to perform the cleaning,

1.10 SAFETY

.1 The Contractor is responsible for the development and respect of site (and adjacent) safety measures during the entirety of the work and all measure must be taken to ensure occupant safety.

.2 Before starting the cleaning work, the technicians must be provided with appropriate safety equipment to handle the dangerous conditions identified by the laboratory analysis.

.3 The Contractor is responsible for the development of lockout procedures to protect technicians from any accidental start up of the ventilation systems or other equipment during the work.

.4 The technicians must have completed the course "Health and safety on construction sites (ASP Construction)", including confined space training, as well as WHMIS, and carry their ASP Construction card with them at all times.

.5 In existing buildings, the Contractor must respect the codes and standards for occupant safety, as well as for the disposal of debris.

1.11 PROTECTION OF THE SITE

.1 The Contractor must ensure the protection of the building and equipment by using protective tarps and covers. At the end of work in each area all surfaces must be cleaned with HEPA filter equipped vacuum cleaners. Area and goods to be returned to same state of cleanliness as before the execution of work.

1.12 METHODOLOGY AND EQUIPMENT

.1 The Contractor must provide a list of primary equipment that will be used during the execution of cleaning work (photos, descriptions, specifications). Contractor must prove that they possess the required equipment. The Owner, in coordination with the Contractor, must establish a location for storage of equipment and material required for work.

.2 The Contractor must submit a procedure they intend to use for each component. It should be noted, for the cleaning of the supply and return ducts, only the “suction with moving brush” with be accepted.

.1 Mechanical method.

.2 Manual method.

.3 Cleaning products for ducts must be VOC-free and biodegradable.

1.13 LIST OF ACCEPTED COMPANIES

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

.1 Accepted companies:

.1 BioVac System

.2 Désinfectair

.3 Environ/Air

.4 Groupe Danco

.5 Hydraulique R&O Services Inc.

Part 2 Product

2.1 SCOPE OF WORK

.1 The cleaning work required is:

.1 Provide the workforce, materials, equipment and surveillance necessary to perform the air duct and ventilation system component cleaning, as specified below:

.2 List of systems to clean: no. 2S-072.

.3 List of components to clean:

.1 Clean the supply fan.

.2 Clean the inside of the filter supports and all other mechanical components.

.3 Clean the chambers of the units.

.4 Clean the heating and cooling coils, the drain pan, and straighten the coil fins.

.5 Clean the inside of the supply fan housing and the protective guards.

.6 Clean the inside of the supply and return ducts.

.7 Clean all the blades of the air baffles and extractors, and all other internal components of the ducts.

.8 Clean the inside of the high-speed ducts and their mechanical components.

.9 Clean the by-pass flaps, the automatic and manual shutters and fire dampers within ducts, indicating their original position.

.10 Clean all return grilles, supply diffusers and their registers.

.11 Sanding and painting of components.

2.2 ACCESS DOORS

.1 Use existing access doors to perform the cleaning.

.2 If other access is needed, proceed as follows:

.1 For openings of more than 300 mm x 300 mm, a leak-tight door with locks must be installed according to accessibility, while maintain the operating pressure of the system. The Contractor must provide shop drawings for the access doors to be used (acceptable products: Nailor and Duct Mate).

.2 For small openings, pre-cut galvanised steel plates of the same gauge or thicker than the existing material, may be used. The plate must overlap the duct by at least 25mm all around the opening. For an opening of 250 mm x 250 mm, the plate must be at least 300 mm x 300 mm. A neoprene gasket of 3.2 mm x 15 mm must be installed around the opening to ensure leak-tightness. The plate to be fastened using self-drilling screws, installed a maximum interval of 100 mm. No openings will be made on flexible duct. Any insulating material on the outside must be replaced and match with existing.

.3 For medium and high-pressure ducts, openings will be permanently closed with pre-cut galvanised steel plates of the same gauge or thicker than the existing material. A permanent leak-tight seal for the duct will be made using cotton tape. The plate to be fastened using self-drilling screws, installed a maximum interval of 100 mm.

.4 During the work, the Contractor must take notes on the plans regarding where openings were made and any mismatch between the plan provided and actual system, and provide these plans to the Owner when work is completed.

.5 Openings made and their closing should not, under any circumstance, effect or restrict the volume of air traveling through the ducts.

2.3 ANTIMICROBIAL AGENTS

.1 Antimicrobial agents used must be registered with the US EPA (40 CFR).

2.4 FILTERS

.1 New filters must be provided and installed for each HVAC system cleaned.

2.5 AIR DUCT CLEANING MATERIAL

.1 Manually operated rotary contact brushes:

.1 Ensure that brushes are specifically designed and made for adapting to different ducts, materials and elements in HVAC systems.

.1 Ensure that the brushed are an appropriate size for the different diameters of ducts in the HVAC systems.

.2 Make sure that the brushes allow scrubbing by direct contact of the interior walls of the ducts and equipment to be cleaned.

.2 Bushes: rotating, manual operation, with integrated motor, with nylon, polypropylene of other non-metal bristles.

.1 Ensure that the motor is strong enough to continue to turn the brush after the bristles are deformed.

.2 Replace used or inefficient brushes as needed.

2.6 MULTIFUNCTIONAL ROBOTIC CLEANING SYSTEM

.1 Self-propelled device with remote control, crawler or on wheels, equipped with the following accessories, especially camera, halogen lights, rotating brushes and a vacuum cleaner.

.1 Ensure that brushes are specifically designed and made for adapting to different ducts, such as those with acoustical lining, materials and elements in HVAC systems.

.2 Ensure that the brushes scrub with direct contact between the bristles and the elements to be cleaned.

.3 Replace used or inefficient brushes as needed.

.2 Camera: 360° rotating digital camera, remote focus, dustproof, with four (4) hours recording capacity,

.1 Lights: two (2) halogen lights, 20 W with dimmer.

2.7 DEFICIENCIES AND EXISTING DAMAGE

.1 If modifications need to be made to existing systems, or damage or deficiencies are found, report to Owner and Engineer.

.2 See also part 3 – Execution, article "FIBERGLASS INSULATION".

Part 3 Execution

3.1 PROTECTION OF COMPONENTS

.1 Ensure that all mechanical and electrical devices near the work are protected.

.2 Do not place objects, equipment, tools and other materials on the duct insulation.

.3 Note the position of balancing registers before cleaning. Ensure that baffles and registers are not moved. If some are moved by accident, return to their original position.

.4 Existing systems:

.1 Install a media filter or a sealed envelope (polyethylene) to the outside of the grilles and diffusers in order to prevent dust entering the rooms during the work.

3.2 CEILINGS

.1 Acoustical tile ceilings:

.1 Open and close ceilings. Clean and repair if they were dirtied or damaged during work.

3.3 FIBERGLASS INSULATION

.1 Use only cleaning methods and equipment compliant with standards from NADCA and NAIMA.

.2 Damaged insulation:

.1 If there evidence of damage, deterioration and/or of mildew and humidity such that insulation cannot be returned to a proper condition by cleaning or the addition of a layer of antimicrobial protection, notify the Owner and Engineer so repairs can be made.

.3 Replacement of damaged acoustic or thermal insulation is not part of the contract, but cleaning work must be performed after such repairs are completed.

3.4 REMOVAL OF MATERIAL AT RISK OF MICROBIAL CONTAMINATION

.1 All work involving removal of acoustical insulation or other contaminated material inside the ventilation system components must be performed in negative pressure. Negative confinement to be achieved by evacuating the air in the area to be treated using HEPA filters (99.97%, 0.3 micron), and an airlock be constructed at the area entrance using a support frame and plastic film with a minimum thickness of 0.6 mm. In addition, decontamination workers are required to wear protective equipment such as hooded covers, half face masks with HEPA filters, safety boots, gloves, protective glasses, etc. The Contractor must perform the decontamination of the surfaces following a submitted and approved method, as required by article "STANDARDS AND REFERENCES".

.2 Respect the norms and regulations in force in the locality.

3.5 ANTIMICROBIAL AGENTS

.1 See article "FIBERGLASS INSULATION".

.2 The use of antimicrobial agents should not be used unless there is significant appearance of mildew growth or if an unacceptable level of contamination is determined through testing.

.3 Application of anti microbial agents of permitted after the removal of surface deposits and debris.

.4 Application to be performed following manufacturer instructions. The agent must be sprayed directly onto the surface and not "atomized" through the system.

3.6 QUALITY CONTROL

.1 Quality:

.1 The quality control programme for the work must satisfy NADCA standards.

.2 Standards for dust:

.1 Ventilation ducts are considered clean if they pass visual inspection under a strong light (100 W) and if they meet NADCA-ACR dust standards of 0.75 mg/100 cm².

.3 The dust collection must be performed by the Contractor, according to the locations predetermined by the Engineer.

.2 Inspection:

.1 Provide remote-controlled video equipment (robot), as well as qualified personnel to operate the equipment, allowing the Engineer to inspect the duct interior at any time.

.2 If some of the inspected ducts do not meet standards and requirements listed above (visual and dust test), repeat cleaning of this part. Repetition of cleaning and inspection/testing fees will be at the Contractor's expense, without cost to the Owner.

.3 Video report:

.1 Provide two (2) copies of the complete video report, showing each component after cleaning for verification by the Engineer.

.2 The video must include identification of the systems and components.

.4 Written report:

.1 Provide two (2) copies of the written report for verification by the Engineer, and must include the following information:

.1 Name and address of the Contractor.

.2 Project name, number (and lot number, if applicable).

.3 Identification of installation cleaned and cleaning dates.

.4 Description of different HVAC systems, with drawings and sketches marking systems cleaned.

.5 Commentary and photographs of each dust collection location.

.6 Cleaning and dust collection methodology.

.7 Laboratory where analysis was performed and what type of analysis.

.8 Laboratory results.

.2 List of recommendations following cleaning, if any.

.3 Identification of the system must always accompany results, comments and recommendations.

.4 Each report must contain a title page and an index, placed inside a 3-ringed binder, and accompanied by a vide report. Plans mark ups were made they should be included in the report.

.5 Work will be considered complete when all reports are accepted by the Engineer.

3.7 LABORATORY ANALYSIS

.1 Ensure that the independent laboratory possess experience in testing samples for work in air duct cleaning.

.2 Ensure that the laboratory uses an electronic supermicroscope to perform the analysis and determine the constituent particles in the samples.

.1 Constituents to be identified by category and size.

.2 Submit analysis reports, containing the percentage concentration amounts of the constituents.

.3 Do not start cleaning work until analysis results are received.

.4 The analysis must be carried out by a chemist who is a member of the Ordre des chimistes du Québec.

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 Submit the documents and samples required.

.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 For all systems or equipment that require an engineering design, shop drawings must include the seal and signature of a professional Engineer recognized in Canada, in the province of Québec.

.2 Shop drawings must include:

.1 Assembly and installation details.

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

.3 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.

.4 In addition to the transmittal letter required by section [01 33 00 – Submittal procedures], use the document titles "Shop Drawing Submittal Title Sheet" published by MCAC (Mechanical Contractors Association of Canada). Specify the section number and article in question.

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 – HEATING – CHILLED WATER

.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 heating – chilled water work and complement each other to form a whole.

- .1 20 00 10 – Mechanical and electrical general instructions.
- .2 23 05 00 – Common work results for HVAC.
- .3 23 05 05 – Installation of pipework.
- .4 23 05 13 – Common motor requirements for HVAC equipment.
- .5 23 05 17 – Pipe welding.
- .6 23 05 19.01 – Thermometers and pressure gauges – Piping systems.
- .7 23 05 29 – Hangers and supports for HVAC piping and equipment.
- .8 23 05 48 – Vibration and seismic controls for HVAC piping and equipment.
- .9 23 05 53.01 – Mechanical identification.
- .10 23 05 93 – Testing, adjusting and balancing for HVAC.
- .11 23 07 14 – Thermal insulation for equipment.
- .12 23 07 15 – Thermal insulation for piping.
- .13 23 21 13 – Hydronic systems.
- .14 23 21 14 – Hydronic specialties.

.3 Heating and chilled water – Scope of the work:

- .1 Included work:
  - .1 The work includes, in general, the labor, the delivery, and the installation of all materials and equipment necessary for the heating – chilled water work indicated on the drawings and specifications.
  - .2 This work includes, but is not limited to:
    - .1 All special connections described in the specification and/or shown in the drawings.
    - .2 Insulation work relating to heating-chilled water work.
    - .3 All acoustic and vibration work related to heating-chilled water work, including the supply and installation of springs, anti-vibrations bases, flexible hoses, and other noise attenuation devices required for the equipment and systems supplied by heating-chilled water.
    - .4 The supports and structural steel components required to support the pipework, the fittings, and the equipment.
    - .5 All tests.
    - .6 All special connections.
    - .7 The complete identification of all devices and accessories, in accordance with section 23 05 53.01 – Mechanical identification.

.8 All the paraseismic measures concerning heating – chilled water work, in accordance with section 23 05 48 – Vibration and seismic controls for HVAC piping and equipment.

.3 Instrumentation openings:

.1 In the pipes and/or ducts, create the openings necessary for measuring instruments and temperature, pressure, flow, etc. control instruments, where required by the Division 25.

.2 Install wells in the piping for the thermometers and the temperature readings.

.3 Install access doors to the ventilation controls.

.2 Work excluded:

.1 In general, the following work is excluded:

.1 Control work, except those specifically requested in this section.

.2 The electrical connections, except those specifically requested in this section.

.4 Special connection:

.1 In general, special connections include all required connections to devices, all piping, adapters, shut-off valves, bypasses, unions, flanges, screens, air vents, controls, test valves, drain valves, control valves, shock absorbers, buffer tanks, traps, ventilation ducts, flexible joints, and other accessories necessary to operate the devices.

.2 When special connections are made by others for their devices, each relevant section should be monitoring these connections and is solely responsible for the proper functioning of its equipment.

.3 Each section is responsible for any damage it may cause the devices to which it makes connections.

.4 Part of the heating – chilled water work:

.1 Controls:

.1 The installation and connections to the piping of chilled water, hot water for heating and all control valves supplied by the Division 25.

.2 Install the control valves following the guidelines of the Division 25 and under their supervision.

.3 Obtain the necessary directives.

.4 The diameters of the control valves shown on the drawings are for reference only.

.5 When the control valves or other accessories are supplied by this section, but installed by others, this section remains directly responsible for the operation of its equipment.

.6 Provide the directives and the supervision required for the installation.

.7 All demolition, relocation, and recalibration of equipment and piping, as indicated on the plans.

.2 Ventilation:

.1 All hot water heating coil connections to the hot water.

.2 All ventilation coil chilled water connections.

.3 Ventilation – Coil drain pans:

.1 Drainage from a pan to the lower pan with galvanized DWV or stainless steel piping with appropriate fittings to the drain and the pipe left at the bottom of the tray by "VENTILATION".

.4 Cleaning and degreasing of the hot water heating systems and the chilled water.

.1 In addition to the drains provided on various devices, provide NPS 1½ fittings with extra heavy cast iron screw caps at low points or anywhere the piping cannot be drained by gravity, on heating systems with hot water, chilled water, glycol water and water cooling towers (to allow a drain hose to be connected).

.2 If a check valve prevents the drainage, install an NPS 1½ connector on the side where drainage is otherwise impossible.

.5 Documents to provide:

.1 Provide the following documents:

.1 The manufacturers' warranty certificates.

.2 The pressure vessel certificates.

.3 The certificates of approval from the concerned authorities.

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

.5 The drawings kept up to date, in accordance with Division 20.

.6 Coordination drawings, in accordance with Division 20.

.7 A list of legends with piping identification, in accordance with Division 20.

.8 A piping identification list.

.9 List of the flow meters' flows.

.6 Tender – Price to be provided:

.1 Provide with the tender, a global fixed price covering the work of "HEATING – CHILLED WATER".

1.6 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 23 01 31 – Air duct cleaning for HVAC systems.

.2 23 05 00 – Common work results for HVAC.

.3 23 05 13 – Common motor requirements for HVAC equipment.

.4 23 05 29 – Hangers and supports for HVAC piping and equipment.
.5 23 05 48 – Vibration and seismic controls for HVAC piping and equipment.
.6 23 05 53.01 – Mechanical identification.
.7 23 05 93 – Testing, adjusting and balancing for HVAC.
.8 23 07 13 – Duct insulation.
.9 23 07 14 – Thermal insulation for equipment.
.10 23 31 13.01 – Metal Ducts – Low pressure to 500 Pa.
.11 23 33 00 – Air duct accessories.
.12 23 33 15 – Dampers – Operating.
.13 23 34 00 – HVAC fans.
.14 23 37 13 – Diffusers, registers and grilles.
.15 23 37 20 – Louvres, intakes and vents.
.16 23 44 00 – HVAC air filtration.
.17 23 73 00.13 – Air handling units – Built up.
.18 23 73 12 – Coils.

.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 This work includes, but is not limited to:

.1 Replacement of ventilation unit no. 2S-072, including all ducts and required accessories.

.2 Installation of new HEPA filters in the supply duct, including all conduits and required accessories.

.3 Supply and installation of a new exhaust fan for room no. 2B-102, including the new ducts, the new return grille, as well as the required accessories.

.4 Supply and installation of a new stale air louver.

.5 The removal of ceiling tiles required in the work area and their reinstallation following the execution of the work, including the replacement of damaged tiles.

.6 All special connections and ducts.

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

.8 All access doors.

.9 Insulation work relating to ventilation – air-conditioning work.

.10 All acoustic and vibration work related to ventilation-air conditioning work including the supply and installation of springs, anti-vibration bases, acoustic plenums, silencers, and other devices required by the ventilation – air-conditioning work.

.11 The supply and the installation of springs, anti-vibration bases, acoustic plenums, silencers, and other equipment required for this section.

.12 All new openings. See Division 20.

.13 Sealing sleeves and openings.

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

.15 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.

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

.17 All tests.

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

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

.20 Duct cleanliness:

.1 All ventilation ducts and equipment should be regularly maintained to a state of cleanliness.

.2 All ventilation ducts and accessories must be cleaned and sealed (polythene or others) at the factory. The ducts and accessories must remain sealed during delivery, storage and installation on site. The temporary protection for ducts and accessories can only be removed when cleanliness level of the site alloys the equipment to start up without clogging the systems or any ducts.

.1 Otherwise, duct cleaning and sample analysis may be required at the Contractor's expense to ensure that the dust level does not exceed 0.75 mg/100 cm^2 in order to comply with the NADCA-ACR standards.

.3 See section 23 01 31 – Air duct cleaning for HVAC systems.

.2 Work excluded:

.1 In general, the following work is excluded:

.1 The controls: the supply and the installation.

.4 Special connections and related work:

.1 See Division 20.

.2 Part of this section's work:

.1 The complete ventilation connections of the various devices indicated on the drawings and/or specifications, whether these devices are part of this section or not. The dimensions of the ventilation ducts to the devices shown in the drawings are approximate and should be verified with the other involved sections before the pipes are manufactured.

.2 The directives, the supervision, and the responsibility for the installation of the various devices provided by this section, but installed by another section.

.3 The welded or screwed connections for the ventilation devices and ducts prepared to receive the drain pipes.

.4 The openings and the access doors required for the control devices and the other instruments. The sealing of the pipes passing through the ventilation units.

.5 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.

.2 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

.6 Submissions – Prices to provide:

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

1.7 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 REQUIREMENTS

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

1.2 REFERENCES

.1 Canadian General Standards Board (CGSB):

.1 CAN/CGSB-1.181-99 – Ready Mixed Organic Zinc-Rich Coating.

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

.1 CSA B139-04 – Installation Code for Oil-Burning Equipment.

.3 Green Seal Environmental Standards (GSES):

.1 Standard GS-11-2008, 2nd Edition – Environmental Standard for Paints and Coatings.

.4 National Fire Code of Canada (NFC 2015)

.5 South Coast Air Quality Management District (SCAQMD), California State, Regulation XI. Source Specific Standards:

.1 SCAQMD Rule 1113-A2007 – Architectural Coatings.

.2 SCAQMD Rule 1168-A2005 – Adhesive and Sealant Applications.

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.

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 Shipping and receiving:

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

Part 2 Product

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 PIPING CONNECTIONS TO DEVICES

.1 Unless otherwise specified, comply with the manufacturer's instructions.

.2 Use valves with union fittings or flanges to isolate the piping network's devices and to facilitate the maintenance and the assembly/disassembly of the components.

.3 Use double joint fittings when the devices are mounted on vibration pads and when the piping is susceptible to movement.

3.2 UNIONS, FLANGES, MECHANICAL COUPLINGS

.1 To permit easy dismantling of the piping and the devices, install unions, flanges, or mechanical seals at all devices, chilled water coils, hot water coils, etc.

.2 Piping NPS 2 or smaller: unions.

.3 Flanged joints with appropriately sized bolts and nuts, bolt length equal to the thickness of the two flanges and the nut.

.4 Mechanical coupling: Victaulic Style 77, Victaulic Zero-Flex.

3.3 CLEARANCE

.1 Provide a clearance around the devices to facilitate the inspection, the maintenance and the observation of their operation, according to the manufacturer's recommendations and the National Fire Code of Canada requirements.

.2 Also, provide sufficient working space, as per the indications, to dismantle and remove devices or pieces of equipment, where appropriate, without needing to interrupt the operation of other network devices or units.

3.4 DRAIN VALVES

.1 Unless otherwise specified, install piping giving it a slope in the direction of flow of the fluid.

.2 Install evacuation/drain valves at the low points of the network, at the devices, and at the isolation valves.

.3 Connect a pipe to each evacuation/drain valve and route it to above a floor drain. The discharge point must be clearly visible.

.4 Use drain valves with the following characteristics: gate or ball type with a nominal diameter of NPS ¾, unless otherwise specified, threaded connections, flexible pipe, cap, and chain.

3.5 DIELECTRIC UNIONS

.1 Use dielectric joints appropriate to the type of piping and suitable for the network's nominal pressure.

.2 Use dielectric unions to connect parts made of different metals.

.3 Dielectric unions with a nominal diameter equal to or smaller than NPS 2: bronze union fittings or valves.

.4 Between the copper pipes and the cast iron pipes, perform the connections by means of a 19 mm ring welded to the copper piping and caulked into the neck of the cast iron pipe.

3.6 PIPING

.1 Piping must not be in contact with the concrete or the ground.

.2 All galvanized piping must be so on the inside and the outside.

.3 Install all pipes so as to not induce any tensile or compressive stress.

.4 Do not bend the piping in any way whatsoever.

.5 The piping identification must always be visible to facilitate its inspection.

.6 For each type of piping, the elbows, the elbow reducers, the adapters, the couplings, and the unions must be of the same brand as the tees.

.7 In general, use long radius elbows.

.8 Cover the fitting threads with Teflon tape.

