TABLE DES MATIÈRES

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 20 00 10 – Mechanical and Electrical General Instructions

.2 Section 23 05 00 – Common Work Results for HVAC.

.3 Section 23 05 05 – Installation of Pipework.

.4 Section 23 05 17 – Pipe Welding.

.5 Section 23 05 29 – Hangers and Supports for HVAC Piping and Equipment.

.6 Section 23 05 48 – Vibration and Seismic Controls for HVAC Piping and Equipment

.7 Section 23 05 53.01 – Mechanical Identification.

.8 Section 23 05 93 – Testing, Adjusting and Balancing for HVAC.

.9 Section 23 07 13 – Duct insulation.

.10 Section 23 07 15 – Thermal Insulation for Piping.

.11 Section 23 23 00 – Refrigerant Piping.

.12 Section 23 31 13.01 – Metal ducts – Low pressure to 500 Pa.

.13 Section 23 32 48 – Acoustical air plenums.

.14 Section 23 33 00 – Air duct accessories.

.15 Section 23 33 15 – Dampers – operating.

.16 Section 23 33 46 – Flexible ducts.

.17 Section 23 36 00 – Air terminal units.

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

.19 Section 23 73 12 – Heating and cooling coils.

.20 Section 23 81 23 – Computer room air conditioning.

1.2 DOCUMENTS/SAMPLES TO SUBMIT FOR APPROVAL/INFORMATION

.1 Submit all required documents and samples in accordance with section 20 00 10 – Mechanical and Electrical General Instructions.

.2 Technical datasheet:

.1 Submit required technical datasheet, and manufacturer instructions and documentation. Technical datasheets must indicate product characteristics, performance criteria, physical size and finish.

.3 Shop drawings:

.1 Submitted shop drawings stamped and signed by professional engineer registered or licensed in Canada in the province of Québec.

.4 Certificates:

.1 Submit certificates signed by manufacturer certifying that the products, materials and equipment meet the requirements as to the physical characteristics and performance criteria.

1.3 DOCUMENTS/ITEMS TO GIVE AT WORK COMPLETION

.1 Submit all required documents and items in accordance with section 20 00 10 – Mechanical and Electrical General Instructions.

.2 O M Sheets: Provide instruction for OM which will be included in the OM Manuals.

1.4 TRANSPORTATION, STORAGE AND HANDLING

.1 Transport, store and handle materials and equipment according to Section 20 00 10 – Mechanical and Electrical General Instructions.

.2 Delivery and acceptance: deliver materials and equipment to site in original factory packaging, labeled with the name and address of the manufacturer.

.3 Waste management and disposal:

.1 Separate waste materials for reuse / re-use and recycling in accordance with Section 01 74 21 – Construction/demolition waste management and disposal.

.2 Remove from site all packaging materials and transport them to the appropriate recycling facilities.

.3 Collect and sort paper packaging, plastic, polystyrene, corrugated cardboard for recycling in accordance with Waste Management Plan.

.4 Sort steel scrap, metal, plastic for recycling and place in designated containers in accordance with Waste Management Plan.

.5 Divert unused metal materials from metal recycling facility.

1.5 SPECIFC 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 Section 20 00 10 – Mechanical and Electrical General Instructions

.2 Section 23 05 00 – Common Work Results for HVAC.

.3 Section 23 05 05 – Installation of Pipework.

.4 Section 23 05 17 – Pipe Welding.

.5 Section 23 05 29 – Hangers and Supports for HVAC Piping and Equipment.

.6 Section 23 05 48 – Vibration and Seismic Controls for HVAC Piping and Equipment

.7 Section 23 05 53.01 – Mechanical Identification.

.8 Section 23 05 93 – Testing, Adjusting and Balancing for HVAC.

.9 Section 23 07 15 – Thermal Insulation for Piping.

.10 Section 23 23 00 – Refrigerant Piping.

.3 Heating and chilled water –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 Standalone air conditioning units.

.2 All special connections described in the specification and/or shown in the drawings.

.3 The supports and structural steel components required to support the pipework, the fittings, and the equipment.

.4 All tests.

