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Part 1 General

1.1 SUMMARY

.1 Related Requirements

- .1 Section 23 05 53.01 – Identification of networks and mechanical equipment.

1.2 EXAMINATION OF THE SITES

- .1 Before submitting its bid, each bidder must visit the site to become familiar with everything that could affect his 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 EQUIVALENT PRODUCT

- .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 its obtention, 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.

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 wholly 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 IMPORTANT NOTE: SUPPLY AND INSTALLION

- .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 "TRADES" "MINOR WORKS".



1.7 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 organisms having jurisdiction.
- .3 Restrictions on smoking
 - .1 It is forbidden to smoke inside the building. Comply with the restrictions that apply to smoking on the property.
- .4 Discovery of hazardous materials
 - .1 If materials applied by spray or trowel may contain asbestos, Polychlorinated biphenyls (PCBs), mold or any other controlled substance is discovered during the demolition, Immediately stop the demolition.
 - .1 Take corrective action and notify the owner's representative immediately.
 - .2 Do not resume work until you have received written instructions.

1.8 TAXES

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

1.9 TRADES 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.

1.10 TOOLS AND SCAFFOLDING

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

1.11 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 works, 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 restore the premises to a clean condition when the work is completed.

1.12 MATERIALS

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

1.13 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 work day, seal with a screw cap or a suitable metal cap all openings in conduits of any kind.

1.14 SHOP DRAWINGS

- .1 Before the fabrication of any equipment, submit for verification two paper copies of the shop drawings, a copy annotated by the Engineer will then be returned as a PDF by e-mail. The drawings will give the dimensions, the weight, the number of attachment points, the location of the center of gravity, the seismic index, the wiring diagrams, the capacities, control diagram, the curves, the space requirements for maintenance and all other relevant data. If applicable, indicate clearly, according to the equipment, the dimensions and the location of plumbing, heating, electrical connections and others. Each drawing must be checked, coordinated, signed and dated by the section before being submitted for verification.
- .2 Shop drawings must be relevant to the proposed equipment. The sheets from general catalogs are not accepted as shop drawings. Each drawing must be identified with the name of the project, the consultant's name, the date and designation of the equipment shown in the drawings and specifications. Drawings must be prepared and signed by the supplier. Drawings pulled from the supplier's website are not accepted.
- .3 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 his drawings.
- .4 The drawings must be in French.



- .5 The Contractor must make the necessary copies of the reviewed and/or updated shop drawings to include them in the instruction manuals to be provided at the end of the work. See the article. " OPERATING AND MAINTENANCE MANUAL ".

1.15 COORDINATION DRAWINGS

- .1 Generalities:
 - .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 works involved, those of the relevant section and those done by others.
 - .3 Communicate with the Architect to procure Architectural drawings.
- .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 ducts, openings, anchorages and supports, relative positions with structure, Architectural works and other mechanical and electrical work.
 - .2 Provide drawings at a 1/30 scale (3/8") on paper.
- .3 Preparation:
 - .1 The Division 23 (section "HVAC - Ventilation") is responsible for the coordination with all mechanical and electrical trades for its coordination drawings. These sections must provide all the data, schematics, drawings and, diagrams necessary for this coordination work.
 - .2 The Division 23 (section "HVAC - Ventilation") must prepare a drawing of its own work with all the necessary data and dimensions and incorporate all information provided by other trades into it.
 - .3 All drawings without exception must be coordinated by the Division 23 (section "HVAC - Ventilation") with the collaboration of all mechanical and electrical Divisions.
 - .4 All coordination drawings for a given sector must all be submitted together for verification.
- .4 Collaboration:
 - .1 Close collaboration must exist between the businesses responsible for the mechanical and electrical work to determine the location of their respective work and avoid incompatibilities.
- .5 Distribution of coordination drawings:
 - .1 Submit to the Engineer for review; two paper copies of the coordination drawings, approved by the Contractor and signed by all sections.