.9 Prevent the introduction of foreign materials into the unconnected openings.

.10 Install the piping so that the various devices can be isolated and thus enable the disassembly or removal of the latter, if necessary, without needing to interrupt the operation of other network devices or units.

.11 Connect the pipes using fittings manufactured in compliance with the relevant ANSI standards.

.12 Connection saddles can be used on the main pipes if the connected bypass branch diameter is not greater than half the diameter of the main pipe.

.1 Before welding the saddle, create an opening with a saw or a drill in the main pipe with a diameter equal to the full internal diameter of the branching pipe to be connected, and deburr the edges.

.13 Install the exposed piping, appliances, rectangular cleanouts, and other similar components in parallel or perpendicularly to the building lines.

.14 Install the concealed piping in such a way as to minimize the space reserved for furring and maximize the headroom and the available space.

.15 Except where otherwise indicated, install the piping giving it a slope in the direction of the fluid's flow to promote the free drainage of the latter and the network's free ventilation.

.16 Except where otherwise indicated, install piping in such a way as to allow the thermal insulation of each pipe.

.17 Deburr the pipe ends and rid them of slag and foreign matter accumulated prior to the assembly.

.18 Use eccentric reducers at the diameter changes to ensure the free flow of the fluid and the network's free ventilation.

.19 Provide means to compensate for the piping thermal expansion, as indicated.

3.7 VALVES

.1 Supply and install all valves indicated on the drawings.

.2 Install the valves in accessible locations. Install the valves so that they are accessible for maintenance purposes, without the need to disassemble the adjacent piping.

.3 Supply and install all the valves required for the operation, the maintenance, and the repair of various devices, without requiring the shut-off of the main pipelines.

.4 When the water piping serving one or more devices passes under the floor, install shut-off valves above the floor.

.5 Unless otherwise indicated, the valves have the same dimensions as the pipes to which they are connected.

.6 Unless otherwise specified, install the valves so that their actuator stem is located above the horizontal line.

.7 When a valve is not manufactured in the requested diameter, install a larger diameter valve with appropriate fittings.

.8 In the places shown on the drawings, at the inaccessible places, and places out of reach, use valves fitted with a wheel and a shaft covered in a special coating of stainless steel and the accessories required for operation from the floor.

.9 Drain valve:

.1 Install drain valves with screens for watering hoses at the following locations:

.1 At each main branch. Also, install a shut-off valve.

.2 Wherever pipes form a low point.

.3 At the places shown in the drawings.

.10 Install globe valves on branches bypassing the control valves.

.11 Unless otherwise indicated, install ball valves at the connection points of the bypass branches for isolating parts of the network.

.12 Install butterfly valves between butt weld neck flanges to ensure the perfect compression of the sleeve.

3.8 SLEEVES

.1 Install the sleeves where the piping passes through masonry, concrete, and fireproofing constructions, and the other indicated locations.

.2 In the concrete beams and joists, use sleeves made of schedule 40 black steel pipe, placed before pouring the concrete.

.3 In the case of foundation walls and where they project onto the covered floors, equip the sleeves at their midpoint with seam welded annular fins.

.4 For openings in concrete walls or floors for piping, install metal or plastic sleeves prior to pouring the concrete.

.5 Install the sleeves so that they are flush with the concrete or masonry surfaces.

.6 Before installing the sleeves, cover the exposed exterior surfaces with a thick layer of zinc rich paint compliant with the CAN/CGSB-1.181 standard.

.7 The diameter of the sleeve must be sufficient to allow the installation of the piping and its thermal insulation. Leave a 6 mm annular clearance between the sleeves and the pipes or between the sleeves and the thermal insulation that covers the pipes.

.8 The sleeve must be of a diameter leaving little opening clearance between the wall and the outside of the sleeve.

.9 Steel sleeves:

.1 Manufactured with schedule 40 pipe, held in place by three supports, spot-welded to the steel frame.

.10 Sealed steel sleeves:

.1 Manufactured with schedule 40 pipe provided with a sealing plate, 3 mm on the outer perimeter. Seam weld the plate to the outer wall of the pipe. The plates can be round or square. They can also be common for a series of sleeves placed one near the other. Each plate must be fixed to the floor.

.2 Steel sleeves with sealing plates must be installed for any apparent pipe or pipe in counter, and through a slab not on the ground. This applies to mechanical and electrical.

3.9 SEALING OF OPENINGS

.1 General:

.1 The seal must meet water, fire, smoke, and acoustic requirements.

.2 The seal applies to the sleeves and the openings.

.3 The seals must be done by each relevant mechanical and electrical section, in cooperation with the other sections, under the Contractor's coordination.

.4 Each section must provide the sealing method to be used.

.5 Elsewhere:

.1 Provide space for the installation of a fire-stop material or device.

.2 Be sure to respect the required fire resistance rating.

.6 Fill the sleeves that are in place for future use of a lime-based coating or another filler material that is easy to remove.

.7 Prevent all contact between the pipes or between the copper pipes and the sleeves.

.2 Exterior walls other than foundation walls:

.1 For exterior walls, the seal between the sleeve and the pipe must be done with dry tow, PC-4, and molten lead on each side of the wall.

.3 Fire protection, firestop walls:

.1 For all drilled holes, sleeves, or openings in the fire partitions and in all other fireproof constructions, the space between the pipe or conduit and the sleeve or opening should be caulked using tightly packed fiberglass and an application of resilient putty, fire proof, 25 mm deep, on each side of the opening.

.2 If the gap to be caulked on the periphery of the pipe or pipes exceeds 25 mm, close this space with collars or angle irons of each side of the opening, after the placement of the fiberglass and resilient putty. Have the arrangement and the installation of the product approved by the representative of resilient product.

.4 Smoke seals and acoustic seals:

.1 Unless otherwise indicated, seal the space between the pipe and the sleeve or the opening, the space between the duct and the sleeve or the opening, using tightly packed fiberglass and an application of resilient fireproof putty, 25 mm deep, on each side of the opening. When the space on the periphery of the pipes and conduits exceeds 25 mm, close this space with collars or angle irons of each side of the opening, after the placement of the fiberglass and resilient putty.

.5 Watertight seals:

.1 In places where there is a possibility of water damage, and in the specific places mentioned in the preceding paragraph, all circular pipe or duct through a floor must be fitted with a watertight steel sleeve, extending above the finished floor by 50 mm.

.2 The part between the inside of the sheath, the low wall (or concrete, at the places not requiring sheaths) and the piping or the ventilation duct must be made water tight by the concerned section by caulking the opening with tightly packed fiberglass and a resilient fireproof putty application, 25 mm deep. When the space to be caulked on the periphery of the pipes and conduits exceeds 25 mm, close this space with collars or angle irons of each side of the opening, after the placement of the fiberglass and resilient putty.

.6 Acceptable products:

.1 Resilient putty: Flamesseal firestop type, 3M, Vulken.

.2 Fire barrier: Double AD fiber Fire Barrier, UL approved.

.3 Non-shrink filling concrete: In Pakt of Master Flow 13, without iron filings.

.4 Gasket: Link-Seal, as manufactured by Thunderline Wayne Michigan Corporation (Corrosion Service Co. - Ontario).

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 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.

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

.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 Unless otherwise indicated, squirrel-cage induction type, operating at 208 V, three-phase, and 60 Hz or at 575 V, three-phase, and 60 Hz. Some motors operate at different voltages, according to their description which is given in each of the respective sections.

.4 1 HP or higher motors, high efficiency type, according to the standards CSA C390M1985, IEEE 112B, IEC 34-2, or JEC 37.

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

.6 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.

.7 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.

.8 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.

.9 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 For axial fans with motors placed in the airflow, the totally enclosed and cooled by the outside airflow type of motor (TEAO) with a minimum service factor of 1.0 can be used.

.3 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 TWO SPEED MOTORS

.1 Unless otherwise indicated, motors with star connections and variable torque.

.1 1 800 and 1 200 rpm: separate windings type.

.2 1 800 rpm and 900: consequent poles.

2.5 BELT DRIVES

.1 Reinforced belts must be installed in the drive pulley. The multiple belts must be provided and installed by matched sets.

.2 The pulleys must be in cast iron or steel and be fixed on the shafts by means of removable keys, unless otherwise indicated.

.3 Motors under 10 HP: standard drive pulleys with pitch diameter adjustable in a range of plus or minus 10%. Use the intermediate position when setting the prescribed speed.

.4 10 HP and higher motors: unless otherwise indicated, fixed pitch diameter pulleys, with split taper bushing and keyway. Provide pulleys of suitable dimensions, suitable to the system balancing characteristics.

.5 The required dimensions of the pulleys will be determined during commissioning.

.6 Transmission design features: at least 1.5 times the nominal values stated on the motor nameplate. On the drive motor shafts, the cantilevered loads must stay below the manufacturer's calculation limits.

.7 The mounting plates on rails must allow adjustments along the axis.

2.6 BELT DRIVE GUARDS

.1 Provide guards for the unprotected transmissions.

.2 Belt drive guards:

.1 Expanded metal grating, welded to a steel frame.

.2 Sheet metal top and bottom, at least 1.2 mm thick.

.3 Holes 38 mm in diameter on the two axes of the shaft, for the installation of a tachometer.

.4 Removable for maintenance.

.3 The lubrication of the equipment and the use of test instruments must be possible even when the guards are in place.

.4 The belt guards must permit the displacement of the motors for the tension adjustments.

.1 U-shaped components made of galvanized mild steel, at least 1.6 mm thick.

.2 Securely fastened in place.

.3 Removable for maintenance.

.5 Guards for unprotected fan air inlets and outlets:

.1 Wire rod or expanded metal gratings, galvanized, 19 mm mesh.

.2 Net free area of at least 80% of the fan openings' area.

.3 Securely fastened in place.

.4 Removable for maintenance.

2.7 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 I – Power Boilers.
  - .2 BPVC 2015 – Section V – Non-Destructive Examination.
  - .3 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.

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.

2.2 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 In potable domestic water systems, no filler or flux metal should have a lead content of greater than 0.2%.

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

.6 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.

.7 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.

.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.

.8 Welding – Steel pipe:

.1 Arc welding.

.2 Welded V-joints with piping properly prepared for this purpose. Spot weld pipes first (it must be possible to pass a thin blade between the two parts to be welded). Complete the welding only after verification. Ensure that the welding procedures used are registered with and are approved in writing by the appropriate authorities.

.3 The welders must possess the qualifications defined in the standard CSA B.51.

.4 Retain the services of qualified welders possessing certification issued by the appropriate authority for each welding process used.

.5 Present the welders' certificates of qualification.

.6 Each welder must identify his work with a stamp that provided to him by the appropriate authority.

.7 For the verification of weld quality, a visual examination by a specialized independent laboratory and samples may be required, and this at the expense of the relevant section.

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: radiography and ultrasound.

.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.

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

.2 ASME B40.200-2008 – Thermometers, Direct Reading and Remote Reading.

.2 Canadian General Standards Board (ONGC or CGSB):

.1 CAN/CGSB-14.4-M88 – Thermometers, Liquid-in-Glass, Self-Indicating, Commercial/Industrial Type.

.2 CAN/CGSB-14.5-M88 – Thermometers, Bimetallic, Self-Indicating, Commercial/Industrial Type.

.3 Efficiency Valuation Organization (EVO):

.1 International Performance Measurement and Verification Protocol (IPMVP).

.1 IPMVP, version 2007.

.4 Green Seal Environmental Standards (GS):

.1 GS-11-11 – Standard for Paints and Coatings.

.2 GS-36-11 – Standard for Commercial Adhesives.

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 Certificates:

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

.4 Test and evaluation reports:

.1 Submit certified test reports for thermometers and pressure gauges from approved independent testing laboratories, indicating compliance with specifications for specified performance characteristics and physical properties.

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 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 THERMOMETERS

.1 General:

.1 All thermometers must be of the same brand.

.2 Provide a list of all the thermometers, indicate the scale and the wells used.

.3 The thermometer probe must be long enough to be in contact with the heat transfer fluid while taking into account the thickness of the thermal insulation. The penetration of the well must be equal to at least 50% of the pipe's diameter.

.4 Adjustable angle thermometers, aluminum housing 230 mm (9") in height, mercury in a glass tube, black graduation on white background, brass probe, depending on the length of the probe, Trerice no. BX9.

.5 Stainless steel wells complete with union fitting and extension when there is thermal insulation, Trerice no. 138.

.6 All thermometers should be calibrated.

.2 Scales:

.1 Scales with graduations in the international and the imperial systems (°C/°F).

.2 Chilled water: -40 at 40°C (-40 at 110°F).

.3 Heating water: 0 at 115°C (30 at 240°F).

.3 Installation:

.1 Install thermometers at the locations shown in the drawings, so that they are easily visible, and protected from mechanical shocks.

.2 Install them within 300 mm of the chillers' water boxes.

.3 Provide tee fittings with female threads for the installation of the wells.

.4 Coat the inside of the wells with silicone grease or graphite for an accurate reading.

2.2 PRESSURE GAUGES

.1 General:

.1 All pressure gauges must be of the same brand. Provide a list of all the pressure gauges and specify the range used.

.2 Type A pressure gauge:

.1 Polypropylene housing reinforced with fiberglass, acrylic window, watertight assembly, 114 mm (4½") diameter, white dial back and black marking.

.2 Adjustable pointer, micrometric adjustment.

.3 Stainless steel movement.

.4 Bourdon tube: stainless steel tube and socket.

.5 Liquid: glycerine for temperatures of -18 at 66°C.

.6 Accuracy: ± 0.5% of the scale.

.7 Acceptable product: Liquid Filled, Trerice no. 450.

.3 Pressure impulse dampeners – Models:

.1 Trerice no. 870 stainless steel.

.2 Trerice no. 885 brass for steam service.

.4 Valve – Model:

.1 Jenkins no. 201SJ.

.5 Scale:

.1 Scale with international and imperial system graduations (kPa/psi).

.2 Select the operating range of each pressure gauge according to the normal operating pressure with possible extreme pressures.

.6 Installation:

.1 Install pressure gauges at the locations shown in the drawings and the specific sections, so that they are easily visible and sheltered from mechanical shocks.

.2 Provide a tee fitting with female thread.

.3 When the piping is located more than 2.4 m above the floor, install the gauges at 2 m or less from the floor with appropriate tube and anchor.

2.3 MANUFACTURER LIST

.1 List of manufacturers, section 23 05 19.01.

.1 Thermometers and pressure gauges:

.1 Ashcroft

.2 Marsh

.3 Mueller

.4 Pitanco

.5 Trerice

Part 3 Execution

3.1 PRESSURE GAUGES

.1 Install pressure gauges in the following locations.

.1 Upstream and downstream of control valves.

.2 Provide pressure gauges with a shut-off valve for the purposes of network balancing.

.3 Use extensions when the pressure gauges are installed on insulated pipes.

3.2 PROTECTION

.1 Protect the installed equipment and components against damage during the construction.

.2 Repair the damage to the adjacent materials and equipment caused by the installed thermometers and pressure gauges.

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 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.

.6 For vertical pipe support systems in high-rise buildings, submit shop drawings and calculations with the seal and signature of an Engineer validating the design of the supports.

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 Completely install, outside the insulation, all piping supports for chilled water, domestic cold water, and water tower water (insulated). Install steel saddles with two grooves of appropriate length and width at each support to distribute the weight, to the satisfaction of the "THERMAL INSULATION" section which provides a rigid material over the entire length of the saddle.

.12 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.

.13 Install the supports in the mechanical shafts, in the same horizontal plane, to allow for the installation of a floor by others.

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

.15 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.

.16 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 ANCHORS – GENERAL

.1 Adequately guide and anchor all piping to allow proper functioning of the expansion loops, the expansion joints, and the ball joints, and to avoid stress at joints and any pipe warping.

.2 Manufacture the anchors from steel framework using fully welded construction, and solidly fixe to the building's frame.

.3 In general, attach the anchors to the main beams and the cast slabs, but not to prestressed or prefabricated slabs.

.4 The frame should not be damaged by the anchors.

.5 Submit the position of the anchors and the appropriate construction drawings for verification by the structural Engineer.

.6 Design the anchors so that they do not transmit excess heat to the building's steel framework.

.7 The temperature of the anchors' component must be based on a 2.2°C temperature variation factor per mm of distance between the outer surface of the piping and the steel framework.

.8 Securely anchor all piping connected to a device by means of flexible connections.

.9 See the anchor details for piping.

2.4 PIPE HANGERS

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

.1 Before the concrete is poured: use special concrete inserts (Grinnell fig. 282 type).

.2 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.

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

.4 For very large pipes, heavy devices, devices subject to vibrations, and anchors subject to considerable loads, install the support rods through the slab, welded to steel plates above the latter. 150 mm x 150 mm x 6 mm steel plates or larger, according to the load.

.5 Consult the structural Engineer for these special cases.

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

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

.2 Hinge components must be provided as required to allow the horizontal movement and the vertical movement of the supported pipe.

2.5 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 support at very direction change.

.1 Steel piping:

Piping nominal diameter	Rod diameter	Maximum horizontal spacing
NPS ½	9.5 mm	1.5 m
NPS ¾	9.5 mm	1.8 m
NPS 1	9.5 mm	2.1 m
NPS 1¼	9.5 mm	2.4 m
NPS 1½	9.5 mm	2.7 m
NPS 2	9.5 mm	3 m
NPS 2½	12.7 mm	3.4 m
NPS 3	12.7 mm	3.7 m
NPS 4	15.9 mm	4.3 m
NPS 5	15.9 mm	4.9 m
NPS 6	19 mm	5.2 m
NPS 8	22.2 mm	5.8 m
NPS 10	22.2 mm	6.7 m
NPS 12	22.2 mm	7 m
NPS 14	25.4 mm	7.6 m
NPS 16	31.8 mm	8.3 m
NPS 18	31.8 mm	8.5 m
NPS 20	31.8 mm	9.1 m
NPS 24	38.1 mm	9.8 m

.2 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

2.6 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 Pipe roller supports: with carbon steel yoke, rod, and nuts, and cast iron roller, compliant with the standard MSS SP69.

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

.4 Pipe roller stands: cast iron stand and roll and carbon steel support rod, compliant with the standard MSS SP69.

.5 Steel piping:

.1 Adjustable Clevis type hanger, Grinnell fig. 260.

.6 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.

.7 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".

2.7 SADDLES

.1 Thermally insulated pipes:

.1 Shields consist of a 300 mm (12") long curved plate, with raised edges, with welded central reinforcement for pipes of nominal diameters equal to or larger than NPS 12, carbon steel, compliant with the standard MSS SP69.

.2 Ribbed shields, fig. 251 or 251S from E. Myatt or 168 from Grinnell.

2.8 SUPPORTS FOR DEVICES

.1 When they not provided by the devices' manufacturer, the components for their support must be made of structural steel. Submit the calculations with the shop drawings.

.2 Devices rigidly suspended by four threaded rods:

MAXIMUM WEIGHT OF THE SUSPENDED DEVICE, ACCORDING TO THE LENGTH AND THE DIAMETER OF THE RODS, FOR INSTALLATION WITHOUT STIFFENER OR BRACING POUNDS (KG)										
Maximum length of the threaded rods		Threaded rod diameter								
		in	¼	⅜	½	⅝	¾	⅞	1	1¼
in	mm	mm	6.4	9.5	12.7	15.9	19	22.2	25.5	31.8
15	381		870 (395)	2210 (1005)	4100 (1864)	6580 (2991)	9850 (4477)	13700 (6227)	18030 (8195)	29090 (13223)
18	457		830 (377)	2210 (1005)	4100 (1864)	6580 (2991)	9850 (4477)	13700 (6227)	18030 (8195)	29090 (13223)
21	533		670 (305)	2210 (1005)	4100 (1864)	6580 (2991)	9850 (4477)	13700 (6227)	18030 (8195)	29090 (13223)
24	610		550 (250)	2210 (1005)	4100 (1864)	6580 (2991)	9850 (4477)	13700 (6227)	18030 (8195)	29090 (13223)
27	686		460 (209)	2210 (1005)	4100 (1864)	6580 (2991)	9850 (4477)	13700 (6227)	18030 (8195)	29090 (13223)
30	762		390 (177)	1960 (891)	4100 (1864)	6580 (2991)	9850 (4477)	13700 (6227)	18030 (8195)	29090 (13223)
33	838		320 (145)	1720 (782)	4100 (1864)	6580 (2991)	9850 (4477)	13700 (6227)	18030 (8195)	29090 (13223)
36	914		270 (123)	1520 (691)	4100 (1864)	6580 (2991)	9850 (4477)	13700 (6227)	18030 (8195)	29090 (13223)
39	991		230 (105)	1350 (614)	3870 (1759)	6580 (2991)	9850 (4477)	13700 (6227)	18030 (8195)	29090 (13223)
42	1067		200 (91)	1200 (545)	3490 (1586)	6580 (2991)	9850 (4477)	13700 (6227)	18030 (8195)	29090 (13223)
45	1143		180 (82)	1080 (491)	3170 (1441)	6580 (2991)	9850 (4477)	13700 (6227)	18030 (8195)	29090 (13223)
48	1219		160 (73)	960 (436)	2890 (1314)	6460 (2936)	9850 (4477)	13700 (6227)	18030 (8195)	29090 (13223)
51	1295		140 (64)	850 (386)	2650 (1205)	5950 (2705)	9850 (4477)	13700 (6227)	18030 (8195)	29090 (13223)
54	1372		---	770 (350)	2440 (1109)	5490 (2495)	9850 (4477)	13700 (6227)	18030 (8195)	29090 (13223)
57	1448		---	690 (314)	2240 (1018)	5090 (2314)	9850 (4477)	13700 (6227)	18030 (8195)	29090 (13223)
60	1524		---	630 (286)	2070 (941)	4730 (2150)	9380 (4264)	13700 (6227)	18030 (8195)	29090 (13223)
63	1600		---	570 (259)	1910 (868)	4410 (2005)	8770 (3986)	13700 (6227)	18030 (8195)	29090 (13223)
66	1676		---	530 (241)	1750 (795)	4120 (1873)	8220 (3736)	13700 (6227)	18030 (8195)	29090 (13223)
Note: this table takes into account the paraseismic measures, for devices suspended with four threaded rods, without spring, stiffening, or bracing.										

2.9 ANCHOR BOLTS AND TEMPLATE

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

2.10 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 HORIZONTAL MOVEMENT

.1 The inclination of the suspension rods resulting from the horizontal movement of the pipe from the "cold" to the "hot" position must not exceed 4° relatively to the vertical.

.2 When the horizontal movement of the pipe is less than 13 mm, shift the supports or the hangers so that the rods are vertical in the "hot" position.