.5 All special connections.

.6 Sealing of sleeves and openings.

.7 The complete identification of all devices and accessories, in accordance with section 23 05 53.01 Mechanical Identification.

.8 The paraseismic measures concerning heating – chilled water work, in accordance with Section 23 05 48 – Vibration and Seismic Controls for HVAC Piping and Equipment.

.9 All insulation of piping according to Section 23 07 15 – Thermal Insulation for Piping.

.10 Support for the condenser located on roof.

.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.

.3 The provision of acoustic and vibration devices.

.4 Flashing.

.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 All connections for drainage, overflow, safety valve exhaust, etc. from all heating and refrigeration devices to the funnels.

.5 Documents to provide:

.1 Provide the following documents:

.1 The manufacturers' warranty certificates.

.2 The certificates of approval from the concerned authorities.

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

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

.5 Erection (coordination) drawings, in accordance with Division 20.

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

.7 A piping identification list.

.6 Overall price – Separate price:

.1 Upon submission, present an overall inclusive price covering the heating – chilled water work.

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 Section 23 05 00 – Common Work Results for HVAC.

.2 Section 23 05 29 – Hangers and Supports for HVAC Piping and Equipment

.3 Section 23 05 48 – Vibration and Seismic Controls for HVAC Piping and Equipment.

.4 Section 23 05 53.01 – Mechanical Identification

.5 Section 23 05 93 – Testing, Adjusting and Balancing for HVAC

.6 Section 23 07 13 – Duct Insulation

.7 Section 23 31 13.01 – Metal Ducts - Low Pressure to 500 Pa

.8 Section 23 32 48 – Acoustical Air Plenums.

.9 Section 23 33 00 – Air Duct Accessories.

.10 Section 23 33 15 – Dampers - Operating

.11 Section 23 33 46 – Flexible Ducts.

.12 Section 23 36 00 – Air Terminal Units

.13 Section 23 37 13 – Diffusers, Registers and Grilles

.14 Section 23 73 12 – Heating and Cooling Coils.

.15 Section 23 81 23 – Computer Room Air Conditioning

.3 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 Systems No.UTA-06.1:

.1 Existing ventilation system supplying the north peripheric zone. The modification of distribution, including VAV box, heating coils, ducts air transfer and grills and diffusers.

.2 Systems No.UTA-06.2:

.1 Existing ventilation system supplying the central zone. The modification of distribution, including VAV box, heating coils, ducts air transfer and grills and diffusers.

.3 All special connections and ducts.

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

.5 All access doors.

.6 All new openings. See Division20.

.7 Sealing sleeves and openings.

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

.9 The coordination of erection 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.

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

.11 All tests.

.12 Before the work, measure the flow of exhaust system 5.4.

.13 All work for the balancing and the adjustments of the air quantities for systems VE-5.4, UTA-06.1 and UTA-06.2, including the zone located outside of the work zone.

.14 Paraseismic measures for ventilation – air conditioning work, according to section 23 05 48 - Vibration and Seismic Controls for HVAC Piping and Equipment.

.15 The tests required to demonstrate the operating characteristics of the air diffusers installed at the window head and sill.

.2 All insulation work related to ventilation according to Section 23 07 13 – Duct Insulation

.3 Work excluded:

.1 In general, the following work is excluded:

.1 The fireproof cabinets.

.2 The installation of the equipment used for acoustic and vibration treatments.

.3 The fresh air and exhaust air louvers.

.4 The controls: the supply and the installation.

.4 Samples

.1 See Section 20 00 10 - Mechanical and Electrical General Instructions.

.2 Submit all samples requested by the different sections of Division 23.

.5 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.

.6 Documents to provide

.1 Provide the following documents:

.1 The certificates of approval from the concerned authorities.

.2 Shop drawings, device drawings, and erection drawings.

.3 A list of duct identification legends.

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

.5 The drawings, kept up to date.

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

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

.7 Submissions – prices to provide

.1 Global price:

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

.8 Submissions - Other information:

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

.2 All work described in Section 23 05 48 - Vibration and Seismic Controls for HVAC Piping and Equipment. Indicate the name of the selected company.