- .2 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 location and exact dimensions of their openings, perforations, sleeves, equipment, pipes and ducts, whether the Structural, Architectural or Engineering drawings are dimensional drawings or not.
 - .2 The Division 23 (section “HVAC -Ventilation”) must ensure the full coordination of its work with the coordination drawings.
 - .3 No compensation will be given for the modifications imposed on the work, for the purpose of coordination and integration of the electromechanical systems amongst them.
 - .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 does not relieve the relevant section of its responsibilities and obligations to provide complete and duly proven, ready to operate systems in perfect condition and fully integrated.
 - .5 Verification of coordination drawings by the Engineer is limited to ensuring that the technical requirements seem to be met (fire damper, grids, insulation, etc.). The Engineer does not check the quality of the coordination carried out by the Contractors.
- .7 Pre-existing work:
 - .1 Coordination drawings should take into account 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 well supports.
 - .6 All mechanical and electrical work in mechanical rooms, tunnels, wells, parking lots, main and secondary electrical room.
 - .7 All mechanical and electrical work in all places where space is particularly restricted.
 - .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 in places deemed necessary.



- .10 For all work on automatic sprinklers, the coordination drawings are the responsibility of the Division 21.
- .11 Coordination drawings of the thermal plant, cooling towers, etc., are the responsibility of the Division 23 (section "HEATING - CHILLED WATER").
- .9 Collaboration drawing originals:
 - .1 Upon completion of the works, a USB media of each operation and maintenance manual and two hard copies of the drawings of the work, as executed, must be given to the Owner at no cost, by each mechanical and electrical section.

1.16 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

1.17 OPERATION AND 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 media.
- .2 These manual must contain:
 - .1 A list and illustration of all equipment components: pumps, fans, filters, controls, burners, alarm panels, lighting fixtures, transformer stations, generators, fire alarms, etc.
 - .2 A copy of the approved shop drawings, and as executed.
 - .3 The instructions for lubrication published by the manufacturers with the specifications of the oils and greases to be used and the frequency of lubrication.
 - .4 A diagram indicating the identification numbers of each valve, the normal operating position, the location, and flow direction for each of the piping systems.
 - .5 Prepare a properly attached glossary containing the number, location, and function of each valve. This glossary should contain a separate chapter for all shut down (or emergency) valves and main valves. The numbering code must be approved.
 - .6 A diagram of the controls with explanatory text.
 - .7 A list identifying access points to fire shutters and controls in the walls and ceilings.
 - .8 A list of legends of the piping, the piping identification codes, and ventilation systems.
 - .9 A list of the systems' final calibration values, as approved.
 - .10 A list of the different Subcontractors 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 point 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 colored 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 binding strips.
- .6 Submit a copy to the Engineer for comments and then deliver three copies of the manuals 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.

1.18 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 architectural boxing shall be borne by the Contractor.
- .4 Reread the articles "COOPERATION WITH OTHER TRADES" and "TESTING".

1.19 PLACEMENT OF PIPING AND DUCTS

- .1 No pipe must not 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 floor. 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 Architect or the Engineer 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.

1.20 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.

1.21 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 fastening components and metal accessories of the same texture, color 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 manholes, and other similar parts with the building walls.
- .5 Disposition for the future:
- .1 In any place where a space was left free for future use, ensure that this space remains free and install materials and equipment related to the work so that future connections of the added equipment can be done without needing to redo the floor, walls or ceiling, or even, a portion of the mechanical or electrical facilities.

1.22 PAINTING

- .1 Apply a base coat of mordant 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 colored 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.
 - .1 Such as the Sierra Performance S30 Griptec from Rust-Oleum, or Sierra Performance S71 as an aerosol.
- .3 Unless otherwise indicated, do not apply a layer of mordant on the uninsulated pipe, except when subjected to weather.
- .4 On insulated pipes, no additional painting is required to that required in the thermal insulation sections.
- .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 networks and mechanical equipment.



1.23 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 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.

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

- .1 Generalities:
 - .1 Unless otherwise indicated, the openings necessary for the piping and ventilation ducts, in the form of sleeves to install or drilling, are the responsibility of each relevant mechanical and electrical section.
 - .2 Each relevant section is responsible for all damages and breaks due to its drilling.
 - .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 ducts 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 deck, drill and reinforce openings, according to the guidelines of the structural Engineer.
 - .9 It is not allowed to drill in column projections or strips without special permission from the structural Engineer who will decide how to proceed.
 - .10 For rectangular ventilation ducts, all necessary casings and their installation are the responsibility of another Division. However, the dimensions, quantity, placement, and verification are the responsibility of the duct installer. Any additional steel reinforcements and additional related work is also the responsibility of another Division.
 - .11 Unless otherwise specified, install electrical conduits through walls or concrete floors before the concrete is poured.
- .2 Round, square and rectangular openings in concrete:
 - .1 All new round openings required for ventilation work and all new square or rectangular openings required for mechanical and electrical works in the concrete must be done by the general Contractor, following the structural Engineer's guidelines, at the expense of the relevant section.