3.4 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 3 EXECUTION

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 included:

.1 In general, the work includes the calculation, the supply, the supervision, and the responsibility for all materials and equipment necessary for the mechanical and electrical work on seismic restraint systems:

.1 In the event that the work or a sector of the works does not require seismic restraint systems, a letter signed and sealed by a seismic Engineer is required to confirm this fact.

.2 The calculations, the assumptions, the factors, and the installation details for the seismic restraint systems needed to meet the required standards. A signed and sealed Engineering report is required by a seismic Engineer for any new construction. This report also testifies the compliance with the various codes. This report is also required for retrofitting (renovation) projects, whose works include the installation of new equipment and distribution networks. A report must also be produced by the same Engineer for the purpose of work acceptance.

.3 Supplying seismic restraint systems and delivering this equipment to the site are this section's responsibility.

.4 The supervision of the installation of all mechanisms used for seismic control and the presentation of a compliance report issued by the seismic Engineer attesting the installations' compliance with the requirements stated in this report and those dictated by the Quebec Construction Code. A certificate of compliance will be issued prior to the work acceptance.

.5 Seismic control mechanisms include, for each discipline, but are not limited to:

.1 Braces and stiffeners at the supports (if required) for mechanical piping, ventilation ducts, and electrical conduits.

.2 Properly anchoring all devices not fitted with vibration isolators to the framework (anchored directly to the framework), whether they be mechanical or electrical.

.3 Seismic mechanisms of all pipes and devices or equipment fitted with vibration isolators.

.4 Properly anchoring all pipes and devices with vibration isolators to the framework.

.2 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).

1.6 RESPONSIBILITIES

.1 Each section (plumbing, heating - chilled water, fire protection, ventilation – air-conditioning, controls, and electrical) remains responsible for its discipline's seismic restraints systems.

.2 It is to be noted that only each relevant section knows the details, the dimensions, and the run of the mechanical pipes, the ventilation ducts, and the electrical conduits, and the names of the manufacturers that provide the devices (boilers, pumps, chillers, ventilation units, water towers, MCC, etc.).

.3 Each section retains the services of an experienced professional to design, supply, and supervise the installation of all the seismic restraint systems. This professional must have recognized expertise in the field of seismic protection for similar electromechanical installations.

.4 The consultant specialized in seismic control is responsible towards the section of the discipline concerned with the design, the supply, and the supervision of the installation of their seismic restraint systems of the concerned discipline. He remains the supervisor of the seismic measurements' structural integrity of the concerned discipline. This design report will be transmitted to the Engineering consultant for information.

.5 Each relevant section hires a consultant specializing in seismic design, whose specialized Engineer performs the calculations and elaborates the installation details for the seismic restraint systems. Before the end of the work, he must produce a compliance report for the installed seismic restraint systems. This report must be signed by the same Engineer who signed the design report.

1.7 SEISMIC CONTROL STANDARDS

.1 Unless otherwise indicated, the seismic restraints systems and the required anchors should be designed and selected to meet the requirements of the latest edition of:

.1 Construction Code of Quebec.

.2 NFPA (fire protection).

.3 CSA S86, S832.

.4 FEMA-450r1 (for existing buildings and for reference).

.5 The best Engineering (accepted) practices are also detailed in ASHRAE (Practical Guide to Seismic Restraint) and SMACNA (Seismic Restraint Manual – Guidelines for Mechanical Systems).

.6 The standards FEMA-172 and FEMA-365 must be used for the seismic rehabilitation of an existing building.

.2 The seismic zone considered is the following: Saint-Hubert: $S_a(0.2) = 0.64$.

.3 The site acceleration factor F_a to be considered in the calculations comes from the data sent by the structural Engineer which is related to the soil profile (zone category). In the context of this project, the zone category is E.

.4 Seismic importance factor I_E:

.1 Mechanical piping, ventilation ducts, and electrical conduits anchored directly (rigid fixation) to the framework: Civil protection: $I_E = 1.5$.

.5 For Saint-Hubert:

Description	Location category: E and I_E = 1.5		
	Lateral force V_p (g)		
	Ground level	Mid-height	Roof
Flat bottom tank (with contents) attached directly to a floor located at ground level or below it in a building (table 4.1.8.18 no. 13).	0.10	0.20	0.30
Rigid components with non-ductile materials or assemblies (table 4.1.8.18 no. 19).	0.35	0.71	1.06
Flat bottom tank (with contents) attached directly to a floor located at ground level or below it in a building containing toxic or explosive substances, liquids with a flash point below 38°C (100°F), or fire-extinguishing liquids (Table 4.1.8.18 No. 14).	0.14	0.28	0.43
Rigid components with ductile materials and assemblies (table 4.1.8.18 no. 18).			
Machinery, accessories, equipment, conduits, and reservoirs (with contents) containing toxic or explosive substances, liquids with a flash point inferior to 38°C (100°F), or fire-extinguishing liquids (rigid with rigid assembly and flexible with flexible assembly) (table 4.1.8.18 no. 12).	0.53	1.06	1.60
Electrical cable trays, bus bar ducts, conduits (table 4.1.8.18 no. 17).	0.18	0.35	0.53
Flexible components with non-ductile materials or assemblies (table 4.1.8.18 no. 21).	0.89	1.77	2.66
Machinery, accessories, equipment, conduits, and reservoirs (with contents) (rigid with rigid assembly or flexible with flexible assembly) (table 4.1.8.18 no. 11).	0.35	0.71	1.06
Flexible components with ductile materials and assemblies (table 4.1.8.18 no. 20).			
Pipes and ducts (with contents) containing toxic or explosive materials (table 4.1.8.18 no. 16).	0.18	0.35	0.53
Pipes and ducts (with contents) (table 4.1.8.18 no. 15).	0.12	0.24	0.35

.6 Other coefficients (Cp, Ar, Ax, R_p) are according to the Quebec Construction Code.

.7 For non-ductile assemblies, the adhesives, or the compressive anchor cartridges, the R_p value is 1.0.

.8 For superficial, chemical, epoxy resin, or embedded anchors, the R_p value is 1.5 if the embedding length/diameter ratio is less than 8.

.9 Anchor cartridges and simply installed anchors should not be used as anchors to resist tensile loads.

.10 Installation integrity level:

.1 For $I_E = 1.5$: at the least, the following systems must remain operational during and after an earthquake:

.1 Heating and steam piping installations.

.2 Communication system.

.3 Static uninterruptible power supply.

.4 Emergency generating units.

.5 Fire protection system.

.6 Elevators.

.7 Those identified by the Owner.

.2 Submit a complete dynamic analysis of the systems and the equipment referred to above, provide details concerning the maximum planned forces that will be applied to the equipment, and make recommendations for modifications or additional supports aiming to maintain the equipment in good working condition.

1.8 CALCULATIONS

.1 The consultant specializing in seismic restraint systems must obtain from the relevant mechanical or electrical section all information relating to devices, pipes, ventilation ducts, and electrical conduits required for the seismic restraint calculations (weight, type of fluid number, thermal insulation, run, spacing between supports, groups on trapeze supports).

.2 The consultant specializing in seismic restraint systems must obtain from the manufacturers of each device and equipment of the concerned discipline, the characteristics required in article "SHOP DRAWINGS AND DEVICES" in section 20 00 10 – Mechanical and electrical general instructions (weight, location of the center of gravity, number of attachment points, location of the center of gravity of the mounting points, rotational speed, seismic fragility of the internal components, etc.).

.3 The calculation parameters, the calculations, and the installation details for the anchor bolts and the seismic restraint systems should be checked by an Engineer specializing in seismic control design.

.4 For vertical loads or equipment overturning risks, use the equations detailed in the standard FEMA 450-1.

.5 Provide for information: the seismic Engineer’s design report, the parameters or the values used in compliance with the Building Code of Québec, the bases of calculations, the data of the analyzed equipment or networks, the calculations for seismic bracing, the overturning calculations, the overturning moments, the anchor calculations, the recommended restraint systems, and the installation details, and this for each installed network and equipment. Provide the plans locating the restraints and the drawings for each device along with product specifications.

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

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

.8 Also, see the article "SEISMIC STANDARDS".

1.9 DOCUMENTS TO PROVIDE

.1 Provide the shop drawings of the seismic restraint systems, the calculations, and the calculation coefficients.

.1 The calculation coefficients represent the categories for location, risk, seismic zone, building height, height of installation, and all required parameters listed in the Quebec Construction Code.

.2 For each electromechanical device, provide:

.1 The identification.

.2 The manufacturer's name and the model.

.3 The physical dimensions.

.4 The weight.

.5 The location of the center of gravity (indicate whether the location was obtained from the manufacturer of the device or supposed).

.6 The location and the number of attachment points.

.7 The location of the attachment points' centers of gravity (when the center of gravity is different from the unit's center of gravity).

.8 The rotational speed (if applicable).

.9 The seismic fragility of the internal components of the device.

.10 The horizontal and vertical force considered in the calculations.

.11 For civil protection projects, I_E = 1.5: the OSHPD Special Seismic Certification or the certification from the manufacturer confirming the capability of the equipment to withstand seismic forces and the confirmation that it will remain operational during and after an earthquake.

.3 Anchor bolt calculations indicating:

.1 The type of bolts, the manufacturer, and the model.

.2 The diameter.

.3 The embedment depth in the concrete.

.4 The concrete's compressive strength.

.5 The minimum spacing between the bolts and the concrete bases' edges.

.6 The applied and allowable stresses in shear and in tension.

.7 The overturning moments.

.8 The component's opposing (righting) moment.

.4 The types of mechanical seismic restraint systems for each device and indicate the characteristics of the cables and the rigid structural members, as well as the various elements of the seismic restraint system.

.5 For I_E = 1.5: present calculations or test results (or both) demonstrating that the equipment and systems listed in paragraph 1.4.2.2 can remain operational during and after an earthquake.

.6 For $I_E = 1.5$: the consultant specialized in seismic control should submit the 100% complete documents, prepared in accordance with the quality standard, and of the same dimensions as the construction documents that constitute the tender documents. These must contain in entirety the working drawings, the list of equipment, the design calculations, the drawings, and the specifications that are used for the detailed design of the seismic restraint systems.

.2 The consultant specializing in seismic control must provide a written document countersigned by the relevant section certifying that the plans, the specifications, the shop drawings, the products supplied, and the installation have been checked by an Engineer specializing in seismic design, and are adequate and compatible with the entire building, while respecting the seismic design standards, and must provide a compliance report.

.3 Provide the following documents:

.1 The operation and maintenance instruction manuals.

.2 The plans maintained up to date.

1.10 SEPARATE PRICES

.1 See the article "INSTRUCTIONS TO BIDDERS – SEPARATE PRICES".

1.11 INSPECTIONS

.1 After having installed all rigid and flexible restraints and ensured proper operation under standard operating conditions, proceed to the seismic restraint system inspection and repairs.

.2 The specialized consultant will inspect all seismic restraint system installations it has calculated and provided. Submit a written report signed by the same Engineer who produced the design report including, among other things:

.1 The installation errors with the corrective actions to be implemented.

.2 The improperly (inappropriately) selected seismic dampers.

.3 The other deficiencies that could affect the proper operation of seismic restraint systems with the corrective actions to be implemented.

.4 The steps to correct the installations.

.5 The electromechanical installation’s signed certification of compliance with the standards previously listed, to be issued once all defects or errors have been corrected. This report must be delivered to the Consulting Engineer prior to the work acceptance.

Part 2 Product

2.1 GENERAL

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

.2 The seismic restraint systems must be compatible with the mechanical and electrical designs, and the building's structure. They must not impede the mechanical and electrical systems' normal operation, including the expansion of normal operation networks and the expansion joints of the buildings. They must be designed and installed to withstand the minimal acceleration forces described.

.3 At the building's joints, the seismic restraint systems must be designed to bear a multiplicative factor of two times the expansion joint movement planned by the structural Engineer.

.4 Seismic protection devices must not be anchored to two different structures, such as a wall and a ceiling, and they cannot be attached to another component.

.5 A distribution network or a piece of equipment that is braced or is not required to be braced must not cause damage to an essential type of distribution network or equipment.

.6 The seismic restraint systems should be able to, in the event of an earthquake, prevent all permanent displacement, in all directions, caused by lateral, rising, or rocking movements.

.7 The seismic consultant shall verify that the combined vibration isolators are sufficient to respond to the calculated seismic forces. Seismic shocks, cable attachment hardware and other fastener systems from manufacturers who specialize in these products are to be used, and adjustments to be made by each concerned section, as required.

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

.9 The fasteners and the fixation joints must be capable of withstanding the same maximum loads as the seismic protection devices.

.10 For the longitudinal braces, the pipe fastener must necessarily be directly on the pipe (under the thermal insulation).

.11 The seismic braces must be located near the supports (maximum distance of 100 mm (4")) for piping, ventilation duct, or electrical conduit systems.

.12 Depending to the type of service and its manufacturing material, the positioning and the number of braces must consider the maximum permissible offset according to the forces involved throughout distribution network.

.13 The seismic restraints installed on the pipe networks must be compatible with the requirements relating to anchors and pipe network guidance.

.14 Do not add rigid type seismic restraints to existing supports for piping, ventilation ducts, and electrical conduits without checking the ability of these supports to withstand the increased forces created.

.15 Highly resistant mechanical expansion anchors must be used to fix seismic restraints to concrete structures. The use of anchors and fasteners installed with a nail gun is prohibited. Cartridge fasteners and anchors simply installed must not be used for tensile loads. See section 23 05 29 – Hangers and supports for HVAC piping and equipment.

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

.17 The seismic protection devices installed on piping networks, duct networks, and related fasteners attached to the equipment must be compatible with the anti-vibration and anti-seismic devices destined for the components. They add to the devices provided for the vertical support of the component.

.18 The seismic protection devices must not interfere with the fire protection devices nor compromise their integrity.

.19 The vertical supports, including vibration isolators, should in no way develop moments (righting (opposition) forces) during the normal operation of the networks or equipment.

.20 Service risers and those in the wells must include seismic restraint systems and follow this section's recommendations.

.21 Stiffeners will need to be added to the hanger rods when required, to prevent buckling.

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

.23 Check with the division "STRUCTURE" prior to anchoring the suspension or wall stabilization elements. The equipment aimed by these fastening elements are, among others, the tanks.

.24 Reread the article "PAINTING" in section 20 00 10 – Mechanical and electrical general instructions.

2.2 PIPES WITHOUT VIBRATION ISOLATORS OTHER THAN THE FIRE PROTECTION

.1 The pipe supports must withstand all transitory conditions (in case of seismic event), including:

- .1 The weight of the pipe, the valves, the accessories, the fittings, the thermal insulation, and the internal fluids.
- .2 The forces imposed by the thermal expansion and contraction effects in the elbows and the loops.
- .3 The friction forces generated in the expansion joints to the guides (rails) and the supports.
- .4 The other loads, such as water hammers, the vibrations, and the reactions to safety valve forces.
- .5 The occasional loads, such as ice, wind, and seismic forces.

.2 The pipe supports must be fitted with longitudinal and transverse bracing. They can be of the rigid type or the flexible (cable) type. In a same bracing system, always use identical spacers (do not use rigid spacers with cables). Comply with the SMACNA installation diagrams.

.3 Use one or more of the following methods, according to the site conditions:

- .1 Securely affix the piping to the framework.
- .2 Reinforce the pipe in all directions.

.3 Reinforce the piping's fixation points to the framework.

.4 Affix the piping with braces. Fixing the pipe by bracing prevents oscillations in the horizontal plane, swinging in the vertical plane, and sliding and buckling in the axial direction.

.5 Use flexible bracing for a trapeze hanger piping installations.

.6 Use flexible bracing for a piping installations with vibration isolators. The flexible bracing must not be in full tension to avoid undue forces on the components.

.4 Except for fire protection, seismic bracing may be omitted for:

.1 Oil, diesel, propane, natural gas, refrigeration, medical gases, vacuum, and compressed air piping, with a diameter smaller than NPS 1.

.2 The piping installed in the boiler room and in the mechanical rooms, with a diameter smaller than NPS 1¼.

.3 The NPS 2½ or smaller piping. For the pipes installed on trapeze hangers, whose total weight is less than the weight of an NPS 2½ pipe or the equivalent of 14.9 kg/m (10 lb/ft).

.4 The individually suspended pipe, whose length between the top of the pipe and the anchors is 300 mm (12") or less. The seismic restraints cannot be omitted if a single support respecting this length is present throughout pipe's run. If the ducts are installed on a trapeze, the allowable length of 300 mm (12") is located between the bottom of the trapeze and the anchor.

.5 The equipment weighing less than 9.1 kg (20 lb) in operation.

.5 The maximum spacing between seismic bracing must be as follows, unless otherwise specified in the various tables (see the SMACNA tables):

Description	Oil, diesel, natural gas, and propane gas pipes, PVC pipe, and pipes with clamping screws or rings	Others
Transverse		
0.25 g 0.5 g 1.0 g 2.0 g	7.6 m 6.1 m 6.1 m 3 m	15.2 m 12.2 m 12.2 m 6.1 m
Longitudinal		
0.25 g 0.5 g 1.0 g 2.0 g	12.2 m 12.2 m 12.2 m 6.1 m	24.4 m 24.4 m 24.4 m 12.2 m
Riser		
0.25 g 0.5 g 1.0 g 2.0 g	12.2 m 9.1 m 9.1 m 6.1 m	12.2 m 9.1 m 9.1 m 6.1 m

.6 Each pipe run must have at least two transverse braces and one longitudinal brace. A transverse bracing must be installed at each end of the run.

.7 A transverse brace can be used as a longitudinal brace at a 90º elbow of the same diameter if installed within 600 mm of an elbow, or as shown in the offset tables issued by SMACNA, or a tee fitting, provided that the brace is of suitable dimensions for longitudinal bracing.

.8 For gas piping, the bracing calculations must consider the weight with a multiplying factor of 2.

.9 When piping passes through a building's seismic joint or expansion joint, or when piping is connected to a device based on vibration isolators, flexible multidirectional joints must be installed. Consult the regulations issued by ASHRAE (Handbook and Practical Guide to Seismic Restraint) for the allowable deviation length (refer to tables 8.1 and 8.2).

.10 The embranchments should not be used as braces for the main pipes.

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

.12 All cast iron pipe, glass pipe, or other pipe having mechanical joints with rings and clamping screws supported by supports 300 mm or further from the framework should be fitted with seismic braces at all the changes of direction of 90° or more. The riser pipe joints must be stabilized with braces between the floors.

.13 The riser pipes must be supported laterally at each floor (see SMACNA details).

.14 The walls constituting the compartmentation, the firewalls, or other security features may not be considered as a means of bracing.

2.3 FIRE PROTECTION PIPES AND EQUIPMENT

.1 The pipe or equipment supports must withstand all transitory conditions (in case of seismic event), including:

- .1 The weight of the pipe, valves, fittings and internal fluids must consider a multiplying factor of five (5) times the mass of the pipes and accessories filled with water.
- .2 Other loads, such as water hammers.
- .3 The occasional loads, such as a weight of 114 kg (to represent a worker grabbing a pipe during a fall from a ladder during installation, NFPA-13), and seismic forces.

.2 Seismic restraint systems must be according to the NFPA-13 standards, latest edition.

.3 The equipment must include seismic restraint systems and comply with the NFPA-20 requirements, latest edition.

.4 Use one or more of the following methods, according to the site conditions:

- .1 Securely affix the piping to the framework.
- .2 Reinforce the pipe in all directions.
- .3 Reinforce the piping's fixation points to the framework.

.4 Affix the piping with braces.

2.4 VENTILATION DUCTS WITHOUT VIBRATION ISOLATORS

.1 The ventilation duct supports must withstand all transitory conditions (in case of seismic event), including:

.1 The weight of the ducts, the accessories, the fittings, the stiffeners, the thermal insulation, and the acoustic insulation.

.2 The forces imposed by the pressure of the air moving in the ducts.

.3 The occasional loads, such as ice, wind, and seismic forces.

.2 The ventilation duct supports must be fitted with longitudinal and transverse bracing. They can be of the rigid type or the flexible (cable) type. In a same bracing system, always use identical spacers (do not use rigid spacers with cables). Comply with the SMACNA installation diagrams.

.3 Respect the brace installation angle that must vary from an angle of 45 to 60° relative to the horizontal.

.4 Seismic bracing may be omitted for:

.1 Rectangular ducts with cross sections smaller than 0.56 m².

.2 Oval ducts with cross sections smaller than 0.56 m².

.3 Circular ducts with a diameter smaller than 700 mm.

.4 Ducts whose length between the top of the duct and the level of the anchor is 300 mm or less. The seismic restraints cannot be omitted if a single support respecting this length is present throughout the duct's run. If the ducts are installed on a trapeze, the allowable length of 300 mm is located between the bottom of the trapeze and the anchor.

.5 Ventilation ducts that are installed on trapezes and the total weight of the ducts is less than the weight of a duct of 700 mm, 0.56 m², or the equivalent of 14.9 kg/m.

.6 The terminal units, the fans, or other equipment that weigh less than 9 kg, connected rigidly or flexibly to the duct, and must be suspended by at least four rods.

.7 Only for normal buildings, I_E = 1.0: the braces can be omitted for grilles, diffusers, and lighting fixtures, except those installed in the issued spaces, including the corridors.

.5 The spacing between seismic braces should be as follows (refer to the SMACNA tables):

Seismic risk levels	Maximum distance between braces	
	Transverse and riser	Longitudinal
0.25 g	12.2 m	24.4 m
0.5 g	9.1 m	18.2 m
1.0 g	9.1 m	18.2 m
2.0 g	6.1 m	12.2 m

.6 Transverse braces must be installed at each end if the length of the duct is less than the maximum allowable distance. Transverse braces must be installed at each elbow and at the each end of a length. The minimum is two per duct length.

.7 Install at least one longitudinal bracing per duct length. A transverse brace can be used as a longitudinal brace for 90° elbows if installed within two times the width of the duct fitting or as recommended by SMACNA and that the brace is calculated for larger cross sections.

.8 The ducts may be grouped on a same support and the braces are calculated accordingly.

.9 The walls through which ventilation ducts run can serve as transverse bracing, provided that the walls securely surround the pipes.

.10 When ducts pass through a seismic joint or a building expansion joint, a flexible connector must be installed (minimum length of 250 mm).

.11 The grilles and the diffusers can be fixed with the metal screws in the tees of the false ceiling, which is itself braced, and the loads are calculated accordingly.

.12 For a redevelopment (retrofitting) project, the flexible bracing must be selected.

.13 If flexible joints are installed in the conduits' run, then flexible bracing must be selected.

.14 A conduit should not be anchored to a structure or to a part of the building that responds differently to earthquakes.

2.5 ELECTRICAL CONDUITS, BUSBARS, RACEWAYS, ETC.

.1 The electrical duct supports must withstand all transitory conditions (in case of seismic event), including:

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

.2 The occasional loads, such as ice, wind, and seismic forces.