.1 Acceptable companies:

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

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 DES MATIÈRES

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 DOCUMENTS/SAMPLES TO SUBMIT FOR APPROVAL/INFORMATION

.1 Submit all required documents and samples in accordance with section 20 00 10 – Mechanical and Electrical General Instructions.

.2 Technical datasheet:

.1 Submit required technical datasheet, and manufacturer instructions and documentation. Technical datasheets must indicate product characteristics, performance criteria, physical size, finish and

1.4 TRANSPORTATION, STORAGE AND HANDLING

.1 Transport, store and handle materials and equipment according to Section 20 00 10 – Mechanical and Electrical General Instructions.

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, manifolds, pumps, chilled water coils, hot water coils, glycol coils, steam coils, cooling towers, tanks, fan-coil units, etc.

.2 Piping NPS 2 or smaller: unions.

.3 Piping NPS 2½ or larger: flanges or mechanical seals.

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

.5 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 Dielectric fittings with a nominal diameter larger than NPS 2: flanges.

.5 On the steam and condensate piping, perform the connections between two pipes of different metals, such as copper and steel, using cast iron connectors and brass adapters or flanges with gaskets. Install the bolts in isolated sleeves. Nuts and bolt heads with isolated washers.

.6 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 pipe lines.

.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 Remove the internal parts prior to welding the connection.

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

.12 Unless otherwise indicated, install gate valves, at the connection points of the bypass branches, for the purpose of isolating parts of the network.

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

.14 Provide valves of a nominal diameter equal to or greater than NPS 2½ with a chain operated device when installed more than 2400 mm above the floor, in a mechanical room.

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 Concealed or apparent piping going through a slab not on grade must have steel sleeves extending 50 mm above the finished floor to hold back water. Round off the edges.

.7 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.

.8 For kitchens and laundry rooms, use stainless steel sleeves.

.9 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.

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

.11 Steel sleeves:

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

.12 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 Steel sleeves with sealing plates must be installed for all visible or concealed mechanical and electrical pipes, crossing the floors of the following locations:
  - .1 Main kitchen.
  - .2 Main kitchen dishwasher.
  - .3 Mechanical room.
  - .4 Laboratories.
  - .5 Equipment sterilization rooms, reverse osmosis water treatment rooms, and pure water treatment rooms.

3.9 SEALING OF OPENINGS

.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 At the foundation walls and the floors under ground level, the seal between the foundation wall and the outside of the sleeve must be ensured by the relevant section with non-shrink concrete. The space between the inside of the sleeve and the piping must be filled with putty that is fire retardant, waterproof, and will not harden.

.6 Elsewhere:

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

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

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

.8 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 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.

.4 Watertight seals:

.1 In places where there is a possibility of water damage and particularly in engine rooms, kitchens, dishwashing rooms, in rooms located above transformer rooms, control centers for communications, alarms, and computers, all ventilation ducts other than circular, and all wells with pipes and/or ducts going through a floor must be surrounded by a concrete low wall of 75 mm in height from the finished floor to prevent water leaks through these openings. See the article "CONCRETE WORKS" in Section 20 00 10 - Mechanical and Electrical General Instructions.

.2 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.

.3 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.

.4 All work and pipes going through the tiles with water proofing membrane should be installed in such a way as to ensure the watertight integrity of these floors.

.5 Any piping, other than cast iron piping, and all ventilation ducts going through a roof must be fitted with counterflashing supplied and installed by the relevant section. The flashing and the casing surrounding pipes and conduits are to responsibility of other sections and allow the expansion of the piping.

.6 The small walls, the removable covers and the watertight pipe seals going through the roof of these walls are at the expense of the contractor.

.5 Wells:

.1 Blocking the wells' horizontal openings must be done by the relevant mechanical or electrical section, in accordance with specifications from other divisions, while ensuring protection against fire, smoke, and water. The contractor must coordinate each stakeholder's tasks. For boiler room and mechanical room ceilings, blocking should be done with cut steel plates, sealing the space between the pipes, the required profiles irons, and the concrete of a thickness ensuring protection against the fire and smoke.