- .3 Openings in concrete block walls and drywall:
 - .1 Openings to be drilled by the Contractor. Sealing of openings by the Contractor. In the case of openings in piping of temperatures higher than 38 °C, the relevant mechanical section must install a 20 gauge galvanized steel sleeve, according to the article "SLEEVES" in this section.
- .4 Concrete beams and columns:
 - .1 The drilling of new openings in the concrete beams and columns is prohibited.
- .5 Steel beams and columns:
 - .1 The drilling of new openings in the steel beams and columns is prohibited.
- .6 Floor drains and funnel drains:
 - .1 All new vertical openings to be drilled in the concrete for the laying of new floor drains and funnel drains should be performed as follows: in the upper part of the slab, with a diameter sufficient to lay the drain body, and in the lower part, with a sufficiently smaller diameter to lay the drainage pipe. The drain body part must be made watertight using of epoxy.
- .7 Vertical openings in concrete for piping:
 - .1 All new vertical openings to be drilled in concrete with integrated finish or already cast finish, for the laying of pipes, must be performed as follows : In the upper part of the slab, with a sufficient diameter to affix the sealing plate of the sleeve, and in the lower part, with a sufficiently smaller diameter to accommodate the steel sleeve.
 - .2 In the case of concrete slab whose finish is not yet cast, the opening in the concrete must be drilled to accommodate the steel sleeve only. Make the sealing plate resting on the raw slab watertight with epoxy before pouring the concrete and/or finish.
- .8 Fire and smoke barriers: Complies with CAN/ULC-S115-11 standard method of fire tests of firestop systems. Install fire and smoke barriers around pipes, ducts, cables and other object that go through a fire all, in order to offer a fire protection equal to the adjoining wall, ceiling and floor.
- .9 Toutes les nouvelles ouvertures doivent être effectuées en dehors des heures d'occupation du bâtiment.
- .10 All new opening to be made outside of normal building hours.

1.25 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 the 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.
- .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.

1.26 INSPECTIONS

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

1.27 TESTING

- .1 Each section must cooperate with the other sections, so as to enable them to complete their tests within the time delay required 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 All tests must be performed in the presence of the Engineer and to his satisfaction.
 - .2 The Engineer may require a test of installations and equipment before accepting them.
 - .3 For temporary trials, obtain written permission to operate and test installations and permanent equipment before being accepted by the Engineer.
 - .4 Give a written 48 hour notice to the Engineer before the date of the test.
 - .5 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.
 - .6 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.
 - .7 Prevent dust, dirt, and other foreign matter from entering the openings of installations and equipment during testing.
 - .8 Provide to the Engineer a certificate or letter from the manufacturer confirming that each section of the installation was implemented to their satisfaction
 - .9 Submit the written test results to the Engineer.
 - .10 The tests must be performed and accepted prior to the installation of the thermal insulation.
 - .11 Do not conceal or embedded piping, conduits, or equipment before the tests are completed and accepted.



- .12 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.
- .13 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.
- .14 Provide hydraulic pumps, air compressors, fans and other equipment necessary to perform all tests and related temporary work.
- .15 Correct any leak detected. The defective part must be removed, repaired and the test is redone until the results are satisfactory.
- .16 Whenever tests are conducted with water, place the pressure gauge at the highest point of the installation.
- .17 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.
- .18 For joints with caulking, it is not permitted to repair cracks using other materials.
- .19 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.

1.28 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 Engineer 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 on controls as planned in the operating sequences.



- .3 During this period, prior to acceptance "with reservation", each relevant section will need to conduct normal maintenance, in accordance with the instruction manuals provided by the Contractor during the maintenance. The maintenance for the period between the provisional and final acceptance will be covered by the Owner if all information necessary for maintenance is provided and the training was completed. Otherwise, the Contractor will need to undertake the maintenance.