.2 The conduit supports must be fitted with longitudinal and transverse bracing. They can be of the rigid type or the flexible (cable) type. In a same bracing system, always use identical spacers (do not use rigid spacers with cables), according the SMACNA installation diagrams.

.3 Use one or more of the following methods, according to the site conditions:

.1 Securely affix the piping to the framework.

.2 Reinforce the conduits in all directions.

.3 Reinforce the conduits' fixation points to the framework.

.4 Affix the conduits with braces. Fixing the conduits by bracing prevents oscillations in the horizontal plane, swinging in the vertical plane, and sliding and buckling in the axial direction.

.4 Seismic bracing may be omitted for:

.1 Electrical conduits suspended individually, whose length between the top of the conduit and the anchor is 300 mm or less. If the conduits are installed on a trapeze, the allowable length of 300 mm is located between the bottom of the trapeze and the anchor.

.2 Electrical conduits smaller than 80 mm in diameter. If the electrical conduits are installed on trapezes and if the total weight is less than an NPS 2½ pipe or the equivalent of 14.9 kg/m.

.5 The maximum spacing between seismic braces should be as follows, unless otherwise specified in the various tables (refer to the SMACNA tables):

Description	Electrical conduits		
	Transverse	Longitudinal	Risers
0.25 g	15.2 m	24.4 m	12.2 m
0.5 g	12.2 m	24.4 m	9.1 m
1.0 g	12.2 m	24.4 m	9.1 m
2.0 g	6.1 m	12.2 m	6.1 m

.6 Transverse braces must be installed at each end if the conduit length is less than the maximum allowable distance. Transvers braces must be installed at each elbow and at each length end. The minimum is two per conduit length.

.7 When the conduits pass through a seismic joint or a building expansion joint or that the conduits are connected to a device based on vibration isolators, flexible multidirectional joints must be installed.

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

.9 The conduit risers must be supported laterally at each floor (see SMACNA details).

2.6 ELECTROMECHANICAL DEVICES WITHOUT VIBRATION ISOLATORS

.1 The supports must withstand all transitory conditions (in case of seismic event), including:

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

.2 The forces imposed by the thermal expansion and contraction effects.

.3 The reactions during start-ups and stops.

.4 The vibration.

.5 The occasional loads, such as ice, wind, and seismic forces.

.2 Coordinate with structural Engineer for the weight of the equipment and the internal tanks, as well as the weight of their contents. If this weight is greater than 10% of the mass of the floor that supports the whole, rational analysis must be undertaken and consider its lateral forces.

.3 The devices or equipment must be securely anchored or fixed to the building's framework of the same structural composition to prevent them from sliding, oscillating, or tilting. Provide the supports (hanger brackets) in sufficient quantity and of adequate strength to withstand the shear stress and to prevent movement. Avoid support failure in tension, compression, or by an excessive rotation imposed to the foundation (framework).

.4 Devices resting on the floor (slab) are anchored securely to the floor or fixed to a structural wall with metal straps, etc. For devices with a high center of gravity (from the floor), provide rigid supports to avoid overturning, which, from the top of the equipment and diagonally, can be installed to the ceiling, the floor, or even to a structural wall.

.1 For equipment not fitted with attachment points, see to the addition of these anchor points, by welding or by another method of attachment, or provide the installation of fixing belts.

.2 For MCC motor controls center cabinets, electrical inlets, etc., where indicated, use external steel frames with cabinets anchored to the floor (and to the ceiling if possible).

.5 Seismic restraints may be omitted for equipment or components with operating weights less than 9.1 kg.

.6 The minimum number of anchors is four and they must be lined with neoprene.

.7 Suspended devices:

.1 With flexible type of bracing, anchoring to the slab, in compliance with the regulations. The installation angle varies from 45 to 60° relative to the horizontal.

.2 Lighting fixtures installed in the issued corridors or if the ceiling is specifically designed to withstand earthquakes (placed on the suspended ceiling's tees or surface mounted): attached to the structural slab with 12-gauge cables or chains of a length so that no part of the lighting fixture hangs lower than 2 m above the floor to at least two opposite corners. The cable has a PVC protective covering (sleeve). The lighting fixture must be able to oscillate at an angle of 45° without any risk of it colliding into a component. The brace must be capable of supporting twice the weight of the suspended component.

2.7 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.

.10 Location and specifications:

.1 See the vibration bases and isolators tables at the end of this section.

.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:

.1 Comprising one or more springs placed inside an aluminum casing (heat treated aluminum alloy or 345 MPa cast iron), resistant to corrosion.

.2 Isolate the upper and lower parts of the housing using neoprene linings designed to minimize the vertical friction.

.3 Use this type isolator as little as possible and always after having received the approval.

.4 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.

.5 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.

.6 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.

.7 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.

.8 Flexible pipes:

.1 Genera:

.1 Provide the flexible pipes shown in the vibration bases and isolators table.

.2 The dimensions of the piping and not of the connections to the device.

.1 For pipes NPS 2 and smaller:

.1 Threaded fittings.

.2 For pipes NPS 2½ and larger:

.1 Flanged fittings. Ensure that the alignment of the piping does not exceed the flexible piping's allowable alignment limits.

.2 For pipe NPS 2 and smaller:

.1 Flexible pipe made from a stainless steel mesh, minimum operating pressure of 1035 kPa, resistant to fatigue loading, lateral movement of 13 mm in amplitude at 500 Hz, Flexi-Tube TSN model.

.2 For copper pipe, brass mesh, Flexi-Tube CBH model.

.3 For pipe NPS 2½ and larger:

.1 Stainless steel flexible pipe with multiple rings, malleable iron flanges and control rods, resistant to an axial compression and extension of a minimum of 13 mm, and to a lateral motion of a minimum of 7 mm, operating pressure of 1100 kPa, at a temperature of 38°C, Flexi-Tube FST model.

2.8 BASES

.1 General:

.1 This section must provide the directives and the supervision for the installation of all bases.

.2 See the details of the different types of bases.

.3 Also see the article "VIBRATION ISOLATORS".

.4 Locations: see the vibration bases and isolators tables.

.2 Calculations:

.1 These calculations comprise for each rotary machine:

.1 The machine identification.

.2 The manufacturer.

.3 The model.

.4 The speed.

.5 The engine power.

.6 The rotor’s diameter.

.7 The weight.

.8 The physical dimensions.

.9 The type of base.

.10 The dimensions of the concrete base.

.11 The weight of the concrete base.

.12 The base’s frame.

.13 The type of spring.

.14 The positioning of the springs.

.15 The positioning of the anchors.

.16 The springs' kH/kV ratio.

.17 The attenuation percentage of the base in function of the anticipated load.

.3 Type I – Concrete leveling base:

.1 See the article "CONCRETE WORKS" in section 20 00 10 - Mechanical and electrical general instructions. See the drawings.

.4 Type II – Inertia base:

.1 See the article "CONCRETE WORKS" in section 20 00 10 - Mechanical and electrical general instructions. See the drawings.

.5 Type III – Common metal base:

.1 Supplied and installed by the section providing the device. See the drawings.

.6 Type IV – Elevated steel base:

.1 Supplied and installed by the section providing the device. See the drawings.

.7 Type V – Device installed on springs:

.1 Install the vibration isolators directly under the device and fix them to the supports of the latter, with stabilizers if required. See the drawings.

.8 Type VI – Suspended devices:

.1 See the drawings.

.9 Type VII – Axial fan, vertical installation:

.1 See the drawings.

.10 Type VIII – In-line pump:

.1 See the drawings.

.11 Type IX – Cantilever base:

.1 Metal frame supplied and installed by the section providing the device. Attach it to the wall or to a concrete column.

.12 Type X – Levelling base on rock:

.1 Liquid Hornflex SL resilient sealant from Tamms Industries (with primer application before applying the sealant).

.2 Fiberglass board with a density of 96.3 kg/m³. Seal the exposed surface with the resilient sealant.

.3 Base dimensions: according to the guidelines of the section providing the device.

.4 See the drawings.

.13 Supports – Piping:

.1 Pump suction and discharge:

.1 To prevent all of the piping's and accessories' weight from resting on the pump connections. Steel supports and saddles with lead or plastic inner lining. The anchoring to the floor or to the anti-vibration base. They may be welded to the steel pipe.

.2 Piping supports with vibration isolators:

.1 Hanger type isolators, depending on whether the pipe is suspended or supported at the floor.

2.9 DEVICES WITH VIBRATION ISOLATORS

.1 The supports must withstand all transitory conditions (in case of seismic event), including:

.1 The weight of the devices, the accessories, the thermal insulation, and the internal fluids.

.2 The forces imposed by the thermal expansion and contraction effects.

.3 The reactions during start-ups and stops.

.4 The vibration.

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

.2 These devices must be securely anchored to the building structure to prevent them from slipping or tipping.

.3 Apply one or more methods, according to the site conditions:

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

.2 Use separate dampers additionally to anti-vibration devices.

.3 Use a damping system constructed from a combination of structural elements and an elastomeric material, with the approval of the Engineer.

.4 The damping effect achieved by an elastomeric material or other means must be soft and regular so as to prevent high impact loads.

.5 Seismic restraint systems should not interfere with the vibration isolators. They must only operate in the event of an earthquake and not cause any overturning moment.

.6 Each device must have at least four flexible seismic dampers in no tension, installed as near as possible to device's corners so as to avoid preventing the vibratory movement of the equipment during operation.

.7 Each type of seismic damper must have the following characteristics:

.1 The non-cemented impact surface must have a high quality elastomeric in place for resetting.

.2 The resilient material must be easily accessible for damage inspection and replacement.

.3 The assembly must be able to reduce movements in all directions.

.4 The dampers must be tested by independent laboratories and be certified by an Engineer registered in this discipline.

.5 In general, a maximum spacing of 6 mm between the device and the seismic damper.

.8 Pipes, ventilation ducts, and devices supported with the vibration isolators:

.1 To avoid transmitting the vibrations through the rigid bracing during normal operation, these suspended components will have slack cables made of galvanized steel or stainless steel, see F type seismic dampers.

.2 The seismic restraint equipment must have the characteristics described for pipes and ventilation ducts without vibration isolators.

.9 Seismic damper types:

.1 In general, the seismic dampers will be integrated with the vibration isolators. When seismic forces are too high or that the vibration isolators are pre-existing, they are the separate type.

2.10 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 Stiffeners on hanger rods:

.1 Mason Industries Inc. and Vibro-Acoustics (Distributions P.G.A.L. Inc.)

.2 Power-Strut (Mueller Flow Control)

.3 Unistrut (Routleco Inc.)

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

.5 Vibron Ltd, Kinetics Noise Control (The Master Gtoup ltd).

.2 Mechanical piping and electrical conduit supports without vibration isolators:

.1 Mason Industries Inc. and Vibro-Acoustics (Distributions P.G.A.L. Inc.)

.2 Power-Strut (Mueller Flow Control)

.3 Unistrut (Routleco Inc.)

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

.5 Vibron Ltd, Kinetics Noise Control (The Master Gtoup ltd).

.3 Stiffeners on suspension rods and fire protection pipe supports:

.1 Hilti

.2 Nvent (Erico/Caddy)

.3 Tolco Inc.

.4 Victaulic

.5 Or approved equivalent

.4 Seismic dampers:

.1 Mason Industries Inc. and Vibro-Acoustics (Distributions P.G.A.L. Inc.)

.2 Vibro-Racan, Vibration Mountings & Controls Inc. and Korfund Dynamics Co. Inc. (Racan Carrier).

.3 Vibron Ltd, Kinetics Noise Control (The Master Gtoup ltd).

.5 Steel framing external to certain equipment’s cabinets:

.1 Power-Strut (Mueller Flow Control)

.2 Unistrut (Routleco Inc.)

.6 Vibration isolators:

.1 Korfund Sampson Ltd

.2 Mason Industries

.3 Vibro-Racan (Racan Carrier)

.4 Vibron Ltd

.7 Flexible Hoses:

.1 Flex-Hose (Enviroair)

.2 Flex-Pression

.3 Flexi-Tube

.4 Flexonics

.8 Bases:

.1 Mason Industries

.2 Vibro Racan (Racan Carrier)

.3 Vibron Ltd

.3 List of experts certified for seismic calculations:

.1 Blais Expert-conseils & associés (450-923-3337)

.2 ParaSis (514-949-7272)

.3 Polydex (819-536-3332)

.4 None of the manufacturers are certified to perform the seismic calculations signed by an Engineer member in O.I.Q. (project in Québec). The Contractor must use the above specialists with the products from the certified manufacturer.

Part 3 Execution

3.1 LOCATIONS

.1 At locations described in Part 2.

3.2 VIBRATION ISOLATORS

.1 In general, anchor the vibration isolators onto leveling bases and fix them to the supported devices. Adjust the leveling nuts.

3.3 SEISMIC RESTRAINT SYSTEM INSTALLATION

.1 All anchoring and fixation points must be able to withstand the same maximum loads as the seismic protection devices, according to the latest version of the Quebec Construction Code.

.2 Do not weld the seismic braces directly to the supports and the reinforcements that transport the mechanical pipes, ventilation ducts, or electrical conduits.

.3 For equipment not fitted with attachment points, provide an attachment device or install fixing belts, all approved by an Engineer specialized in seismic design.

.4 The structural bases of the equipment must be stabilized to prevent the seismic devices from overturning. The installation of equipment on two simple beams, for example, is prohibited.

3.4 SEISMIC ANCHORING

.1 Check on site that the anchor bolts, the diameters of the inserts (pins), the embedment depth in the concrete, and the length of the welds are in conformance with the drawings submitted and follow the instructions.

.2 Bolted to the frame all the various equipment that is not isolated against vibration. Check with the division "STRUCTURE" for imposing equipment.

.3 The holes around the bolts must be a maximum of 1.6 mm larger than bolt's diameter.

.4 Oblong holes for bolt adjustment is prohibited.

.5 The anchors in the concrete slabs will have to be distanced from the concrete edges, follow the anchor manufacturer's recommendations, according to the standard ASTM-E488.

3.5 SEISMIC CABLE

.1 Attach the cables to the equipment suspended from the ceiling so that the axial projection of the cables pass through the equipment's center of gravity.

.2 Install the cables using cable grommets, mounting lugs, and other appropriate hardware parts to ensure the alignment of the protection devices and prevent the cables from bending at the fixation points.

.3 Guide the ceiling suspended equipment's cable restraints for them to preferably be at 90° from each other (in the plane) and then attach them to the ceiling slab so that they have an angle not exceeding 45° with the latter.

.4 Adjust the cable restraints so as to allow the normal operation of the vibration isolators without being visibly slack (6mm movement or less).

.5 At a same bracing, always use identical spacers (do not use a rigid brace with a cable brace).

3.6 CLEARANCES

.1 All seismic restraint systems must be checked after the mechanical and electrical systems have been started to ensure that the recommended clearances are obtained. No more than recommended, since the fragility of the unit may be affected. Make adjustments where required. Ensure that the seismic dampers do not cause short circuits at the vibration isolators.

.2 A clearance of at least 25 mm must be provided between the seismic protection devices and all other service equipment and elements.

3.7 BASES

.1 Type II – Inertia base:

.1 Pour the concrete constituting the inertia bases onto a flat smooth surface using a polyethylene provided by this section. Anchor the devices to the bases using bolts and expansion shields.

3.8 SUPPORTS – PIPING

.1 On piping NPS 3 or larger connected to a device capable of generating vibration, install spring vibration isolators at the first three supports.

.2 The static deflection of the first support being equal to the deflection of the isolators supporting the device, the others must have a deflection of 25 mm.

.3 Note: if the equipment is installed on anti-vibration pads, use supports having an equal deflection.

VIBRATION BASES AND ISOLATORS CHARACTERISTICS							
Identification		**2S-072**	**072-VE-02**				
Localization		Room no. 2B-100	Room no. 2B-102				
Leveling bases		No	No				
Bases	Type	VI	VI				
	Thickness						
Vibrations isolators	Type spring	ST	ST				
	Cushions						
	Flexion (in.)						
Flexibles fittings	Suction						
	Discharge						
Comments							

Notes :

E : nested isolator
ELM : nested isolator with a motion limiter
S : vibration isolation hangers
N : Neoprene pad
NSN : Neoprene-steel-neoprene pad
SNS : steel -neoprene-steel pad
RP : seismic spring
ST : with stabilizer
VD : see the description in the specifications

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 ACCESSES

.1 The identification of accesses applies to valves, manual dampers, motorized dampers, pressure reducing boxes, control points, electrical boxes, and any other device, instrument, or accessory.

.2 Each concerned section must identify the access doors on their visible side with self-adhesive labels of 20 mm in diameter, from Avery, and in the colour shown below:

.1	Heating and cooling:	yellow
.2	Plumbing:	green
.3	Ventilation:	black
.4	Sprinklers and fire protection:	red
.5	Controls:	brown
.6	Electricity:	pink
.7	Communications:	orange

.3 Provide samples of each colour for verification.

.4 In ceilings with acoustic panels, each relevant mechanical and electrical section is required to identify the panels serving as accesses with coloured labels on the underside of the reversed tee according to the table above.

.5 Include the legend in the operations and maintenance manuals.

2.3 VALVE IDENTIFICATION

.1 Each relevant mechanical section must identify the valves that are part of their installation.

.2 All valves must be equipped with a 50 mm x 50 mm coloured plastic tag with rounded corners, displaying the letters and the numbers engraved in a different colour and attached with a sturdy steel wire to the valve stem.

.3 Use multi-stranded steel wire with lead cylinder to permanently seal the tag's wire.

.4 The numbering must be alphanumeric. It must take into account the sector and the floor. It must be continuous for all the sections. Each section must collaborate with the other sections to determine the numbering.

.5 Provide a numbering list for approval.

2.4 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.

.5 Compressed air piping:

.1 Piping NPS 1 and larger:

.1 Identify the pipe, according to the article "IDENTIFICATION OF PIPING, DUCTS, AND VENTILATION UNITS".

.2 Piping NPS ¾ and smaller:

.1 Identify the pipping such as valves with tags, steel wire, and lead. The tag must indicate the controls, the compressed air, and the operating pressure in kPa.

.6 Provide samples, as well as the identification list for verification.

2.5 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".

2.6 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 exposed plumbing, insulated or not. Identify the pipes installed in the suspended ceilings above the access doors. In suspended ceilings with removable panels, identify the pipes everywhere.

.4 Identify all apparent ventilation ducts, insulated or not, in the mechanical rooms. Identify all ventilation units. In suspended ceilings, identify the ventilation ducts above the access doors. In suspended ceilings with removable panels and where the ducts are exposed, except in mechanical rooms, identify the ducts only in shafts accessible to the shaft's exit.

.5 Identify the ducts at all fire dampers.

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

.7 In trenches and/or in non-removable suspended ceilings, pipes and ventilation ducts are considered concealed.

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

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

.10 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.
- .2 For ducts and piping NPS 2 ½ or larger, including the insulation, letters and numbers are 50 mm x 10 mm, arrows are 25 mm in height by150 mm in length.

.11 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.

.12 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.

.13 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.

.14 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.

Services	Identification legend	Back colours	Secondary identification colours
River water	RIV. WATER	Green	None
City water	CITY WATER	Green	None
Cold water	COLD WATER	Green	None
Distilled water	DIST WATER	Green	None
Demineralized water	DEMIN. WATER	Green	None
Condenser water supply	COND. WATER SUPPLY	Green	None
Condenser return water	COND. WATER RETURN	Green	None
Chilled water supply	CHILLED WATER SUPPLY	Green	None
Chilled water return	CHILLED WATER RETURN	Green	None
Refrigerated water supply	REF. WATER SUPPLY	Green	None
Refrigerated water return	REF. WATER RETURN	Green	None
Domestic hot water supply	DHW SUPPLY	Green	None
Recirculated domestic hot water	DHW RECIRC.	Green	None
Hot water heating supply, up to 120ºC	HEATING SUPPLY	Yellow	Black
Hot water heating return, up to 120ºC	HEATING RETURN	Yellow	Black
Superheated water supply, higher than 120ºC	SUPER HEATED WATER SUPPLY	Yellow	Black
Superheated water return, higher than 120ºC	SUPER HEATER WATER RETURN	Yellow	Black
Makeup water	MAKE-UP	Yellow	Black
Boiler water supply	BOILER WATER FEED	Yellow	Black
Condensate water return	CONDENSATE	Yellow	Black
Purge	PURGE	Yellow	Black
Treated water	TREATED WATER	Green	None
Brine	BRINE	Green	None
Waste water	WASTE WATER	Green	None
Storm drain	STORM DRAIN	Green	None
Sanitary drain	SANITARY DRAIN	Green	None
Combined sewer	COMBINED SEWER	Green	None
Acid drainage	ACID DRAINAGE	Yellow	Black
Motor exhaust	MOTOR EXH	Yellow	Black
Combustible (indicate the type)	COMB. (TYPE)	Yellow	Orange
Steam (indicate the pressure)	STEAM. ... KPA	Yellow	Black
Lubricating oil	LUB OIL	Yellow	Orange
Compressed air for controls	COMP. AIR FOR CONTROL	Green	None
Gasoline	GASOLINE	Yellow	Orange
Liquefied petroleum gas	LIQUIFIED PETROLEUM	Yellow	Orange
Natural gas	NAT. GAS	Yellow	Orange

Services	Identification legend	Back colours	Secondary identification colours
Chlorine	CL	Yellow	Black
Nitrogen	N	Blue	Yellow
Oxygen	O	Yellow	Orange
Vacuum	VACCUM	Green	None
Compressed air with gauge pressure equal or less than 700 kPa	CA. ... KPA	Green	None
Compressed air with gauge pressure equal or more than 700 kPa	C.A. ... KPA	Yellow	Black
Water, fire protection	FIRE PROTECTION WATER	Rouge	White
Water, automatic sprinkler	SPRINKLER	Rouge	White
Carbon dioxide (fire)	CO_2	Rouge	White
Vent (plumbing)	PLUMBING VENT.	Green	None
Vent	VENT	Yellow	Black
Glycol	GLYCOL	Yellow	Black
Halon	HALON	Rouge	White
Suction refrigerant (include refrigerant no.)	REFRIG. SUCTION. (NO ...)	Yellow	Black
Ventilation ducts:			
Cold air supply	(NO OF SYST.) COLD SUPPLY	White	None
Hot air supply	(NO OF SYST.) HOT AIR SUPLLY	White	None
Return	(NO DU SYST.) RETURN	White	None
Evacuation	((NO OF SYST.) EXHAUST	White	None
New air	(NO OF SYST.) FRESH-AIR	White	None

2.7 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 Division 23, section "HEATING – CHILLED WATER" must provide a table of the main valve(s) of each of service for the entire building and for all mechanical sections.