.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).

3.10 ESCUTCHEON PLATES

.1 Install the escutcheons (chrome plated rings) in places where pipes pass through walls, partitions, floors, ceilings, and in the finished areas and rooms. This article does not apply to mechanical rooms, parking lots, or warehouses.

.2 Manufacturing: single piece escutcheons, fixed by a locking screw.

.1 Material: chrome or nickel plated brass or stainless steel grade 302.

.3 Dimensions: outer diameter greater than that of the opening or sleeve.

.1 Inner diameter appropriate to outer diameter of the pipes on which they are mounted, or their insulation.

END OF SECTION

TABLE DES MATIÈRES

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 DOCUMENTS/SAMPLES TO SUBMIT FOR APPROVAL/INFORMATION

.1 Submit all required documents and samples in accordance with section 20 00 10 – Mechanical and Electrical General Instructions.

.2 Technical datasheet:

.1 Submit required technical datasheet, and manufacturer instructions and documentation. Technical datasheets must indicate product characteristics, performance criteria, physical size, finish and

.3 Shop drawings:

.1 Submitted shop drawings stamped and signed by professional engineer registered or licensed in Canada in the province of Québec.

.4 Certificates:

.1 Submit certificates signed by manufacturer certifying that the products, materials and equipment meet the requirements as to the physical characteristics and performance criteria.

1.4 DOCUMENTS/ITEMS TO GIVE AT WORK COMPLETION

.1 Submit all required documents and items in accordance with section 20 00 10 – Mechanical and Electrical General Instructions.

.2 O M Sheets: Provide instruction for OM which will be included in the OM Manuals.

1.5 TRANSPORTATION, STORAGE AND HANDLING

.1 Transport, store and handle materials and equipment according to Section 20 00 10 – Mechanical and Electrical General Instructions.

.2 Delivery and acceptance: deliver materials and equipment to site in original factory packaging, labeled with the name and address of the manufacturer.

.3 Waste management and disposal:

.1 Separate waste materials for reuse / re-use and recycling in accordance with Section 01 74 21 – Construction/demolition waste management and disposal.

.2 Remove from site all packaging materials and transport them to the appropriate recycling facilities.

.3 Collect and sort paper packaging, plastic, polystyrene, corrugated cardboard for recycling in accordance with Waste Management Plan.

.4 Sort steel scrap, metal, plastic for recycling and place in designated containers in accordance with Waste Management Plan.

.5 Divert unused metal materials from metal recycling facility.

1.6 ACCEPTABLE MATERIALS OR PRODUCTS

.1 When materials or products are prescribed by their trademarks, consult the instructions to tenderers in order to know the procedure concerning the request for approval of substitute's materials or products.

Part 2 Product

2.1 GENERALITIES

.1 Piping DN 50 or smaller: unless otherwise indicated, threaded fittings (standard threads) with union-fittings at the equipment.

.2 Piping DN65 or larger: unless otherwise indicated, welded joints with flanged fittings at the equipment.

2.2 THREAD

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

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

2.3 ELECTRODES

.1 Electrodes: comply with relevant CSA W48 series standards.

2.4 WELDING – GENERALITIES

.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 Welding – Copper piping:

.1 "50-50 solder" means brazing with 50% lead and 50% tin.

.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 50-50, 95-5, or silver solder.

.4 DWV type: 50-50 solder.

.5 K, L, and M types:

.1 DN 50 and smaller: 95-5 solder.

.2 DN 65 and larger: silver solder.

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

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

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

.4 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 the competent authorities and are approved in writing by the latter.

.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 competent authority for each welding process used.

.5 Present the welders' certificates of qualification.

.6 Each welder must identify his work with a stamp that will have been delivered to him by the competent 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.

.5 Welding – Stainless steel piping:

.1 TIG welding (arc welding, according to the Heliarc method), without filler metal. Use argon as the inert shielding gas from the ambient air.

.2 Adequately purge the inside of the pipe and use argon as the carrier gas during the welding.