1.29 EQUIPMENT CALIBRATION AND OPERATION

.1 Generalities:

- .1 Vibration tests are required to ensure that:
- .1 The equipment operates within acceptable levels of vibration.
 - .2 That vibration or noise is not transmitted to the building structure.
- .2 The company in charge of the work of each relevant section must use the services of a firm specialized in vibration analysis to conduct verifications and the work required by this article.
- .3 Before proceeding to any work, have the selection of the specialized firm, which must be retained to perform the analyses, approved. Submit the qualifications of the firm and the methodology to be used to perform the work.
- .4 The work must be performed by a qualified Engineer or technician.
- .5 Provide a list of personnel who will be assigned to the project and a list of equipment and devices that will be used to perform the analyses.

.2 Analyses:

- .1 Fans with a 1 HP or stronger motor must be analyzed.
- .2 Pumps with a 3 HP or stronger motor must be analyzed.
- .3 All systems modulated by a variable frequency speed controller must be analyzed over the entire range of operating frequencies.
- .4 ANSI S3.29 and ISO 2631-2 standards must be followed for occupant comfort.
- .5 If the acceptable values of vibrations are not available from the manufacturer of the equipment, use the RMS (IRD 1988).
- .6 Also refer to the chapter "Sound and Vibration Control" from ASHRAE.
- .7 Minimum criteria to be met:
 - .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 4mm/sec.
 - .2 Filtered value (by frequency band): peak maximum velocity of 2mm/sec.



.3 General procedure:

.1 Generalities:

- .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 adjustment 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 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 / sec., 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.

1.30 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

1.31 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 hours after having been formally notified.
- .2 Manufacturers must offer a one year warranty from the starting operation date or eighteen months from the date of delivery to the site, as appropriate. The warranty must include the cost of materials and labor, and the replacement of defective parts and/or manufacturing defect. In the case of chillers, a five-year warranty applies if the refrigerant is contaminated due to the compressor motor burning.
- .3 The warranty is for a period greater than one 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-year warranty.
- .5 General conditions:
 - .1 It is expected that several contracts of the same discipline may be executed by different companies, that another company may have adjustments or tests to be executed on its work, that another company may have work to be done which are a subsequent phase of its work, that each company is committed, through this specification, to accept that its work is subject to all conditions listed above without changing the terms of the warranty.
- .6 The use of permanent equipment for temporary purposes does not relieve the relevant section of its responsibilities and obligations with respect to the acceptance and guarantee of its work.
- .7 The Engineer and/or the Owner reserve the right start the operation equipment and mechanical and electrical works without affecting the section's obligation to see to the full maintenance of its work up to acceptance "with reservation".

1.32 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.

1.33 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 labor 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. It still 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.

1.34 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.

1.35 CERTIFICATION OF CONFORMITY

- .1 Upon completion of the works, each Subcontractor must provide the Engineer the certificate of compliance attesting that all work was performed according to drawings and specifications, and according to the applicable codes. See the example 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 his seal to it.

1.36 CLEANLINESS OF THE SYSTEMS

- .1 Take every necessary measure and precaution to keep the inside of all of the ventilation systems' components and ducts clean.
- .2 Duct cleanliness:
 - .1 All ducts and ventilation equipment should be regularly maintained for cleanliness.

1.37 CLEANING

- .1 Clean the work area as work progresses. At the end of each work day, 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.

1.38 SECURITY CONTROLS

- .1 All staff assigned to the works will be subject to security checks. Obtain required approvals, as required, for all those who must report on the work site.
- .2 Staff will be monitored daily at the beginning of the period of work, and we will give them a pass they will carry with them at all times and return at the end of the work period, after Security control.

1.39 COST BREAKDOWN

- .1 Before submitting the first application for payment, provide a detailed breakdown of costs related to the contract, also indicating the overall contract price, according to the engineer's specifications. Once approved by the engineer, the breakdown of costs serve as a baseline for the purpose of calculating payment.

Part 2 Products

2.1 NOT USED

- .1 Not Used.

Part 3 Execution

3.1 NOT USED

- .1 Not Used.



CERTIFICATE DE 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