.5 Photocopied table with black characters on a white background, glass framed. The table must be handed to the Owner. Provide ten additional copies of this table.

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

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

2.8 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 Codification:

X	XX	XXX
Project subdivision:	Set or system:	Element:
Examples: 2 – Tower A	Examples: 45 – Staircase pressurization	Examples: V31 – Supply air fan
3 – Units AB	A1 – Steam	V60 – Humidifier
4 – Unit C	P1 –Domestic cold water	
5 – Unit D		
6 – Boiler room		

2.9 IDENTIFICATION ACCORDING TO THE EXISTING SYSTEM

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

.2 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

TABLE OF CONTENTS

Part 1 General

1.1 QUALIFICATION OF TAB PERSONNEL

.1 Submit names of personnel to perform TAB to the Engineer within ninety (90) 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.

.2 Only undertake TAB when building is essentially completed, including:

.1 Installation of ceilings, doors, windows, and other components that may affect results are complete.

.2 Installation of sealants, caulking, and weather-stripping is complete.

.3 Pressure tests, seal tests, and other tests defined in other sections of Division 23 are completed.

.4 Equipment required for TAB are installed and in good working condition.

.5 Start-up and verification for proper, normal and safe operation of mechanical and associated electrical and control systems affecting TAB including but not limited to:

.1 Proper thermal overload protection in place for electrical equipment.

.2 Air systems:

.1 Clean filters in place.

.2 Duct systems clean.

.3 Ducts, duct shafts, and plenums including ceilings are airtight, within specified tolerances.

.4 Correct fan rotation.

.5 Balancing, fire, and smoke dampers are installed and open.

.6 Coil fins are combed and clean.

.7 Access doors and hatches, installed and closed.

.8 Outlets installed, volume control dampers open.

.3 Hydronic systems:

.1 Systems flushed, filled and vented.

.2 Correct pump rotation.

.3 Strainers in place, baskets clean.

.4 Isolating and balancing valves are installed and open.

.5 Balancing valves are installed and calibrated to factory settings.

.6 Chemical treatment system complete, operational.

1.5 INSTRUMENTS

.1 Prior to starting TAB, submit to the Engineer a list of instruments to be used, with their serial numbers.

.2 Calibrate in accordance with requirements of the most stringent of referenced Standard for applicable system or HVAC system.

Part 2 Product

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 HYDRONIC SYSTEMS

.1 General:

.1 Perform all measurements and adjustments required to obtain correct flow rates in all parts of the systems and all equipment. These flows are determined using the specification as well as relevant shop drawings.

.2 Unless otherwise indicated, TAB firm required to use the following methodology:

.1 Check installations as to the availability and the accessibility of all elements necessary to the carry out the adjustments.

.2 For each piece of equipment part of a system, determine, measure, and adjust flow rates required to meet the requirements of the specifications or shop drawings.

.3 Present the results in a report, including hydraulic diagram showing all devices and equipment measured and adjusted and tables showing the measurement results.

.4 Before starting TAB, submit an outline of the proposed procedures required to comply with of this article, and a list of equipment and instruments to be used.

.2 Procedures:

.1 Produce a hydraulic diagram of the system by identifying all devices and equipment that will need to be measured or adjusted. Also, identify all measuring points to ensure that sufficient connections are provided in appropriate locations on the piping. Use this identification as a reference in the balancing report. Ensure that piping does not have any short-circuits.

.2 Establish a diversity factor by comparing pumping capacity to the sum of flows of the end devices.

.3 Using the controls schematic, determine the required position of control devices in order to obtain flow conditions representative of the calculated diversity factor. Coordinate with Division 25.

.4 Ensure that system has been properly flushed and purged of air.

.1 Operate all manual valves and set them to their normal operating position.

.2 Ensure that all control valves are in desired position prior to starting measurement.

.3 Ensure that expansion tanks are adequately charged.

.5 When design flow conditions are reached, measure suction and discharge pressure at the pump(s). Measure at zero flow.

.6 Measure voltage between phases and amperage of each phase of the pump motor, at the conditions mentioned above.

.7 Check correlation between pressure versus the flow rate readings and the pump curve.

.8 Constant flow shall be maintained for the entire TAB procedure by either manually adjusting valves at discharge of the pump or by adjusting the pump speed, as appropriate.

.9 Start the balancing procedure by adjusting first the branch with the least resistance (usually, but not necessarily the shortest) and ending with the branch pipes having the most.

.3 Primary/secondary circuits:

.1 For primary/secondary pumping systems, reasonably adjust the primary circuit before adjusting the secondary circuits. During the adjustment of the primary circuit, the secondary pumps must be in operation. Ensure that there is flow.

.4 Flow measurements:

.1 In places where balancing valves are shown, refer to relevant technical data sheets and perform measurements and adjustments as per manufacturer's instructions.

.2 Any equipment, such as coils, some valves, control valves, chillers, etc., having a flow versus pressure drop relationship certified by the manufacturer, can be used to measure the flow. If fluid density is constant, flow rate can be determined by measuring the pressure difference delta P_2 between the inlet and the outlet by applying the Bernoulli equation as follows:

.1 Where P_1 is the pressure drop at flow Q_1, as provided by the manufacturer, actual flow (Q_2) can be calculated by measuring the actual pressure drop P_2.

$$\frac{Q_1^2}{Q_2^2} = \frac{\Delta P_1}{\Delta P_2}$$

.2 Control valves are excellent devices for measuring flow rates. As Cv or Kv is known from the valve's data sheet, we can determine the pressure difference across it and therefore determine the flow rate (Q_1).

.3 Using the Cv value, we apply the equation $h = 2.3 (Q_1/Cv)^2$ where Q_1 is in gpm (US) and h is in feet.

.4 Using the Kv value, we apply the equation $h = (36 Q_1/Kv)^2$ where Q_1 is in L/s and h is in kPa.

.5 Ensure that the control valve is fully open before taking any measurements. Adjust the balancing valve to required "h" value.

.6 The accuracy of the results depends on the accuracy of the manufacturer's data, the accuracy of the pressure gauge used, as well as the constancy of the fluid's density.

.3 The system's pump can be used as a flow indicator, if a calibration curve is provided. Pump specification will indicate if the calibration curve is required.

.1 Measure the differential pressure between the suction and discharge of the pump. Use the pump curve to determine the flow rate.

.2 If the pump curve is a calibration curve, its reading can be considered exact and the result used as is.

.3 If the pump curve is the published curve, the curve can be validated by taking a pressure reading at the pump's discharge at zero flow and comparing it with the value given on the curve.

.4 If the values are the same, the published curve can be used as if it were a calibration curve.

.5 If the values are not the same, draw a new curve parallel to the published curve with the pressure measured at zero flow as a starting point. This new curve will be used to determine flow rates at other pressures.

.6 Measure the pressures with the greatest possible precision. The flatter the pump curve, the more important the reading's accuracy becomes.

.7 Ensure that the measured pressure reading at the suction of the pump is above the NPSH (Net Positive Suction Head) required by the manufacturer.

.8 Measure the amperage and voltage of the pump's motor at operating flow rate. Locate the operating point on the pump curve and compare it with the calculated power requirements to check for concordance.

.9 Compare flow rate at the pump with the flow rate of the system.

.5 Hydraulic TAB Report:

.1 For each balanced system, the report shall include, as a minimum, the following information:

.1 Pumps:

.1 Design information:

.1 Identification (refer to drawings and specification).

.2 Flow rate.

.3 Hydrostatic head.

.4 Brake horsepower (BHP).

.5 Nominal motor power.

.2 Equipment data:

.1 Identification (refer to drawings and specification).

.2 Manufacturer, model, serial number.

.3 Size.

.4 Type.

.5 Design pressure (corresponding to maximum operating temperature).

.6 Seal types.

.7 Motor nameplate: power, voltage, number of phases and frequency, FLA, rpm.

.2 Measurement results:

.1 Pumps:

.1 Identification (refer to drawings and specification).

.2 RPM.

.3 Fluid temperature.

.4 Voltage and amperage (each phase).

.5 Pressure before and after strainer.

.6 Shut-off pressure.

.7 Suction and discharge pressure at design flow.

.8 Corrected curve, if required.

.9 Measured pressure where pressure sensors (by the Division 25) are installed.

.2 Terminal equipment:

.1 Identification (refer to drawings and specification).

.2 Manufacturer, model, size.

.3 Identification of the manufacturer's reference curve: pressure versus flow.

.4 Pressure in.

.5 Pressure out.

.6 Pressure and corresponding flow rate (following the corrected curve, if applicable).

.3 Other locations:

.1 At branches pressure reading. Identify branches on the diagram.

.2 At risers: pressure reading. Identify the risers on the diagram.

.3 Primary/secondary circuits: pressure or flow. Identify the primary/secondary circuit on the chart.

3.2 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 Canada (NEBB Canada) 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 Low pressure ducts:

.1 Conduct 500 Pa static pressure test on the ducts.

.2 Maximum allowable loss:

.1 For all ducts, as per "Leakage Class 6" from HVAC Air Duct Leakage Test Manual, second edition, 2012, for each section tested, maximum leakage of 0.48 L/s/m² of duct wall.

.2 For overall system, the sum of the leakage must not exceed 3% of the fan(s) airflow.

.3 Portable test equipment to include, among other things, a radial blade fan, ventilation duct with calibrated orifice and a U-tube manometer.

.4 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.

.3 System adjustment for balancing work:

.1 Adjust dampers for minimum outside air.

.2 Dual-duct system and constant volume multizone, ensure the proper airflow through the cooling coils and maintain it throughout the adjustments.

.4 Terminal equipment adjustments:

.1 Adjust airflow from terminal units up to the fan.

.2 Use balancing dampers at main branches for major adjustments and dampers at terminal units for precise adjustments.

.3 These adjustments may require multiple iterations.

.4 Note: the total airflow adjusted at the terminal units compared to the readings obtained in the ducts may provide an indication of leakage.

.5 When the system is set to the design airflow, at the branches and the outlets, perform the following readings:

.1 Motor amperage.

.2 Differential pressure at the fans (discharge minus inlet).

.3 Differential pressure at all secondary components (upstream minus downstream).

.4 Differential pressure at all system's primary components (air intake, air exhaust, filters, coils, air-mixing plenums, etc.).

.5 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 Test at the terminal devices:

.1 Identification of the terminal device by ID number and location.

.2 Type of terminal device:

.1 Manufacturer

.2 Model

.3 Dimensions

.4 Output factor

.3 Design airflow and air speed.

.4 Airflow and air speed results.

.5 Adjustment, where applicable, of airflow pattern diffuser.

.6 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.

.6 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 Hydrauliques R&O Services Inc.

.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.

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.

1.7 SCOPE OF THE WORK

.1 The work generally includes, but is not limited to: labor, supply and installation of all materials and equipment necessary for the insulation work shown on the drawings and in the specification for plumbing, heating, chilled water, fire protection, ventilation, and air conditioning.

.2 Consult the drawings and the specification of all mechanical work.

1.8 INCLUSIVE PRICE

.1 Provide an overall fixed price with the tender, covering all the work in sections 23 07 13, 23 07 14 and 23 07 15.

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 D INSULATION

.1 Rigid mineral fiberboard bonded by a thermosetting resin with integrated FSK vapor barrier, with a density of 36 kg/m³, maximum service temperature of 232°C.

.2 Maximum thermal conductivity "k": 0.035 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 CEMENT INSULATION

.1 Compliant with the standard ASTM C449/C449M.

.2 Use for fittings, flanges, valves, and accessories.

2.5 JACKETS

.1 PVC jackets:

.1 Preformed one piece molded jacketing compliant with CGSB 51.53-95, similar to the Proto Corp. PVC type or equivalent.

.2 Operating temperatures:

.1 Minimum: -20°C

.2 Maximum: 65°C

.3 Permeability: 0.02 perm.

.4 Thickness:

.1 Internal: 20 mils minimum.

External: 30 mils minimum; 40 mils minimum on piping 380 mm and larger.

.5 Adhesive and sealant: follow the manufacturer's recommendations.

.2 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.

.3 Aluminum jackets:

.1 Aluminum jacketing compliant with the standards CSA HA.4-1980 and ASTM-B209, to be used on exposed elements located outdoors and in mechanical rooms, when specified.

.2 Corrugated or embossed aluminum alloy jacketing, 0.4 mm thick, with longitudinal S joints with 50 mm wide overlapping ends, factory installed internal protective covering and also featuring an aluminum alloy joint cover with mechanical fasteners. Vapor barrier membrane.

.3 Jackets for connecting to matrix elements made of 0.4 mm thick aluminum alloy with factory installed internal protective covering.

2.6 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.

2.7 MANUFACTURER LIST

.1 Comply with "MANUFACTURER LIST" from section 20 00 10.

.2 List of manufacturers, section 23 07 13:

.1 Type D thermal insulation:

.1 Johns Manville: Spin-Glas 814, type II with a FSK vapor barrier.

.2 Knauf: panel for air ducts with FSK.

.3 Owens-Corning Fiberglas: AF530 with FRK.

.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 Insulating cement:

.1 IIG Calcoat No. 127 applied in successive 8 mm (0.3") layers.

.4 Mechanical Fasteners:

.1 Welding pins, pin fasteners, Duro-Dyne.

.5 Canvas jackets:

.1 Flexpak

.2 S. Fattal Cotton Inc.

.6 PVC jackets:

.1 Johns-Manville

.2 Proto Corp.

.7 Aluminum jackets:

.1 Thermoclad Plus jacketing with anti-corrosion protection, Polysurlin type, Stucco finish.

.8 Thermal insulation protection support:

.1 Insulgard

.2 Steel support

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.

.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 No insulation is required for:

.1 Ducts fitted with acoustic insulation serving as thermal insulation, unless otherwise indicated.

.2 Acoustic plenums (boxes).

.2 Systems nos. 2S-072:

.1 All supply ducts from the system's plenum boxes in the mechanical room and in shafts:

.1 Up to the grilles and diffusers:

.1 Insulation: type D

.2 Thickness: 25 mm

.3 Exhaust air outlets and exhaust air ducts:

.1 On all outdoor air and exhaust air ducts located within the building, but outside the mechanical rooms:

.1 Insulation and thickness:

.1 Insulation: type D

.2 Thickness: 100 mm in 50 mm two layers with overlapping joints

.3 As above, except at critical points (high humidity or electrical equipment rooms). These ducts will be double walled and insulated and do not require external insulation. Check plans and ventilation specification.

.2 On exhaust air ducts, at the outlet of the exhaust fans, extend the insulation 2.5 m upstream of the motorized dampers.

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 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-C335-05ae1 – Standard Test Method for Steady State Heat Transfer Properties of Horizontal Pipe Insulation.

.2 ASTM-C449/C449M-07 – Standard Specification for Mineral Fiber-Hydraulic-Setting Thermal Insulating and Finishing Cement.

.3 ASTM-C533-07 – Standard Specification for Calcium Silicate Block and Pipe Thermal Insulation.

.4 ASTM-C547-07 – Standard Specification for Mineral Fiber Pipe Insulation.

.5 ASTM-C553-02 – Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.

.6 ASTM-C612-04e1 – Standard Specification for Mineral Fiber Block and Board Thermal Insulation.

.7 ASTM-C795-03 – Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel.

.8 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.

.1 Hydrated calcium silicate insulation: ONGC 51.2-M88 or 51-GP-2M.

.5 Vapor barrier covering: ONGC 51-GP-52Ma.

.6 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 South Coast Air Quality Management District (SCAQMD), California State:

.1 SCAQMD Rule 1168-A2005 – Adhesive and Sealant Applications.

.6 Thermal Insulation Association of Canada (TIAC):

.1 National Insulation Standards 2005.

.7 Underwriters' Laboratories of Canada (ULC):

.1 CAN/ULC-S102-07 – Standard for Method of Test for Surface Burning

.2 Characteristics of Building Materials and Assemblies.

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 equipment 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.

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.

1.7 SCOPE OF THE WORK

.1 The work generally includes, but is not limited to: labor, supply and installation of all materials and equipment necessary for the insulation work shown on the drawings and in the specification for plumbing, heating, chilled water, fire protection, and ventilation – air conditioning.

.2 Consult the drawings and the specification of all mechanical work.

1.8 INCLUSIVE PRICE

.1 Provide an overall fixed price with the tender, covering all the work by sections 23 07 13, 23 07 14 and 23 07 15.

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 B INSULATION

.1 Elastomeric cellular thermal insulation in tubular, flexible sheet, or roll form, according to the application.

.2 Maximum thermal conductivity "k": 0.039 W/m.°C at 32°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 CEMENT INSULATION

.1 Compliant with the standard ASTM-C449/C449M.

.2 Use for fittings, flanges, valves and accessories.

2.5 JACKETS

.1 PVC jackets:

.1 Preformed one piece molded jacketing compliant with CGSB 51.53-95, similar to the Proto Corp. PVC type or equivalent.

.2 Operating temperatures:

.1 Minimum: -20°C

.2 Maximum: 65°C

.3 Permeability: 0 .02 perm.

.4 Thickness:

.1 Internal: 20 mils minimum.

External: 30 mils minimum; 40 mils minimum on piping 380 mm and larger.

.5 Adhesive and sealant: follow the manufacturer's recommendations.

.2 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.

.3 Aluminum jackets:

.1 Aluminum jacketing compliant with the standards CSA HA.4-1980 and ASTM-B209, to be used on exposed elements located outdoors and in mechanical rooms, when specified.

.2 Corrugated or embossed aluminum alloy jacketing, 0.4 mm thick, with longitudinal S joints with 50 mm wide overlapping ends, factory installed internal protective covering and also featuring an aluminum alloy joint cover with mechanical fasteners. Vapor barrier membrane.

.3 Jackets for connecting to matrix elements made of 0.4 mm thick aluminum alloy with factory installed internal protective covering. For F type insulation: 0 .8 mm thick.

2.6 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: 0.048 W/m.°C.

.8 Foamglas from Pittsburgh Corning.

2.7 MANUFACTURER LIST

.1 Comply with the article "MANUFACTURER LIST" from section 20 00 10 – Mechanical and electrical general instructions.

.2 List of manufacturers, section 23 07 14:

.1 Type B thermal insulation:

.1 Armacell AP from Armaflex with adhesive 520 and WB finish.

.2 Rubatex Insul-Tube 180 with adhesive R-373 from Nomaco RBX.

.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 Insulating cement:

.1 IIG Calcoat no. 127 applied in successive 8 mm (0.3") layers.

.4 Mechanical Fasteners:

.1 Welding pins, pin fasteners, Duro-Dyne.

.5 Canvas jackets:

.1 Flexpak

.2 S. Fattal Cotton Inc.

.6 PVC jackets:

.1 Johns-Manville

.2 Proto Corp.

.7 Aluminum jackets:

.1 Thermoclad Plus jacketing with anti-corrosion protection, Polysurlin type, Stucco finish.

.8 Thermal insulation protection support:

.1 Insulgard

.2 Steel support

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, where 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 For all insulated piping exposed to water, steam, or oil, and all insulated piping passing through the mechanical room floor: cover the insulation with a 0.75 kg copper sheet with blind welded 50/50 joints or with a corrugated aluminum sheet with two stainless steel straps of 225 mm in minimum height.

.8 Install all piping supports for chilled water, cold glycol water, and domestic cold water completely outside the insulation. For this piping, use a rigid material at each support. Install a steel saddle of appropriate length and width to distribute the weight. This material must be supplied and installed by this section. Steel supports and saddles are supplied and installed by each relevant mechanical section to this section's satisfaction. Alternatively, when applicable, Insuguard protectors can be used.

.9 Notify applicable sections and properly adjust the supports and saddles to ensure that saddles remain in place.

.10 Leave access to strainers uncovered. However, for domestic cold water and chilled water piping, insulate them with a removable cover shaped piece of insulation to allow removal of the strainer for cleaning purposes. Have a sample of this cover approved.

3.3 APPLICATION

.1 See sections "EQUIPMENT INSULATION SCHEDULE" for thicknesses.

.2 Apply insulation blocks, panel segments, or molded pipe insulation and secure them firmly with mechanical fasteners, wires, or straps. Insulation must fill all contours without gaps. Insulation must be covered with 12 mm thick cement finish to ensure a smooth surface contour. The cement must be reinforced with mesh or reinforcing membrane.

.3 On resilient insulation, use a reinforcing mesh prior to applying cement finish. On rectangular flues, install a metal corner bead before applying cement finish.

.4 In the case of cold equipment, use insulation with vapor barriers or apply a vapor barrier treatment on-site.

.5 Depending on the type of insulation, provide an air space between the flue, chimney and ducts.

.6 Finishes:

.1 Interior/exterior:

.1 On insulation (hard cement layer not required), apply an aluminum jacket fixed with sheet metal screws or rivets, caulk or seal every joint.

.2 Interior:

.1 Above hard cement layer, apply a fireproof canvas jacket using adhesive coating and then apply a coating of canvas finish. Alternatively, finish with PVC jacket with all joints and seams sealed.

.3 Irregular spots or protrusions are to be finished with canvas jacket or weatherproof coating to ensure a proper finish.

3.4 EQUIPMENT INSULATION SCHEDULE

.1 Generators:

.1 Drain pan for fan heaters:

.1 Insulation: type B

.2 Thickness: 9.5 mm flexible mat or roll

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 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, furred-in spaces, and the floor-ceiling assemblies

.4 "Exposed" elements: elements that are not concealed (as previously defined), located in mechanical rooms, tunnels, accessible service spaces, and outdoor spaces.

.5 Insulation system: systems consisting in particular of the insulation itself, the fasteners, jackets and other accessories.

.2 References:

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

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

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

.3 ASTM-B209M-04 – Standard Specification for Aluminum and Aluminum Alloy Sheet and Plate Metric.

.4 ASTM-C335-04 – Standard Test Method for Steady State Heat Transfer Properties of Horizontal Pipe Insulation.

.5 ASTM-C411-04 – Standard Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation.

.6 ASTM-C449/C449M-00 – Standard Specification for Mineral Fiber-Hydraulic-Setting Thermal Insulating and Finishing Cement.

.7 ASTM-C533-2004 – Calcium Silicate Block and Pipe Thermal Insulation.

.8 ASTM-C547-2003 – Mineral Fiber Pipe Insulation.

.9 ASTM-C795-03 – Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel.

.10 ASTM-C921-03a – Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.

.2 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.

.3 "k" thermal conductivity factors:

.1 ASTM-C-335 for precast or rigid insulation.

.2 ASTM-C-177 or C-518 for the other types.

.4 Department of Justice Canada (JUS):

.1 Canadian Environmental Assessment Act (CEAA), ch.33, 1995.

.2 Canadian Environmental Protection Act (CEPA), ch. 33, 1999.