Part 3 Execution

3.1 QUALITY OF THE WORK EXECUTION

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

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

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

.2 Backup rings:

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

.2 Do not install rings for orifice flanges.

.3 Fittings:

.1 Fittings NPS 2 and smaller: welded couplings.

.2 Bypass fittings: welded tees or wrought fittings.

3.3 INSPECTIONS AND CONTROLS – GENERAL REQUIREMENTS

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

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

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

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

.5 Definitions:

.1 Tests:

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

.1 Radiography.

.2 Ultrasound.

.3 Eddy Current.

.4 Liquid penetrant.

.5 Magnetic particle inspection.

.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 (non boiler piping):

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

.6 Non-destructive test requirements for the welds:

Description	Operating conditions		
Temperature	400°C or lower	401°C or higher	175°C < T <450°C
Pressure	All	All	P > 7100 kPa
Weld type : Butt weld Circumference - Longitudinal	Visual inspection – Pressure test	RT for DN 50 or larger. RT or MT for DN 50 or smaller.	RT for DN 50 and walls 20 mm or larger. Visual for walls 20 mm or smaller, for all diameters.
Branchement soudé	Visual inspection – Pressure test	RT for DN 100 or larger MT or PT for 100mm in diameter or smaller.	RT pour branches > DN 100 and walls 20 mm or larger. Visual for walls 20 mm 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 : liquid penetrant 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

TABLE DES MATIÈRES

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 DOCUMENTS/SAMPLES TO SUBMIT FOR APPROVAL/INFORMATION

.1 Submit all required documents and samples in accordance with section 20 00 10 – Mechanical and Electrical General Instructions.

.2 Technical datasheet:

.1 Submit required technical datasheet, and manufacturer instructions and documentation. Technical datasheets must indicate product characteristics, performance criteria, physical size, finish and

.3 Shop drawings:

.1 Submitted shop drawings stamped and signed by professional engineer registered or licensed in Canada in the province of Québec.

.4 Certificates:

.1 Submit certificates signed by manufacturer certifying that the products, materials and equipment meet the requirements as to the physical characteristics and performance criteria.

1.4 DOCUMENTS/ITEMS TO GIVE AT WORK COMPLETION

.1 Submit all required documents and items in accordance with section 20 00 10 – Mechanical and Electrical General Instructions.

.2 O M Sheets: Provide instruction for OM which will be included in the OM Manuals.

1.5 TRANSPORTATION, STORAGE AND HANDLING

.1 Transport, store and handle materials and equipment according to Section 20 00 10 – Mechanical and Electrical General Instructions.

.2 Delivery and acceptance: deliver materials and equipment to site in original factory packaging, labeled with the name and address of the manufacturer.

1.6 ACCEPTABLE MATERIALS OR PRODUCTS

.1 When materials or products are prescribed by their trademarks, consult the instructions to tenderers in order to know the procedure concerning the request for approval of substitutes materials or products.

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 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 a same horizontal plane, in order to allow 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 perfect 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 steel framework components, fully welded construction, and solidly fixed to the building's framework.

.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: use inserts combining drilling and anchor (Hilti or Phillips Red Head type). The inserts must not damage the rebars in the concrete.

.3 Beam clamps for beams and other steel works (like Grinnell fig. 292), 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 Anchoring components for hangers fixed to the bottom flange of an I-beam:

.1 Cold pipes with nominal diameter equal to or smaller than NPS 2: malleable cast iron C mounting clamps, with hardened steel cup point setscrew.

.2 Cold pipes with nominal diameter equal to or larger than NPS 2½ and hot piping of all diameters: fixation for beams, consisting of a clamp, an eye rod, and an extension in malleable iron, with a carbon steel clamping ring, hanger rod, nuts, and washers.

.3 Anchoring components for hangers fixed to the top flange of an I-beam:

.1 Cold pipes with nominal diameter equal to or smaller than NPS 2: ductile iron C mounting clamps for the beam top, with non-welded hardened steel cup point set screws, carbon steel locknut and clamping ring.

.2 Cold pipes with nominal diameter equal to or larger than NPS 2½ and hot piping of all diameters: malleable cast iron fasteners for the beam top, consisting of a clamp, a hook shank, a spring washer, a plain washer, and a nut.

.4 Anchoring components for hangers fixed in concrete structures:

.1 Components to anchor in ceilings: cradle (bracket), plate, fastener, welded eye bolt and rod, in carbon steel, with forged steel eye nut, non-welded. The eye has to have a diameter of at least 6 mm larger than that of the rod.

.2 Supports cast in concrete: with wedge and protective plate fitted with a breakable tablet, compliant with MSS SP69.

.5 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.

.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

Piping nominal diameter	Rod diameter	Maximum horizontal spacing
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

.3 PVC or fibre-reinforced plastic (FRP):

Piping nominal diameter Schedule 80	Rod diameter	Maximum horizontal spacing
NPS ½ to NPS 1¼	9.5 mm	1.2 m
NPS 1½ to NPS 2	9.5 mm	1.8 m

Piping nominal diameter Schedule 80	Rod diameter	Maximum horizontal spacing
NPS 2½	9.5 mm	2.4 m
NPS 3	12.7 mm	2.4 m
NPS 4	12.7 mm	2.4 m
NPS 6	15.9 mm	3 m
NPS 8	15.9 mm	3 m
NPS 10	15.9 mm	3 m
NPS 12	15.9 mm	2.4 m
NPS 14	19 mm	2.4 m
NPS 16	19 mm	2.4 m
NPS 18	19 mm	2.4 m
NPS 20	19 mm	1.8 m
NPS 24	22.2 mm	2.4 m

.4 Note: steel supports and rods. In places where there is a risk of corrosion, the hangers and the rods are to be constructed of FRP fiberglass, welded steel painted with epoxy resin, and stainless steel No. 316.

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.

.2 Piping NPS 5 or larger: adjustable Clevis type hanger, Grinnell Fig. 260.

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

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

.8 In places where the horizontal pipe is too close to the tiles to allow the installation of No. 260 hangers and to allow the pipe to expand in both the longitudinal and lateral directions of the pipe, provide and install supports allowing horizontal sliding in all directions. These sliders consist of two adequately supported horizontal steel plates sliding on graphite plates, according to the weight and the transverse and longitudinal movements required. Grinnell Fig. 257, type 4, 5, 6, or 7.

.9 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 Lead: over its entire length.

.3 Cast iron: at each socket or each joint, the interval between two supports should not exceed 3 m, at every meter when adjacent connections spaced by 300 mm or less are installed on piping with mechanical seals.

.4 Asbestos–cement: at each joint, the interval between two joints must not exceed 2 m, at every meter when the adjacent connections are spaced by 300 mm or less.

.5 Plastic: every 1.2 m, at the end of any connection, at any change of direction, as close as possible to the trap if this is a device’s drain pipe longer than 2 m.

.2 Horizontal underground piping:

.1 The horizontal underground piping must rest its full length on a uniform and firm bed. Any material used for leveling must be compacted and free of rocks, ash, or frozen earth. Provide pockets where the collars are placed in order to facilitate making the joints. The socketing must be done carefully to ensure the seamless extension of the interior walls.

.3 Support for a vent above the roof:

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

.4 Supports at mechanical joints:

.1 Install the supports so as to allow the joints to slide and to prevent the direct transmission of vibration by the piping. Install the supports in accordance with the manufacturer's instructions.

2.7 SUPPORTS FOR VERTICAL PIPING

.1 Steel or cast iron piping, drainage, and vents, steel pipe clamps, compliant with the standard MSS SP58, or corrugated steek and U-bolts, Grinnell, type 42, fig. 261 or 137.

.2 Copper or brass piping, copper plated carbon steel clamps, compliant with MSS SP58, Grinnell, type 42, fig. CT-121.

.3 If the liquid's temperature does not exceed 100°C, a support with plastic covering may be used, Grinnell, type 42, Fig. CT-121C.

.4 Bolts: compliant with the standard ASTM A307.

.5 Nuts: compliant with the standard ASTM A563.

.6 Installation: support or guide the pipes at each floor.