.3 Transportation of Dangerous Goods Act (TDGA), ch. 34, 1992.

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

.1 Material Safety Data Sheet (MSDS).

.6 Manufacturers' associations:

.1 Thermal Insulation Association of Canada (TIAC), National Insulation Standards (C2004).

.7 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-S701-01 – Standard for Thermal Insulation, Polystyrene, Boards and Pipe Covering.

.3 CAN/ULC-S702-1997 – Standard for Mineral Fibre Thermal Insulation for Buildings.

.4 CAN/ULC-S702.2-03 – Mineral Fibre Thermal Insulation for Buildings, Part 2: Application Guidelines.

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 piping 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.

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.

1.7 SCOPE OF THE WORK

.1 The work generally includes, but is not limited to labor, supply and installation of all materials and equipment necessary for the insulation work shown on the drawings and in the specification for plumbing, heating, chilled water and fire protection.

.2 Consult the drawings and the specifications of all mechanical work.

1.8 INCLUSIVE PRICE

.1 Provide an overall fixed price with the tender, covering all the work by section 23 07 13, 23 07 14 and 23 07 15.

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 A INSULATION

.1 Preformed wrap made of mineral fiber bonded with thermosetting resin, maximum service temperature of 454°C.

.2 Reinforced vapor barrier: factory applied all service jacket, paintable finish. Jacketing permeability: 0.02 perm. maximum.

.3 Maximum thermal conductivity "k": 0.035 W/m.°C at 24°C.

.4 Products:

.1 Alley K from Manson Insulation.

.2 Earthwool 1000° from Knauf Insulation.

.3 Micro-Lok HP from Johns Manville.

2.3 TYPE F INSULATION

.1 Hydrous calcium silicate, with a density of 232 kg/m³, maximum service temperature of 650°C, in blocks or preformed.

.2 Maximum thermal conductivity "k":

.1 0.061 W/m.°C at 150°C in blocks.

.2 0.065 W/m.°C at 150°C preformed.

.3 Covered with jacket.

.4 Product: Thermo-12 Gold from de Johns Manville.

2.4 ADHESIVES

.1 Compliant with ASTM-E-84-76 and CAN/ULC-S102.

.2 Use to adhere the canvas, tabs and all service jackets, seal joints, and secure the insulation to metal surfaces.

.3 Canvas adhesives:

.1 Products:

.1 120-18 from Bakor.

.2 CP-52 from Childers.

.4 Adhesives for joints, laps, and all-purpose jacketing:

.1 Products:

.1 230-06 from Bakor.

.2 CP-85 from Childers.

.5 Adhesives for adhering insulation on metal surfaces:

.1 Products:

.1 230-38 from Bakor.

.2 CP-89 from Childers.

.3 89 from Mulco.

2.5 CEMENT INSULATION

.1 Compliant with the standard ASTM-C449/C449M.

.2 Use for fittings, flanges, valves, and accessories.

.3 Product: Calcoat-127 from Johns Manville.

2.6 JACKETING

.1 PVC jacketing:

.1 Preformed one-piece molded jacket compliant with CGSB 51.53-95 for piping, fittings, valves and equipment.

.2 Operating temperatures between -20 and 65°C.

.3 Permeability of 0.02 perm.

.4 Thickness:

.1 Internal: 20 mils minimum.

External: 30 mils minimum; 40 mils minimum on piping 380 mm and larger.

.5 Adhesive and sealant: follow manufacturer's recommendations.

.6 PVC jacketing or fittings used outdoors or where exposed to fluorescent lighting must be resistant to ultraviolet rays.

.7 Products:

.1 LoSmoke PVC Jacketing and Fittings from Proto Corporation.

.2 Zeston PVC Jacketing from Johns Manville.

2.7 MANUFACTURER LIST

.1 Comply with the article "MANUFACTURER LIST" from section 20 00 10 – Mechanical and electrical general instructions.

.2 List of manufacturers, section 23 07 15:

.1 Type A thermal insulation:

.1 Johns Manville

.2 Knauf Insulation

.3 Manson Insulation

.2 Type F thermal insulation:

.1 Johns Manville

.2 Knauf Insulation

.3 Manson Insulation

.3 Rigid insulation for piping:

.1 Owens Corning

.4 Adhesives:
- .1 Bakor
- .2 Childers
- .3 Mulco

.5 Insulating cement:
- .1 Johns Manville

Part 3 Execution

3.1 INSTALLATION METHOD

.1 Install insulation once all tests are complete and accepted, and air inside the building is dry enough and in conditions conforming to the manufacturer's standards. Install insulation continuously, without interruption.

.2 All equipment, piping and ducts must be clean, dry and free from foreign matter before installation of the insulation.

.3 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.

.4 This section is responsible for the proper installation of insulation, where specified.

.5 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).

.6 For all insulated piping exposed to water, steam, or oil, and all insulated piping passing through the mechanical room floor: cover the insulation with a 0.75 kg copper sheet with blind welded 50/50 joints or with a corrugated aluminum sheet with two stainless steel straps of 225 mm in minimum height.

.7 Pipes, accessories, and exposed equipment must be insulated on all sides, even if non-visible side is by a wall or a ceiling, using the same material on all surfaces.

3.2 APPLICATIONS OF INSULATION

.1 See the articles "PIPING INSULATION SCHEDULE" for thicknesses.

.2 Hot piping (15 at 315°C):

.1 Piping:

.1 Pipe insulation without integrated jacketing must be held in place using ties no smaller than 300 mm center to center. Insulation with integrated jacketing must be held in place by stapling the laps every 75 mm center to center. Insulation with integrated self-sealant jacketing does not require any additional fastening.

.2 For high temperature steam and hot water pipes, use type F insulation in any areas where there is risk of shock damage or undue crushing.

.2 Fittings:

.1 Insulate the fittings with segments of piping insulation, miter cut to fit the connections.

.2 For flexible fittings on steam pipes, cover the flanges and fittings with a galvanized cylindrical sheet fixed to the flanges on one side only to allow movement of the other flanges inside the cylinder. Cover this sheet with type A insulation with a thickness of 75 mm. For piping connected to the slip-on flange, bevel cut the insulation at 45°. Do not insulate the steam traps, the valves, or the connected accessories shown in the steam trap arrangement details.

.3 Valves and strainers:

.1 Insulate the valve and strainer bodies with segments of adjusted or miter cut piping insulation with a similar thickness to that of the adjacent pipes. Drains, drain plugs, and caps should not be covered.

.4 Flanges:

.1 Insulate flanges with oversized pipe covering or mitred blocks of the same thickness as the adjacent pipe covering.

.2 Insulation termination points:

.1 Terminate insulation at 75 mm from the fittings to provide a working clearance and bevel the insulation at a 45° angle.

.5 Closed cell insulation:

.1 Where indicated, flexible elastomeric or closed cell insulation to be used and installed in accordance with the manufacturer's instructions with an adhesive covered by a paint specific to the product.

.3 Cold piping (5 at 15°C):

.1 Insulation vapour barriers:

.1 The vapour barrier must be installed in a continuous manner, without any openings, in such a way to include all valves, flanges, equipment, fittings, accessories, etc.

.2 Piping:

.1 Apply pipe insulation with an integral vapor barrier jacket to the piping and hold it in place by securing the jacket flap. Seal all flaps and butt strips with vapor barrier adhesive, or alternatively, secure them with staples every 75 mm and cover them with vapor barrier tape. Pipe insulation with integral self-sealing vapor barrier jacketing does not require additional fastening.

.2 Install the rigid pipe insulation between the pipe and every pipe support. The adjacent insulation vapour barrier must be lengthened to envelop the rigid pipe insulation.

.3 Install all pipe supports for chilled water, cold glycol water, and domestic cold-water piping outside of the insulation. For this type of piping, use rigid material at each support. Install steel pipe saddle with appropriate length and width to spread the weight.

This material must be supplied and installed by this section. Steel saddles and supports are supplied and installed by each respective mechanical sector, to the satisfaction of this section.

.4 Advise the respective sectors to adequately adjust the supports and pipe saddles to ensure they remain in place properly. This section is responsible for attaching the pipe saddles to the insulation on either side of the supports.

.3 Fittings:

.1 Insulate fittings with sections of pipe insulation mitered to fit tightly or with tightly fit flexible insulation then apply reinforcing membrane embedded in vapour barrier coating.

.4 Valves and strainers:

.1 Insulate valve bodies, flanges, and strainers with insulating cement, fitted pipe insulation segments, or mitred blocks, of the same thickness as the adjacent insulation and then apply a vapor barrier coated reinforcing membrane. Drains, drain plugs, and caps must be insulated with a removable lid-shaped insulator allowing for the removal of the strainer flanges for cleaning purposes. A sample of this lid should be approved.

.5 Flanges:

.1 Insulate flanges with oversized pipe covering or mitred blocks of the same thickness as the adjacent pipe covering, then cover with a vapor barrier coated reinforcing membrane.

.6 Grooved fittings:

.1 Where the use of grooved pipe fittings is accepted, the method known as "oversized" and recommended by the ACTI will be applied.

3.3 APPLICATIONS OF JACKETING

.1 All insulation installed on pipes, valves, fittings, or any other equipment in an exposed area must be covered in jacketing.

.2 PCV jacketing inside/outside:

.1 Apply PVC jacketing on the insulation et attach in place with adequate ties 100 mm center to center. Cover longitudinal and circumferential joints with a tight edge band.

.2 Apply jacketing or PVC fitting covers on insulated fittings to ensure a complete jacketing of the system. Attach with ties and appropriate jacketing edge bands.

.3 The longitudinal overlap of the jacketing must be positioned on the underside of the pipe to minimize water infiltration.

3.4 PIPING INSULATION SCHEDULE – HEATING – CHILLED WATER

.1 Table of networks that require insulation:

Networks	Location	Pipe dimensions	Insulation types	Thickness	Jacketing (when installation is exposed)
High temperature hot water	Everywhere	NPS 2 or smaller	A or F	65 mm	PVC
Chilled water	Everywhere	NPS 1½ or smaller	A	25 mm	PVC

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.

1.2 REFERENCES

.1 American National Standards Institute (ANSI)/American Welding Society (AWS):

.1 ANSI/AWS A5.8/A5.8M-11 – AMD1 Specification Filler Metals for Brazing and Braze Welding.

.2 ASME:

.1 ANSI/ASME B16.4-06 – Gray-Iron Threaded Fittings Classes 125 and 250.

.2 ANSI/ASME B16.15-11 – Cast Copper Alloy Threaded Fittings Classes 125 and 250.

.3 ANSI B16.18-12 – Cast Copper Alloy, Solder Joint Pressure Fittings.

.4 ANSI/ASME B16.22-12 – Wrought Copper and Copper-Alloy Solder Joint Pressure Fittings.

.3 ASTM International:

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

.2 ASTM-B61-08 – Standard Specification for Steam or Valve Bronze Castings.

.3 ASTM-B62-09 – Standard Specification for Composition Bronze or Ounce Metal Castings.

.4 ASTM-B88M-05(2011) – Standard Specification for Seamless Copper Water Tube Metric.

.5 ASTM-E202-12 – Standard Test Methods for Analysis of Ethylene Glycols and Propylene Glycols.

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

.1 Material Safety Data Sheet (MSDS)

.5 Manufacturers Standardization Society (MSS):

.1 MSS SP67-2011 – Butterfly Valves.

.2 MSS SP70-2011 – Cast Iron Gate Valves, Flanged and Threaded Ends.

.3 MSS SP71-2011 – Grey Iron Swing Check Valves, Flanged and Threaded Ends.

.4 MSS SP80-2008 – Bronze Gate, Globe, Angle and Check Valves.

.5 MSS SP85-2011 – Cast Iron Globe and Angle Valves, Flanged and Threaded Ends.

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 hydronic systems. Data sheets must include product characteristics, performance criteria, dimensions, limits and finish.

.3 Shop drawings:

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

.2 Identify the items referred to in the documentation provided by the manufacturer, namely: valves.

.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 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 PIPING – GENERAL

.1 NPS 2½ to NPS 24 branch connections:

.1 For the welded connection of a pipe of diameter "d" onto a pipe of diameter "D" and/or for the construction of a header of diameter "D":

.1 If the ratio d/D > 2/3, use tees prepared for welding.

.2 If the ratio d/D ≤ 2/3, use reinforced fittings conforming to the Power Piping standard ASME B31.1 or tees prepared for welding, Anvil Anvilets.

.2 If a condition d/D > 2/3 is shown in the drawings, "D" can be increased so that the condition d/D ≤ 2/3 applies.

.2 Mechanical joints:

.1 Without flexible connections between the piping and equipment:

.1 Only the three first joint connecting the piping to the chillers, the cooling towers and pumps can be flexible mechanical joints, type Victaulic or Gruvlock by Anvil. Bolts and nuts to be of stainless steel, compliant with ASTM-f-593 and ASTM-F-594, with rupture-resistance strength of 110 000 psi. Bolts to be in vertical position with nuts below.

.2 With flexible connections between the piping and equipment:

.1 No mechanical joints, piping must be anchored.

2.2 GUIDES

.1 For steel piping, use Anvil fig. 255 type guides.

.2 For copper and brass piping, use Anvil fig. CT-255 guides.

2.3 SUPPORTS

.1 General:

.1 See section 23 05 29 – Hangers and supports for HVAC piping and equipment.

2.4 CHILLED WATER, HOT WATER, 1035 KPA AND LESS

.1 Piping:

.1 Material:

.1 Black steel, Std series, ASTM-A53, CW, grade B.

.2 Fittings:

.1 Reducer elbows, adapters, and couplings, of the same brand as the tees.

.2 NPS 2 and smaller:

.1 Malleable cast iron, ASME/ANSI B16.3, class 150, threaded. Malleable cast iron unions, ASME/ANSI B16.39, class 300, threaded.

.3 Branch connections:

.1 NPS 2 and smaller:

.1 Malleable cast iron threaded tees, ASME/ANSI B16.3, class 150.

.4 Joints:

.1 NPS 2 and smaller:

.1 Threaded for fittings, unions, and branch connections.

.2 Valves:

.1 Ball valves:

.1 NPS 2 and smaller:

.1 Brass body.

.2 Threaded ends.

.3 Class 150.

.4 Internal parts: stainless steel balls, PTFE seat.

.5 Memory stop.

.6 Extension stem for insulated piping, such as Jenkins no. 74083X-SJ.

.7 Model: Crane fig. F9201. Jenkins fig. 201SJ.

.2 Circuit balancing valves:

.1 NPS 2 and smaller:

.1 AMETAL body.

.2 NPS threaded ends.

.3 Class 150.

.4 Self-sealing measuring points.

.5 Polyamide handwheel with digital read-out.

.6 Internal parts: brass, seat seals: stem with EPDM O-rings.

.7 Model: STAD NPT from TA Hydronics. CB from ITT Xylem. CBV from Armstrong Pumps.

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 21 13.

.1 Piping:

.1 Steel and galvanized steel piping:

.1 Nova Tube

.2 Olympia Tube

.3 Omega Steel Company

.4 US Steel

.5 Wheatland (Zeckelman)

.2 Piping accessories:
  .1 Malleable cast iron fittings:
    .1 Anvil
    .2 Bibby Ste-Croix
    .3 Ward
  .2 Joints:
    .1 Gruvlock (Anvil)
    .2 Shurjoint
    .3 Victaulic Co. of Canada Ltd
.3 Dielectric insulators:
  .1 Corrosion Service Co. Ltd (10 Price Street, Toronto)
  .2 Epco Sales
.4 Valves:
  .1 Globe and gate valves:
    .1 Crane
    .2 Hattersley
    .3 Jenkins
    .4 Kitz Corp.
    .5 Milwaukee
    .6 Velan
  .2 Manual main shut-off valves:
    .1 Crane
    .2 Hattersley
    .3 Jenkins
    .4 Kitz Corp.
    .5 Viking
  .3 Supports and anchors:
    .1 Anvil
    .2 Cantruss
    .3 E. Myatt
    .4 Fee & Mason

Part 3 Execution

3.1 SLOPES

.1 Hot water heating and chilled water:

.1 Main pipes:

.1 Slope of 0.15%. Slope rising in the direction of flow of the supply piping. Downward slope in the direction of flow for the return piping. At critical points, the piping can be installed at level provided that it is fully supported.

.2 Branch connections:

.1 1% slope with a spacing of at least 1 m between two connections on the main pipe, wherever possible.

3.2 ANCHORING

.1 See section 23 05 29 Hangers and supports for HVAC piping and equipment.

3.3 VALVES

.1 For valves, follow the manufacturer's recommendations as to the liquid's direction of flow, as appropriate for the different applications.

3.4 TESTING AND CLEANING

.1 General:

.1 See the article "TESTING" in section 20 00 10 – Mechanical and electrical general instructions.

.2 Perform all tests specified below.

.3 All tests must have been conducted satisfactorily before requesting an inspection by the Engineer.

.4 All piping or part thereof must be tested before being covered with insulation or being concealed in partitions, ceilings, or walls. Prior to pressure testing systems, remove or protect devices such as control devices, air vents, or any equipment that is not designed to be subjected to pressures corresponding to those used during the tests.

.5 During hydrostatic testing, ensure that the piping is completely filled with liquid and purged of all air.

.6 In cold weather, use an antifreeze for hydrostatic tests, and at the end of the tests, drain piping completely to prevent any risk of freezing.

.2 Tests:

.1 Piping:

.1 Chilled water and hot water:

.1 A pressure 50% higher than the opening pressure of the safety valve or 1035 kPa minimum must be maintained without leakage for a period of at least two hours throughout the piping. Perform this test with cold water.

.3 Cleaning the strainers:

.1 The strainers must be cleaned periodically by this section.

3.5 BALANCING

.1 Chilled water and hot water:

.1 Adjust the valves to obtain the required water flow at each chiller in each main network, in every primary and secondary network, in each branch, in each coil group, in each coil, in each group of fan-coil units, unit heaters, etc.

.2 Provide three copies for review and comment, a full report of all tests and adjustments performed, indicating the final readings obtained.

.3 Enter the results on a 216 mm x 279 mm size format, entering the name of the system, the device, the required characteristics, and those obtained.

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 ASME:

.1 ASME Boiler and Pressure Vessel Code (BPVC), section VII-2013.

.2 ASTM International:

.1 ASTM-A47/A47M-99(2009) – Standard Specification for Ferritic Malleable Iron Castings.

.2 ASTM-A278/A278M-01(2011) – Standard Specification for Gray Iron Castings for Pressure-Containing Parts for Temperatures up to 650°F (350°C).

.3 ASTM-A516/A516M-10 – Standard Specification for Pressure Vessel Plates, Carbon Steel, for Moderate and Lower – Temperature Service.

.4 ASTM-A536-84(2009) – Standard Specification for Ductile Iron Castings.

.5 ASTM-B62-09 – Standard Specification for Composition Bronze or Ounce Metal Castings.

.3 CSA group:

.1 CSA B51-F09 – Boiler, pressure vessel, and pressure piping code.

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 hydronic specialties. Data sheets must include product characteristics, performance criteria, dimensions, limits and finish.

.3 Shop drawings:

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

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 AIR VENTS

.1 Automatic air vents:

.1 Up to NPS 3, with shut-off ball valve, operating pressure 0 to 1035 kPa, Watts no. FV4.

2.2 STRAINERS

.1 General:

.1 Strainer of same dimension as piping, or larger as indicated, Y type, with eccentric drain connection with screw cap.

.2 Strainer descriptions:

.1 Steel piping:

.1 NPS 2 and smaller:

.1 Cast iron body, ASTM-A126, class B, threaded connections to 1725 kPa, capable of withstanding hydrostatic pressure of 2069 kPa at 65.6°C, up to 1725 kPa at 208°C, Sarco no. IT-250.

.3 Strainer screens:

.1 Stainless steel with perforations of 1.19 mm for water coils.

2.3 BALANCING VALVES

.1 NPS 2 and smaller:

.1 Bronze body, operating pressure of 2069 kPa, at 121°C, threaded connections, globe valve, characteristics: equal percentage.

.2 The faucet serves:

.1 Precise flow measurement.

.2 Precision flow balancing.

.3 Positive shut-off with memory stop for return to service.

.3 ¼" NPT drain, integral check connections, one on each side of seat, to allow connection of instruments, micrometer type indicator for valve's position, for size and locations refer to drawings.

.4 Victaulic no. TA 787.

2.4 MANUFACTURER LIST

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

.2 List of manufacturers, section 23 21 14:

.1 Air vents:

.1 Armstrong

.2 Bell & Gossett

.3 Dunham

.4 Maid-O-Mist

.5 Sarco

.2 Strainers:

.1 Armstrong

.2 Erwel

.3 Fisher

.4 Leslie

.5 Morrison

.6 Sarco

.7 Velan

.8 Watts

.3 Balancing valves:

.1 Armstrong

.2 Bell & Gossett ITT

.3 Tour & Anderson

Part 3 Execution

3.1 GENERAL

.1 Route drain piping, and the discharge pipes connected to the vent connections, to the nearest flour drain.

.2 Provide adequate clearance to allow access to accessories for repair and maintenance purposes.

.3 If the planned clearances cannot be respected, consult the Engineer and comply with their directives.

3.2 AIR VENTS

.1 Automatic air vents:

.1 Install in following locations: on chilled water coils, hot water coils, glycol coils, as indicated in drawings, and each high point.

3.3 STRAINER

.1 Supply and install all the strainers shown in the drawings and those required for the protection and the proper operation of the equipment.

.2 In general, install strainers at suction of all pumps and circulators upstream of all control valves and regulators, upstream of all solenoid valves, upstream of all automatic flow control valves, and upstream of all pressure reducing valves.

3.4 BALANCING VALVES

.1 Install balancing valves where indicated in drawings. Install with straight lengths upstream and downstream, according to the manufacturer's recommendations.

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 01 31 – Air duct cleaning for HVAC systems.

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

.4 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.

.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 Unless otherwise specified, manufacture the ducts in galvanized steel. If the ducts are made of aluminum, use aluminum sheets with a thickness corresponding to the following table:

Galvanized steel:						
– CAL US	26	24	22	20	18	16
– mm	0.551	0.701	0.853	1.006	1.311	1.613
Aluminum:						
– CAL B & S	24	22	20	18	16	14
– mm	0.508	0.635	0.813	1.016	1.295	1.626

.2 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.

.3 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 bracing) on all flat surfaces 200 mm and more in width is also acceptable. For either method, the sheet gauge required will be the same.

.4 In the ducts with dimensions having a greater ratio than 4 to 1, install a sheet division in the center of the longest dimension.

.5 Seal the joints of the ducts.

.6 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.

.7 Definitions:

.1 Low pressure ducts:

.1 Ducts with a static pressure less than 500 Pa and an air velocity below 610 m/min.

.8 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.