.1 To prevent piping slip:

.1 Cast iron piping with mechanical joints: use fittings with outer shoulders.

.2 Steel pipe: weld steel furring to the plumbing.

.3 Copper or brass pipe: weld copper rings to the pipe.

.2 The maximum distance between two supports must never exceed 6 m (20').

.3 Depending on the material and the diameter, vertical piping must be supported at the following maximum distances:

.1 Lead: every 1.2 m.

.2 Copper or brass: every 2 m for NPS 1¼ or smaller or every 3 m for NPS 1½ and larger.

.3 Cast iron with mechanical joints or compression fittings: at all joints.

.4 Plastic: every 1.2 m.

.4 The base of a cast iron column must rest on a concrete pillar, a masonry pillar, or another equivalent material, unless properly suspended or anchored to the building framework.

2.8 SADDLES AND PROTECTION SHIELDS

.1 Thermally insulated cold pipes:

.1 Insulation protection shields with a density of 64 kg/m^3: compliant with MSS SP69, galvanized carbon steel sheet; length calculated for spans up to 3 m.

.2 Thermally insulated hot pipes:

.1 Shields consist of a 300 mm 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.

2.9 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	3/8	½	5/8	¾	7/8	1	1 ¼
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 is valid for the Montreal and the Ottawa/Gatineau regions. In the Quebec City region, it is valid for levels below mid-height of the building. This table takes into account the paraseismic measures, for devices suspended with four threaded rods, without spring, stiffening, or bracing.

2.10 ANCHOR BOLTS AND TEMPLATE

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

2.11 MANUFACTURER LIST

.1 Manufacturer list, this section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment.

.1 Supports:

.1 Cantruss

.2 Grinnell

.3 Fonderie Bibby Ste-Croix

.4 Myatt

.5 or a substitute product approved in an addendum in accordance with the Instructions to tenderers.

.2 Bolts and anchors:

.1 Hilti

.2 Phillips Red-Head

.3 or a substitute product approved in an addendum in accordance with the Instructions to tenderers.

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

TABLE DES MATIÈRES

PART 3 EXECUTION

Part 1 General

1.1 RELATED SECTIONS

.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 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 DOCUMENTS/SAMPLES TO SUBMIT FOR APPROVAL/INFORMATION

.1 Submit all required documents and samples in accordance with section 20 00 10 – Mechanical and Electrical General Instructions.

.2 Technical datasheet:

.1 Submit required technical datasheet, and manufacturer instructions and documentation. Technical datasheets must indicate product characteristics, performance criteria, physical size, finish and

.3 Shop drawings:

.1 Submitted shop drawings stamped and signed by professional engineer registered or licensed in Canada in the province of Québec.

.4 Certificates:

.1 Submit certificates signed by manufacturer certifying that the products, materials and equipment meet the requirements as to the physical characteristics and performance criteria.

1.4 TRANSPORTATION, STORAGE AND HANDLING

.1 Transport, store and handle materials and equipment according to Section 20 00 10 – Mechanical and Electrical General Instructions.

.2 Delivery and acceptance: deliver materials and equipment to site in original factory packaging, labeled with the name and address of the manufacturer.

.3 Waste management and disposal:

.1 Separate waste materials for reuse / re-use and recycling in accordance with Section 01 74 21 – Construction/demolition waste management and disposal.

.2 Remove from site all packaging materials and transport them to the appropriate recycling facilities.

.3 Collect and sort paper packaging, plastic, polystyrene, corrugated cardboard for recycling in accordance with Waste Management Plan.

.4 Sort steel scrap, metal, plastic for recycling and place in designated containers in accordance with Waste Management Plan.

.5 Divert unused metal materials from metal recycling facility.

1.5 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 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 division. He remains responsible 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 CSA S86, S832.

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

.4 The good engineering practices are also detailed in ASHRAE (Practical Guide to Seismic Restraint) and SMACNA (Seismic Restraint Manual – Guidelines for Mechanical Systems).

.5 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: Montréal : $S_a(0.2) = 0.69$

.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.