.9 Before starting the installation of any ducts, demonstrate with tested samples that the specification requirements are met.

2.2 LOW PRESSURE DUCTS

.1 Ducts:

.1 For the sheet thickness, the types of joints, and the reinforcements for rectangular, 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 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 Resilient sealant:
- .1 Minnesota Mining Mfg. from Canada (3M)
- .2 Tremco

.6 Protective paint:
- .1 Sico (Corostop, Crown Diamond)
- .2 ZRC Products Co. (Kerry Industries Ltd)

.7 Bolts and anchors:
- .1 Hilti
- .2 Phillips Red-Head
- .3 Ucan

.8 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.

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.

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.

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, 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 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 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 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.

2.3 ACCESS DOORS

.1 Non-insulated ducts: double-walled doors (sandwich panels), the same material as used for the ducts, but of the next largest thickness (not be thinner than 0.6 mm), with angle iron frame.

.2 Insulated ducts: double-walled doors (sandwich panels), the same material as used for the ducts, but of the next largest thickness (not be thinner than 0.6 mm), with angle iron frame and rigid insulation, fiberglass, 25 mm thick.

.3 Seals: neoprene.

.4 Hardware parts:

.1 Doors measuring up to 300 mm wide: two (2) latches for the frame.

.2 Doors measuring between 301 mm and 450 mm wide: four (4) latches for the frame.

.3 Doors measuring between 451 mm and 1000 mm wide: a piano hinge and at least two (2) latches for the frame.

.4 Doors measuring over 1000 mm side: a piano hinge and two (2) handles operable from the inside and from the outside.

.5 Device to hold the open position.

2.4 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

.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 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 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 CONTROL DAMPERS

.1 General:

.1 Provide shop drawings and a sample of each type.

.2 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.

.3 Regular motorized dampers (MD):

.1 See the article "MOTORISED DAMPERS – GENERAL".

.4 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.

.4 When the dampers control the outside air, the blades must be finely adjustable to prevent any air leaks.

.2 Rigidity and airtightness of 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.

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

.3 Section 23 07 14 – Thermal insulation for 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 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 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 INLINE FAN

.1 Aluminum or steel housing with flanges for connections to ducts, air intake section with profiled cone.

.2 Aluminum or steel wheel with backward curved profiled blades.

.3 Direct drive, fuseless switch.

.4 With acoustic insulation.

.5 Variable air flow:

.1 Motor speed control, semiconductor type, allowing the modulation of the air flow from 50 to 100%.

.2 Control provided by this section, installed and connected by Division 26.

2.3 FLEXIBLE CONNECTORS FOR FANS

.1 Connect the ducts to the fans, the ventilation units, or the other devices of that type, using perfectly sealed flexible connectors, type I or II, compliant with all UL regulations. See the fan tables.

.2 Never paint the flexible connectors. Minimum distance between the ends of the sheet metal: 100 mm. For each flexible connector, use appropriate metal reinforcements to prevent the excessive deformation of these connectors.

.3 Standard type I:

.1 Made of 150 mm wide fiberglass, such as Durolon, with multiple layers of elastomer, 0814 kg/m², 0.61 mm thick, approved by the UL for fire resistance, operating temperature from -40 to 120°C, the waterproof, oil proof, and moisture proof, leak-proof.

.4 Soundproofed type II:

.1 Made of a flexible, sound-absorbing material in vinyl, reinforced with fiberglass, and using barium sulfate to increase its mass, the assembly having a weight of 4.9 kg/m².

.1 Tensile stress resistance: 2070 kPa

.2 Shearing stress resistance: 690 kPa

.3 Resistance in continuous operation to temperatures of -40 to 82.2°C.

.4 Similar to the model KNM-100RB, manufactured by Kinetics Noise Control Inc.

.2 Noise reduction:

Frequency HZ	125	250	500	1 000	2 000	4 000	STC (**)
TL (dB) (*)	15	19	21	28	33	37	26

(*) Transmission loss (TL).
(**) Sound transmission class (STC).

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:

$$\text{cfm}_{\text{max}} = \left[\frac{\text{rpm}_{\text{mot}}}{\text{rpm}_{\text{vent}}}\right] \times \text{cfm}_{\text{vent}} \qquad \text{PS}_{\text{max}} = \left[\frac{\text{rpm}_{\text{mot}}}{\text{rpm}_{\text{vent}}}\right]^2 \times \text{PS}_{\text{vent}}$$

.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 Centrifugal inline fans mounted in a rectangular housing:

.1 Acme
.2 Carnes
.3 Cook
.4 Greenheck
.5 Twin City

.2 Flexible connectors for fans:

.1 Baryfold de Blachford: Spiro-Vibro
.2 Duro-Dyne (Durolon)
.3 Hardcast Carlisle
.4 Kinetics: Spiro-Vibro

.3 Bearings:

.1 Link Belts
.2 Seal Master
.3 SKF

Part 3 Execution

3.1 GENERAL

.1 Install the fans as shown in the drawings.

.2 Take the required precautions to get air movement evenly distributed at the entrance and the exit.

.3 The installation equipment for range hood exhaust must comply with the standard NFPA-96.

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		**072-VE-02**					
Location		Room no. 2B-102					
Manufacturer		Twin City					
Model		DSI-090A					
Arrangement							
Build Class							
Rotation							
Suppression							
Airflow (cfm)		350					
Static pressure (in wg)		0.2					
rpm		906					
O.S. (ft/s)							
Motor	kW (HP)	1/8					
	rpm	1160					
	Volt/Phase	115/1					
	Position						
Notes – Accessories		DD					

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

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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: keys for flow volume control and 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.

.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 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 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.

.2 With neoprene gasket around the edge, allowing a very tight seal.

.3 The return grilles are also used for exhaust.

.4 When installed on exposed branches, fix them with flanges facing the interior of the duct.

.5 Adjustable frontal blades:

.1 For supply grilles in walls or on the sides of an exposed duct, direct the horizontal frontal blades upwards at an angle between 15 and 20°.

.6 When installed on the walls or on the exposed ducts, baked enamel finish, aluminum color.

.7 When installed on the ceiling, baked enamel finish, white color.

.8 When installed in a sill or in the floor, brushed aluminum finish with protective lacquer.

.9 Fastened with exposed screws.

.10 All grilles and diffusers must be equipped with seismic restraint systems.

2.2 RETURN GRILLES ON WALLS ON THE SIDE OF AN EXPOSED DUCT

.1 Type RC (low resistance return grille):

.1 Construction:

.1 Entirely in steel.

.2 Horizontal blades, fixed to 45º.

.3 Blades spaced 19 mm apart.

.4 With insect screen.

.2 Model: such as 530-F-IS from E.H. Price Ltd.

2.3 MANUFACTURER LIST

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

.2 List of manufacturers, section 23 37 13:

.1 Grilles and diffusers:

.1 E.H. Price

.2 Krueger

.3 Nailor Industries Inc.

.4 Titus

Part 3 Execution

3.1 INSTALLATION

.1 Install grilles, grilles with dampers, and diffusers according to manufacturer's instructions.

.2 Where fasteners are visible, use stainless steel flat head screws and embed them in countersunk holes.

END OF SECTION

TABLE OF CONTENTS

Part 1 General

1.1 RELATED REQUIREMENTS

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

1.2 REFERENCES

.1 ASTM International:

.1 ASTM E90-09 – Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.

.2 National Fire Protection Agency Association (NFPA):

.1 NFPA 96-11 – Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations.

.3 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA).

.4 Society of Automotive Engineers (SAE).

Part 2 Product

2.1 LOUVERS

.1 The installation and the supply of louvers are part of another section.

.2 General:

.1 For exhaust air outlets, supply and install louvers with fixed blades.

.2 Profiled aluminum construction, alloy no. 6063-T5, with a minimum thickness of 2.06 mm (12 gauge).

.3 Corners of the frame, perfectly mitered and reinforced with blocking supports.

.4 Design the assembly of the blades to prevent their loosening and vibration, and to ensure that adequate expansion and contraction to prevent the blades from deforming, losing rigidity, or buckling.

.5 45˚ blades having a thickness of 0.53 mm.

.6 Louvers with type Z blades, H-frame with drip edge at the top and bottom.

.1 50% minimum nominal opening.

.2 E.H. Price Ltd no. ZE445.

.3 Dimensions:

.1 Determine the exact dimensions of each louver on site with the manufacturer.

.2 Maximum tolerance of 6.4 mm along the perimeter.

.4 Leak resistance:

.1 Seal between the wall and the air outlets and inlets, using an elastomeric seal of the same color as the louvers. Standard or special colours.

.5 Finishes:

.1 Colours and luster of the Architect's choice.

.2 All bolts, screws, and other assembly accessories are to be aluminum. Paint the exposed parts of bolts and screws with two coats, the same colour as the louvers. Paint supplied by the louver manufacturer.

.3 Provide samples of colours and finishes.

.6 Bird screens:

.1 Behind the fixed blades, a removable screen with standard folded frame and expanded aluminum screen with 12.7 mm no. 2 diamond mesh, wire diameter of 1.6 mm, open area of 80%.

.7 Filling unused parts:

.1 All unused parts of the louvers must be sealed shut with a galvanized steel sheet, thickness of 1.311 mm (18 gauge). Also see the thermal insulation sections.

2.2 MANUFACTURER LIST

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

.2 List of manufacturers, 23 37 20:

.1 Louvers:

.1 American Warming & Ventilating

.2 E.H. Price Ltd

.3 Nailor

.4 Trolec Inc.

.5 Ventex

Part 3 Execution

3.1 INSTALLATION

.1 Install the louvers, the air intakes, and the other vents according to manufacturer's recommendations and SMACNA.

.2 Reinforce and brace the elements as indicated.

.1 Securely fasten the elements to the opening. Caulk edges to ensure a good seal.

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 National Standard Institute (ANSI)/American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE):

.1 ANSI/ASHRAE 52.2-12 – Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particulate Size (ANSI approved).

.2 Canadian General Standards Board (ONGC or CGSB):

.1 CAN/CGSB-115.10-M90 – Disposable Air Filters for the Removal of Particulate Matter from Ventilating Systems.

.2 CAN/CGSB-115.11-M85 – Filters, Air, High Efficiency, Disposable, Bag Type.

.3 CAN/CGSB-115.12-M85 – Filters, Air, Medium Efficiency, Disposable, Bag Type.

.4 CAN/CGSB-115.13-85 – Filter Media, Automatic Roll.

.5 CAN/CGSB-115.14-M91 – High Efficiency Cartridge Type Supported Air Filters for the Removal of Particulate Matter from Ventilating Systems.

.6 CAN/CGSB-115.15-M91 – High Efficiency Rigid Type Air Filters for the Removal of Particulate Matter from Ventilating Systems.

.7 CAN/CGSB-115.16-M82 –Activated Carbon for Odor Removal from Ventilating Systems.

.8 CAN/CGSB-115.18-M85 – Filter, Air, Extended Area Panel Type, Medium Efficiency.

.9 CAN/CGSB-115.20-95 – Polarized Media Air Filter.

.3 International Organization for Standardization (ISO):

.1 ISO 14644-1-99 – Cleanrooms and associated controlled environments - Part 1: Classification of air cleanliness.

.4 National Fire Protection Agency Association (NFPA):

.1 NFPA-96-11 – Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations.

.5 Underwriters' Laboratories of Canada (ULC):

.1 ULC-S111-07 – Standard Method of Fire Tests for Air Filter Units.

.2 ULC-S646-06 – Standard for Exhaust Hoods and Related Controls for Commercial and Institutional Kitchens.

.6 United States Department of Defense Military Standards – Test method standard:

.1 MIL-STD-282-95 – Filter Units, Protective Clothing, Gas-Mask Components and Related Products; Performance Test Methods.

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 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.

.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 efficiency of filter media is given in MERV and MERV-A units. These values must be established according to the standard ASHRAE 52.2-2007. The efficiency established in MERV-A units means that tests were conducted according to the method of the annex (appendix) J of this same standard. This characteristic is accepted, but not mandatory.

.2 The efficiency of the HEPA filters must be established according to the method recommended by the Institute of Environmental Sciences and Technology IEST-RP-CC001.

.3 All media must be approved by the Canadian Insurers Association. They must be certified and labeled class no. 2, according to the standard UL900. Class no. 1 may be required in specified cases.

.4 Systems must never operate without filters.

.5 For the purposes of run-in and adjustments, use 50 mm temporary fiberglass filters at this section's expense.

.6 Upon work acceptance, on each system without exception, replace all filters with new filters of the thickness, the dimensions, and the type shown in the drawings and the specification.

.7 Supply and install all housings required to support the pre-filters and the filters.

.8 For specifications, see the filter tables.

2.2 PLEATED FILTERS OR PREFILTERS, MEDIUM EFFICIENCY (FPME)

.1 Type FPME:

.1 Renewable type filters with pleated media made of synthetic fibers and of uniform thickness. Media supported by a galvanized steel lattice, assembly glued together in a resistant and waterproof frame.

.2 Minimum efficiency of MERV-8.

.3 Initial static pressure loss depending on the thickness and the velocity:

Thickness	Velocity	Loss
25 mm	107 m/min.	57 Pa
50 mm	152 m/min.	77 Pa
100 mm	152 m/min.	67 Pa

.4 Recommended maximum loss of 250 Pa.

.5 Filter considered dirty at 150 Pa.

.6 List of equivalents:

.1 30/30 from Camfil Farr.

.2 Aerostar, series 400 from Dafco Filtration Group.

.3 Pre Pleat 40 from Flanders (JAS Filtration).

2.3 VERY HIGH EFFICIENCY FILTERS (HEPA-1)

.1 Type HEPA-1:

.1 Very high efficiency HEPA type filter with filter media made of fiberglass microfibers fixed with an acrylic resin with corrugated aluminum separators to provide sufficient clearance for the airflow. 16 gauge steel frame with zinc/aluminum alloy to create a durable and corrosion resistant finish. One-piece neoprene seal, entry or exit side, as required. Interior polyurethane sealant, 100% relative humidity resistance.

.2 Capable of withstanding a temperature of 80°C.

.3 Factory checked and certified on a label stuck on the filter.

.4 600 mm x 600 mm x 300 mm filter, filtration area of about 28 m².

.5 99.97% or 99.99% efficiency for 0.3 micron particles. See the article "GENERAL".

.6 338 Pa pressure loss, for an efficiency of 99.97%, and 363 Pa for an efficiency of 99.99% at 152 m/min.

.7 Recommended maximum pressure loss of 500 Pa.

.8 Filter considered dirty at 450 Pa.

.9 List of equivalents:

.1 XH Absolute from Camfil Farr.

.2 Aerostar HEPA Filter from Dafco Filtration Group.

.3 Alpha 2000 from Flanders (JAS Filtration).

.2 HEPA filter housing:

.1 Housing with side access, made of 14 gauge galvanized steel, fully welded, and reinforced with members to withstand a negative or positive pressure of 2000 Pa, weatherproof.

.2 The two access doors are fitted with a positive seal closing mechanism, as well as an ultra-leaktight neoprene gasket. Each door can be easily detached from the housing to facilitate filter replacement through a hinge system on pivots. Each door has seals resistant to a pressure of 2000 Pa.

.3 The housing is also provided with an integral orifice for aerosol injection during the efficiency testing.

.4 Each filter is individually sealed in place by means of an integrated restraint system. Fasteners (four per filter) are fitted with a system ensuring a uniform pressure over the entire filter surface. The filter restraint system must allow filters to compress the seal of the filter to a preferred rate of about 50%.

2.4 FRAMES FOR FILTERS AND PREFILTERS

.1 Universal frame:

.1 Universal mounting frame in 16 gauge galvanized steel, 19 mm inner edge for a fixed installation of the filter and to ensure a seal, polyurethane seal on the inner edge between the frame and the filter, as well as raised support points to ensure the adequate installation of type 8 frames.

.2 Factory perforated frame for easy installation, assembly either by rivets or bolts to mount bank filters. Multiple perforations for the application of various fasteners, allowing the installation of a wide variety of standard size air filters.

.3 The installation of the fasteners must be done without tools or screws.

.4 Allowing the installation of all types of standard filters according to type of fasteners retained. Possibility to assemble a flat or V configuration bank filter to add filter surface and reduce the pressure loss in a duct.

.5 List equivalents:

.1 Type 8 from Camfil Farr.

.2 Aerostar Seal Frame from Dafco Filtration Group

.3 JAS universal frame (JAS Filtration)

2.5 PRESSURE GAUGES FOR FILTERS

.1 Pressure gauge indicating the resistance to air flow, with scale graduated from 0 to 700 Pa on all systems. The indicator must show a differential pressure in the range of 25 Pa. Dwyer Series 2000.

2.6 MANUFACTURER LIST

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

Part 3 Execution

3.1 GENERAL

.1 Install the filters according to the indications in the drawings, in the equipment tables, and according to the manufacturer's recommendations.

.2 Reinforce the filters' frames to prevent buckling and seal around the edges of the filters.

.3 For back to back installation of filters and pre-filters, use two sets of supports spaced 100 mm apart at minimum. Install and remove the pre-filters on the upstream side of the first support and the filters on the downstream side of the second support. The space provided between the two supports allows the installation of the probes and the pressure gauges.

3.2 PRESSURE GAUGES FOR FILTERS

.1 Install a pressure gauge for each filter and pre-filter. For two filters in series, two pressure gauges are required.

FILTER SPECIFICATIONS							
Identification		**2S-072-PF-01**	**2S-072-F-01**				
Location		Unit no. 2S-072 Room no. 2B-100	Room no. 2B-100				
MERV rating		8	HEPA				
Type		FPME	HEPA-1				
Air flow (L/s)		1,650	1,650				
Velocity (m/min.)							
Final pressure loss (inch water)		0.608	1.6				
Quantity		4	2				
Disposition	Horizontal	X	X				
	Vertical						
Dimensions (in)	Length	16	24				
	Height	20	24				
	Depth	2	11.5				
Comments							

Notes:

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 48 – Vibrations and seismic controls for piping and HVAC equipment.

.3 Section 23 31 13.01 – Metal ducts – Low pressure to 500 Pa.

.4 Section 23 33 15 – Dampers – Operating.

.5 Section 23 34 00 – HVAC fans.

.6 Section 23 44 00 – HVAC Air filtration.

.7 Section 23 73 12 – Coils.

1.2 REFERENCES

.1 Definitions:

.1 Certified nominal specifications: technical data published or taken from the manufacturer's documentation, confirmed by tests that have been performed by the manufacturers, or on their behalf by independent laboratories, and certifying the compliance of the elements with the requirements of the codes and the standards in effect.

.2 References:

.1 American National Standards Institute/National Fire Prevention Association (ANSI/NFPA):

.1 ANSI/NFPA-90A-2009 – Standard for the Installation of Air Conditioning and Ventilating Systems, 2009 Edition.

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

.1 ANSI/ASHRAE 90.1-2007 (I-P) – Energy Standard for Buildings Except Low-Rise Residential Buildings.

.2 ANSI/ASHRAE 52.2-2007 – Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size.

.3 Air Conditioning and Refrigeration Institute (ARI).

.4 Canadian General Standards Board (CGSB):

.1 CAN/CGSB 1.181-99 – Ready-Mixed Organic Zinc-Rich Coating.

.5 Master Painters Institute (MPI):

.1 MPI-INT 5.3-2007 – Galvanized Metal.

.6 Sheet Metal and Air-Conditioning Contractors' National Association (SMACNA).

.7 South Coast Air Quality Management District (SCAQMD), California State (SCAQMD) :

.1 SCAQMD Rule 1113-04, Architectural Coatings.

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, instructions, specifications and data sheets for products. Data sheets must include product characteristics, performance criteria, dimensions, limits and finish.

.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.

.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 Panels with polyurethane insulation:

.1 This type of panels must have been tested according to method CAN/ULC S102 "Method of Test for Surface Burning Characteristics of Building Materials and Assemblies" or an equivalent recognized and certified method.

.2 This type of panels will have to meet the standard NFPA-90A "Installation of Air-Conditionning and Ventilating Systems".

.3 Units approved to CSA-C22.2 no. 236 "Heating and Cooling Equipment" (Bi-national standard with UL 1995) are composed of panels that comply with code requirements.

.1

.2 Acoustic properties:

.1 The acoustic properties of panels used in the construction of power plants must be certified by an independent laboratory.

.2 The methods used to establish the insertion loss of the panels must conform to the standards ASTM, E90, and C413.

.3 Acoustic and vibrations :

.1 Consider section 23 05 48 – Vibrations and seismic controls for piping and HVAC equipment.

2.2 MODULAR AIR HANDLING UNITS

.1 Module manufacture:

.1 Manufactured in accordance with the ARI standard 430.

.2 All modules delivered separately include all the components shown on the plans.

.3 All modules will be double-walled, solid surface on both sides, nominal thickness of 50 mm, 18 gauge galvanized steel, and 16 gauge profile structure. Thermally insulated walls with a minimum R factor of 7.5.

.4 All seals will be installed at the factory and the on-site assembly will be done using mechanical fasteners or another approved method, ensuring a perfect seal.

.5 The access panels and doors must allow modules to withstand a static pressure of 1250 kPa, with a maximum leakage rate of 2.3 L/s/m².

.2 Access doors:

.1 Doors or access panels must be provided so as to remove each of the internal mechanical components without compromising the structural integrity of the central module.

.2 In general, the required access doors must be provided on one side only of the unit, on the same side as the piping connections.

.3 All doors must be made using plates identical to those described above.

.4 Each door must be fitted with at least two stainless steel hinges and two cane shaped handles. Doors can be opened from the outside or from the inside.

.5 The seal between the door panel and the frame must be secured by a closed cell neoprene double gasket. These seals must be fixed to the door panel and not on the door frame.

.6 All doors must open to the side having the higher static pressure.

.3 Fan modules:

.1 Centrifugal type fans with forward curved blades, double width and double inlet and dynamically balanced for vibration free operation, aluminium and cadmium plated steel construction. The specifications are certified in accordance with the ARI standard 430. See section 23 34 00 – HVAC fans for fan specifications and data tables.

.2 Silent 60 Hz motor, "open drip proof" type, rotating at 1750 RPM with sealed ball bearings. Possibility of operating in a voltage condition plus or minus 10% versus the nominal design voltage.

.4 Coil modules:

.1 Six (6) row cooling coil with nine (9) fins per inch.

.2 One (1) row heating coil with fourteen (14) fins per inch capable of operating on low or high temperature heating network.

.3 The coils must be "shipping coil" type.

.4 Aluminum fins fixed to copper tubes.

.5 "Flare" type fittings.

.6 Water supply and return on the same side.

.7 High point of each coil with manual air vent valve.

.8 Factory tested to 450 psi air pressure.

.9 Maximum operating pressure of 300 psi at 200°F water temperature.

.10 See section 23 73 12 –Coils.

.11 All piping connections for the coils and the humidifiers must be extended outside of the enclosure through flexible neoprene gaskets on the external/internal panels of the walls. The coil distributors must be located completely inside the enclosure. All connections must be on the same side as the access doors, unless otherwise indicated on the drawings.

.12 Drain pans extended by at least 225 mm downstream of the cooling and recovery coils, allowing to completely clean the drip surface.

.13 All drain pans must be triple sloped and be made of 16 gauge stainless steel. A stainless steel drain fitting with threaded end must be installed laterally at the low point of each pan. The drainage port must be connected from outside the enclosure.

.14 When coils are superposed in a section, the installation must allow removal of any individual coil, without damaging the panels of the enclosure.

.15 All inner panels, including floors, sections used for cooling coils and the supports for this equipment and the sections downstream of this equipment will be made of stainless steel.

.5 Filter modules:

.1 Units will be supplied with 50 mm thick flat filters with MERV-8 filtration efficiency.

.2 See section 23 44 00 – HVAC Air filtration.

.6 Acoustics and vibrations:

.1 Consider section 23 05 48 – Vibrations and seismic controls for piping and HVAC equipment.

.7 Each modular air handling unit and its connection and control panel must be designed to withstand a minimum short-circuit capacity of 5 kA at the connection terminals.

.8 Characteristics:

.1 Identification : 2S-072
.2 Location : Room 2B-100
.3 Supply flow: 3 500 cfm (1 650 L/s)
.4 Total static pressure: 3.32 in H2O
.5 5 HP motor. 575V/1/60
.6 MERV 8 filters. 2” thick
.7 Chilled water coil with a total capacity of 105 MBH.
.8 Hot water coit with a total capacity of 113.87 MBH.
.9 As Trane model UCCAA08D0F0FLC52000000ECW00AA00000000000.

2.3 MANUFACTURER LIST

.1 Modular air handling units:

.1 Ingenia
.2 McQuay
.3 Racan-Carrier
.4 Trane
.5 York

Part 3 Execution

3.1 AIR HANDLING UNITS

.1 Installation:

.1 When the units are delivered in separate modules, the supplier/manufacturer will have to supervise the assembly work.

.2 Refer to the manufacturer's installation manual for on-site handling instructions.

.3 Ensure that each unit is installed level and square.

.4 When the units are delivered in modules, ensure proper seals between the modules.

.5 Check and correct, if necessary, the alignment of doors and the dampers to ensure proper operation.

.2 Anti-vibration pads under the air handling units:

.1 All air units must be installed on anti-vibration pad type isolators. See section 23 05 48 - Vibrations and seismic controls for piping and HVAC equipment.

.3 Fan/motor assemblies:

.1 All fan/motor assemblies must be mounted on a type III base. See section 23 05 48 – Vibrations and seismic controls for piping and HVAC equipment.

.2 Movement limiters must be provided for each fan to ensure stable operation and to protect the flexible connections from tearing.

.4 Electrical connection provisions:

.1 Provide an empty conduit connected to the motor of each fan from a pull box installed on the outer surface of the enclosure.

.5 Grounding:

.1 Also provide a grounding braid between the fan and the enclosure, as specified in the article "GROUNDING" from section 23 31 13.01 – Metal ducts – Low pressure to 500 Pa.

.6 Suspended devices:

.1 Install them using the methods described in section 23 05 48 – Vibrations and seismic controls for piping and HVAC equipment and section 23 05 29 – Hangers and supports for HVAC piping and equipment.

.7 Seismic controls:

.1 See section 23 05 48 – Vibrations and seismic controls for piping and HVAC equipment.

.8 Commissioning units:

.1 The manufacturer must collaborate with the company in charge of the work by this section during the commissioning which will be under the supervision of the Engineer.

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 Definitions:

.1 Certified nominal specifications: technical data published or taken from the manufacturer's documentation, confirmed by tests that have been performed by the manufacturers, or on their behalf by independent laboratories, and certifying the compliance of the elements with the requirements of the codes and the standards in effect.

.2 References:

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

.1 ANSI/ASHRAE 90.1-2007 (I-P) – Energy Standard for Buildings except Low-Rise Residential Buildings.

.2 ANSI/ASHRAE 52.2-2007 – Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size.

.2 Air-Conditioning and Refrigeration Institute (ARI):

.1 ARI 410-2001 – Forced Circulation Air Cooling and Air Heating Coils.

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

.1 ASTM-A53/A53M-10 – Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.

.4 Canadian General Standards Board (CGSB):

.1 CAN/CGSB 1.181-99 – Ready-Mixed Organic Zinc-Rich Coating.

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, instructions, specifications and data sheets for products. Data sheets must include product characteristics, performance criteria, dimensions, limits and finish.

.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 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 COIL SPECIFICATIONS

.1 For specific characteristics, see the coil tables on the plans.

2.2 CHILLED WATER AND HOT WATER COILS

.1 Manufacturing:

.1 Copper manifold with threaded brass fittings, drain plug, minimum NPS 2½ fitting with a maximum velocity of 3.05 m/sec. See the tables.

.2 Copper tubes 16 mm in diameter and with a nominal thickness of 0.508 mm.

.3 Aluminum fins in corrugated sheets, well fixed to the tubes, evenly spaced, and with a nominal thickness of 0.191 mm.

.4 Circuits: Only full, half, and double circuit coils are accepted.

.5 Test pressure of 1725 kPa.

.6 Operating pressure of 1380 kPa.

2.3 MANUFACTURER LIST

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

.2 List of manufacturers, section 23 73 12:

.1 Cooling and heating coils:

.1 Aerofin
.2 Heatcraft
.3 Marlo (Air Eau Qualité Contrôle Inc.)
.4 McQuay
.5 RefPlus
.6 Trane
.7 York

Part 3 Execution

3.1 COILS – GENERAL

.1 Install chilled water and glycol heat recovery coils entirely inside the unit, including the ends, in order to prevent any condensation on the outside of the unit.

3.2 COIL SUPPORTS

.1 Install coils on bases made from brackets, U-irons, I-beams, or WF-beams, welded according to the coil dimensions. Construct the supports so that the coils can be slid into place without dismantling the pipes.

.2 Independently support each coil so as to be able to remove a coil without dismantling the adjacent coils. Seal the joints between the coils. Provide piping connections to allow easy disassembly.

.3 Submit installation drawings.

3.3 COIL DRAIN PANS

.1 Provide drain pans with drainage connections for the chilled water and heat recovery coils.

.2 When installed in a prefabricated unit section, the basin is an integral part of the section and forms the entire floor of this section.

.3 The slider, the sealing plate, and the catch basin must be made of stainless steel 304.

.4 See details.

COOLING COIL SPECIFICATIONS (CHILLED WATER)								
Identification			**2S-072-SR-01**					
Location			2B-100					
Air	Flow (L/s)		1652					
	Velocity (m/s)		2.33					
	PDA (Pa)		143					
	Tº inlet (ºC)	DB	26.7					
		WB	19.4					
	Tº outlet (ºC)	DB	14.4					
		WB	14.2					
Chilled water	Flow (L/min)		64.5					
	PDW (kPa)		4.51					
	Tº inlet (ºC)		7.2					
	Tº outlet (ºC)		14.0					
Coils specifications	Type		Chilled water					
	Rows		6					
	Fins		9/in					
	Number of circuits		-					
	Height (mm)		-					
	Length (mm)		-					
	Quantity		1					
	Total surface (m²)		-					
	Instal-lation	Hor.						
		Vert.	X					
Comments								

Legend:
DB: dry bulb
WB: wet bulb
PDA: static pressure drop, air side
PDW: static pressure drop, chilled water side

HOT WATER HEATING COIL SPECIFICATIONS								
Identification			**2S-072-SC-01**	**2S-072-SC-01**				
Location			2B-100	2B-100				
Air	Flow (L/s)		1652	1652				
	Velocity (m/s)		2.32	2.32				
	PDA (Pa)		34.3	34.3				
	Tº inlet (ºC)	DB	7.2	7.2				
	Tº sortie (ºC)	DB	23.9	23.9				
Hot water	Flow (L/min)		15.5	120.3				
	PDW (kPa)		0.33	17.1				
	Tº inlet (ºC)		82.2	48.9				
	Tº outlet (ºC)		51.3	44.9				
Coils specifications	Type		Hot water	Hot water				
	Rows		1	1				
	Fins		14/in	14/in				
	Number of circuits		-	-				
	Height (mm)		-	-				
	Length (mm)		-	-				
	Quantity		1	1				
	Total surface (m²)		-	-				
	Instal-lation	Hor.						
		Vert.	X	X				
Comments			1	2				

Legend:

DB: dry bulb

WB: wet bulb

PDA: static pressure drop, air side

PDW: static pressure drop, water side

Comments:

1 IN THE CASE OF OPERATION ON THE EXISTING HIGH TEMPERATURE HEATING NETWORK.

2 IN THE CASE OF OPERATION ON THE FUTURE LOW TEMPERATURE HEATING NETWORK.

END OF SECTION

TABLE OF CONTENTS

Part 1 General

1.1 RELATED SECTIONS

.1 Section 20 00 10 – General mechanical and electrical instructions.

.2 All Division 23 and Division 26 sections.

1.2 GENERAL CONDITIONS

.1 All requirements outlined in Division 01 apply to Division 25.

.2 All of Division 25 sections complement each other to form a whole.

.3 All mechanical and electrical drawings and installation details apply to Division 25.

.4 For uniformity, continuity, and compatibility reasons only products from Delta controls distributed by Regulvar are acceptable on this project.

1.3 ACRONYMS AND ABBREVIATIONS

.1 Acronyms used in this section:

.1 BACnet – Building Automation and Control Network.
.2 BTL – BACnet Testing Laboratories.
.3 COSV – Change of State or Value.
.4 DDC – Direct Digital Control.
.5 HVAC – Heating, Ventilation, Air^-Conditioning.
.6 HMI – Human Machine Interface.
.7 I/O – Input/Output.
.8 LAN - Local Area Network.
.9 LCU(s) – Local Control Unit(s).
.10 NC – Normally Closed.
.11 NO – Normally Open.
.12 PC - Personal Computer.
.13 MCU(s) – Master Control Unit(s).
.14 PID – Proportional, Integral and Derivative control loop.
.15 EMCS – Energy Management and Control System.
.16 NMC(s) – Network Management Controller(s).
.17 SSR – Solid state relay.
.18 TCU(s) – Terminal Control Unit(s).
.19 TRIAC – Triode for alternating current.
.20 USB - Universal Serial Bus.
.21 UPS - Uninterruptible Power Supply.
.22 VAV – Variable Air Volume.

.23 VFD – Variable Frequency Drive.

.24 VPN – Virtual private network.

.25 WAN – Wide Area Network.

1.4 DEFINITIONS

.1 EMCS: the energy management system includes all of the building's control and monitoring systems, i.e. all instrumentation, pneumatic, electrical and direct digital controls as well as the centralized management system.

.2 Point: a point may be physical or logic ("virtual").

.1 Physical points: inputs or outputs connected directly to digital controllers that monitor the status or signal amplitude of instrumentation or control the action of equipment (on, off, modulation) and actuators (position, modulation) through relay contacts or control signals.

.2 Logic points: values calculated by the digital controller, for example set points, total values, totalized pulses, corrections based on the results and/or instructions from the control logic.

.3 Point object type: points fall into following object types:

.1 AI (analogue input).

.2 AO (analogue output).

.3 DI (digital input).

.4 DO (digital output).

.5 PI, PO (pulsed signals).

1.5 SCOPE OF WORK

.1 Work included:

.1 Work includes detailed engineering, labour, supply, installation, adjustments, calibration, and all pneumatic, electrical, and electronic wiring of all control systems indicated on drawings and specifications.

.2 Division 25 must include unless otherwise specified, all devices, hardware, piping for pneumatic controls, conduits, junction boxes and wiring for electrical and/or electronic controls pertaining to the control system and to systems' various control components, interconnections between the two types of controls, electrical wiring to panels or starters for the normal operation of such controls, supply and installation of transformers required for low voltage controls.

.3 Dismantling:

.1 This Division's Contractor must read the dismantling scope of work of involved specialties and must be present at the start of the work to participate in selective dismantling.

.2 Recover current transmitter and starter control relay from existing ventilation unit.

.3 Existing EMT control ducts may be reused if in good condition.

.4 Return all dismantled equipment to Owner.

.4 Construction, work includes more specifically:

.1 Supply, installation and wiring of new current transmitter and exhaust fan control box.

.2 Retrieve and reinstall equipment and centralized points as indicated on the plan.

.3 Provide and connect new motorized valves.

.4 Supply 120V or 24V power to various components provided by the Control Contractor.

.5 Update system graphics for Room Nos. 2B-100 and 2B-102.

.6 Identification of all components, conduits, and conductors as per Canadian Space Agency standards.

.7 Start-up of systems, training, and provision of documentation relevant to the use and maintenance of terminal units.

.2 Work excluded:

.1 Unless otherwise instructed, the following work is excluded:

.1 Access doors to controls in ventilation ducts.

.2 Instrumentation openings, refer to Section 01 00 10 - Mechanical and Electrical General Instructions.

.3 Installation of motorized valves to be handed to Division 23.

1.6 DOCUMENTS TO BE SUBMITTED FOR APPROVAL

.1 Provide all project shop drawings for all control equipment supplied.

1.7 QUALITY ASSURANCE

.1 All wiring and installations must comply with manufacturers and the Régie du bâtiment du Québec requirements for all mechanical and electrical work.

.2 The system must include all control and monitoring devices and hardware, as well as all remotely installed devices, accessories and hardware, the software, interlocking cabling and piping required to achieve a complete system described in this section. The system must meet the requirements of applicable local and national codes. If there are contradictions between referenced codes, the requirements of the most recent and/or most stringent local codes must be followed when installing the system.

.3 Unless otherwise specified, use new materials and devices, regularly produced by the manufacturer, CSA and ULC certified, complying to the referenced standards, and meeting any other prescribed requirements.

1.8 WARRANTY

.1 Notwithstanding the warranty period specified in the "WARRANTY" article of section 20 00 10, additions and modifications to the control system must carry a (2) two-year warranty starting on the work's final acceptance date.

1.9 TOTAL FIXED PRICE

.1 Provide with the bid, a total fixed price covering all works of Division 25.

Part 2 Product

2.1 GENERAL

.1 Control devices of each category to be of same type and manufacturer.

.2 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.

2.2 CONTROL DEVICES

.1 R – Electric relays:

.1 4PDT or DPDT, silver-nickel alloy contact, with indicator light and self-holding test button.

.2 Relays supplied with plug-in base with screw terminals.

.3 Activation coil of 12 V D.C., 24 V A.C. or 120 V A.C. voltage depending on application.

.4 Complete with enclosure, when installed outside of panels.

.5 In switching applications, use contactors of sufficient capacity.

.6 As per Omron MYxIN or approved equivalent Magnecraft.

.2 CT – Current transmitters:

.1 Split-core current transmitter.

.2 600 VA.C. RMS isolation.

.3 Full-scale accuracy of ± 2%.

.4 Current range according to application. Equipped with a range selection jumper. Models with a potentiometer to adjust the measuring range are prohibited.

.5 Output signal: 0 to 5 V D.C.

.6 As per Veris Industries Hawkeye no. H922 or approved equivalent Senva.

.3 DPT – Differential pressure transmitter:

.1 For filter:

.1 Fully transistorized piezoresistive transmitter with integrated temperature compensation.

.2 Full-scale accuracy of ± 0.5% with integrated zero-point adjustment.

.3 4 to 20 mA output signal.

.4 LCD screen.

.5 As per ACI A/DLP series or approved equivalent.

.4 Motorized valves:

.1 Three-way – 50 mm (2 in) or less:

.1 Globe valve. Bronze body, threaded union, stainless steel stem, plug and seat.

.2 Class ANSI IV leakage rate.

.3 As per Belimo, G3 series or approved equivalent.

Part 3 Execution

3.1 INSTALLATION

.1 All work conducted by Division 25 must be performed in accordance with requirements described in section 20 00 10.

.2 All controls must be installed and adjusted by competent technicians regularly employed by the contractor. Adjustment cost is part of this contract.

.3 The installation of each device provided by Division 25 must be done in accordance with the product manufacturer's instructions and recommendations.

.4 Similarly, the installation of equipment supplied by others and installed by Division 25 must be done in accordance with the product manufacturer's instructions and recommendations.

.5 This Division is responsible for the complete installation of all equipment it supplies. It is also responsible for all wiring including low or medium voltage power supply, communication wiring, electrical connections for remote controls and measurements these devices require and for the various remote components of mechanical systems.

.6 All wiring must comply with local authorities' requirements and those of the article "ELECTRICAL WIRING" of this section.

.7 All through-wall piping must be protected with a sealed nylon bushing.

.8 All electrical cables and flexible pneumatic tubing passing through a knockout opening must be protected from sharp edges with nylon braided sleeving. Groupings of the same type of cable or tubing in the same braided sleeve are permitted.

.9 Control panels must have no unused open knockout openings.

.10 Wall mounted temperature sensors installed against exterior walls must be fitted with an insulating base supplied by this Division.

.11 For motor stop/start control, whether the starter is a magnetic or a manual type, supply and install an interface relay or contactor between the controller's digital output and the starter electrical circuit. In the case of a manual starter, the contactor must be compatible with the motor voltage and current.

3.2 ELECTRICAL CONNECTIONS

.1 Reuse of existing cables:

.1 Reuse of existing cables for control of relocated equipment and instruments is permitted provided that:

.1 The pre-dismantling verification report certifies proper signal transmission.

.2 Cables are long enough to connect seamlessly at the new location.

.3 Integrity of conductors and protective jackets is maintained.

.2 Division 25 must supply and install cables, conduits, junction boxes, connectors, and all necessary hardware for the following complete connections:

.1 All devices specific to its specialty.

.2 All connections required to meet the operating sequences described in this Division's sections.

.3 All remote connections of hardware supplied and installed by other Divisions and required for the proper operation of a mechanical equipment or system as indicated on its reviewed shop drawing.

.3 Comply with Division 26 requirements for installation of conduits, junction boxes, wiring.

.4 Comply with the prevailing Quebec Electrical Code requirements for the installation of conduits, junction boxes and wiring. These requirements apply to the entire installation, including low-voltage installations.

.5 Grounding of the entire installation by the controls Contractor is part of this contract and must be done in accordance with the Quebec Electrical Code requirements and the equipment manufacturers' recommendations.

.6 Notwithstanding the conductor sizes specified in Division 26, the conductor sizes used exclusively for control circuits are as follows:

.1 120 V: 14 AWG minimum gauge.

.2 24V: 18 AWG minimum gauge, shielded, twisted cable, FT4 rating when in EMT conduit and FT6 when exposed.

.3 Secondary network communications: 24 AWG minimum gauge, low capacitance.

.7 Cables for input or output analogue processing signals must have two or three 18 AWG conductors, twisted with aluminum shielding, and drain wire, and fitted in a protective PVC sheath. Drain wires must be securely wired and grounded at the source point. The other end must be protected from grounding by a dielectric shield.

.8 Control conductor gauges must be selected so that the voltage loss is less than 5% of the supply voltage.

.9 Unless otherwise specified, all cables must be in EMT thin-walled metallic conduit. EMT conduits must be sized to meet a fill rate not exceeding 40%.

.10 Use of exposed (plenum) cables:

.1 FT-6 certified cable is permitted only in the ceiling spaces of rooms and corridors where cables remain accessible (ceilings made of removable soundproofing tiles) and only for the connection of control signals, secondary level communication and 24 V voltage to devices connected to a terminal control unit (TCU). Its use is prohibited in mechanical or electrical rooms, service shafts, on exposed walls or ceilings, or any other place where there is a risk of physical damage.

.2 Exposed FT-6 wiring must follow the building axis and be neatly tied at least every 1.5 m with J-hooks designed specifically for this purpose. The use of tie wraps, of suspended ceiling frames, ventilation duct or water pipe hangers, or other means of supporting cabling is strictly prohibited.

.3 For wall control connections, FT-6 cables must be run from the electrical box to the ceiling in metallic conduits.

.4 Install cord fittings at the ends of metallic conduits to protect FT-6 cables from abrasion.

.11 N.O. or N.C contact position shown on drawings is to illustrate a system or equipment's principle of operation, and not as the actual position of available contacts. This Division is responsible for the proper operation of its control systems and for the proper protection of the systems it controls.

.12 All junctions and connections must be made without exception within junction boxes provided by this Division and made on industrial grade screw terminals. The use of twist-on ("marrette") connectors, crimping fittings or twisted cables wrapped with electrical tape is prohibited.

3.3 TEST RUNS AND CALIBRATION

.1 Calibration:

.1 Calibrate all new and existing control devices.

.2 Controls of each Division must be checked and adjusted and demonstrated to be functioning properly.

.2 Simulate all alarms and log them.

.3 Division 25 must cooperate with and assist in the testing and adjustment of devices and systems of other Divisions, both when requested by them and when the proper system operation is at stake.

3.4 START-UP

.1 The controls Contractor, upon completion of the system installation, must proceed with its system start-up. To ensure safe operation, start-up is divided into the following phases: control system verification and control system start-up with the electromechanical systems in operation.

.2 During the control system verification phase, the controls technician must perform, but not be limited to, the following steps:

.1 Check calibration and signal reception of all transmitters.

.2 Check operation of all electrical actuators.

.3 Check operation of all controls and feedback associated with the control.

.4 Simulate all alarms.

.5 Simulate all control loops and adjust parameters.

.6 Simulate a power failure sequence and ensure proper operation of the control system.

.3 The final start-up phase must be done under the supervision of the Owner's representatives. During this phase, the systems must operate in fully automatic mode. The control technician must make the necessary corrections and fine-tuning to achieve a functional and safe system, free of cyclical patterns. The controls Contractor must perform, at its own expense, the adjustments and modifications required to optimize the operating sequences.

.4 Upon completion of start-ups, demonstrate to the designated professional the control system operation.

3.5 TECHNICAL STAFF TRAINING

.1 Provide the services of a qualified employee for a period of one (1) hour to brief the Owner's representatives on the operation of the EMCS controls.

3.6 NARRATIVE SEQUENCES OF OPERATION

.1 General:

.1 Adjust all delays, dead bands and thresholds based on field observations during start-ups to achieve stable operation.

.2 Program historical data on all control points.

.3 Program the following alarms:

.1 High and low room and return temperatures.

.2 High and low system supply temperature.

.3 Unintended unit fan shutdown.

.2 System no. 2-072-VA1:

.1 Keep actual sequence of operation.

.3 System no. 2-072-VE1:

.1 Fan no. 2-072-VE1 is started or stopped by the user using the wall switch connected to the fan starter.

END OF SECTION