Description	Location Category: E and I_E = 1.0		
	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 (CCQ-2005, Table 4.1.8.17 No. 13).	0.07	0.14	0.20
Rigid components with non-ductile materials or assemblies (CCQ-2005, Table 4.1.8.17 No. 19).	0.24	0.48	0.73
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 (CCQ-2005, Table 4.1.8.17 No. 14).	0.10	0.19	0.29
Rigid components with ductile materials and assemblies (CCQ-2005, Table 4.1.8.17 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) (CCQ-2005, Table 4.1.8.17 No. 12).	0.36	0.73	1.09
Electrical cable trays, bus bar ducts, conduits (CCQ 2005, Table 4.1.8.17 No. 17).	0.12	0.24	0.36
Flexible components with non-ductile materials or assemblies (CCQ-2005, Table 4.1.8.17 No. 21).	0.61	1.21	1.82
Machinery, accessories, equipment, conduits, and reservoirs (with contents) (rigid with rigid assembly or flexible with flexible assembly) (CCQ-2005, Table 4.1.8.17 No. 11).	0.24	0.48	0.73
Flexible components with ductile materials and assemblies (CCQ-2005, Table 4.1.8.17 No. 20).			
Pipes and ducts (with contents) containing toxic or explosive materials (CCQ-2005, Table 4.1.8.17 No. 16).	0.12	0.24	0.36
Pipes and ducts (with contents) (CCQ-2005, Table 4.1.8.17 No. 15).	0.08	0.16	0.24

.4 If the value $S_a(0.2)$ is less than 0.12, the seismic restraint systems can be omitted.

.5 For buildings other than those for civil protection, if the product $I_E*F_a*S_a(0.2)$ is less than 0.35, the seismic restraint systems may be omitted.

.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 $I_E = 1.0$: during or after the earthquake, the fixed equipment must not necessarily remain in working order as if in normal operating conditions. The mandatory requirements are that the seismic restraints prevent the mechanical and electrical equipment and systems and the related systems from causing injuries to persons and to prevent the equipment from moving from its normal position during an earthquake.

.2 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.

.3 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 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.

.3 The certificate renouncing all claims of ownership and copyright of the models, the drawings, the working drawings, the details, and the specifications to the owner.

1.10 SEPARATE PRICES

.1 Upon submission of the tender, present an overall price covering the calculations, the supply, and the supervision of seismic restraint systems for each of the relevant disciplines.

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 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 installations 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 GENERALITIES

.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 consultant specializing in seismic restraint systems must validate the vibration isolators, the integrated and separate seismic dampers, the cable restraint equipment, and the other restraint systems from manufacturers that regularly produce the same equipment, in agreement with each relevant sections' proposed installation.

.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 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 = 1.0 buildings, the accessories, such as diffusers and the lighting fixtures installed in the suspended ceilings, do not have to be stabilized, except in the issue corridors, or if the ceiling is specifically designed to withstand earthquakes.

.23 For I_E = 1.3 and 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.

.24 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.

.25 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 static and dynamic conditions, 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 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 lbs) 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	7.6 m	15.2 m
0.5 g	6.1 m	12.2 m
1.0 g	6.1 m	12.2 m
2.0 g	3 m	6.1 m
Longitudinal		
0.25 g	12.2 m	24.4 m
0.5 g	12.2 m	24.4 m
1.0 g	12.2 m	24.4 m
2.0 g	6.1 m	12.2 m
Riser		
0.25 g	12.2 m	12.2 m
0.5 g	9.1 m	9.1 m
1.0 g	9.1 m	9.1 m
2.0 g	6.1 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 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 static and dynamic conditions, including:

.1 The weight of the pipes, the valves, the fittings, and the internal fluids must consider a multiplicative factor of 1.15.

.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 Comply with the FM Global requirements, if these are more stringent than the NFPA recommendations.

.5 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 static and dynamic conditions, 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 90º 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 renovation 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 static and dynamic conditions, 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 65 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 static and dynamic conditions, 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 indoor 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 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.

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.

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 exit 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 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 Generalities:

.1 Characteristics:

.1 Types of vibration isolators:

.1 Open

.2 Nested

.3 Fitted with motion limiter

.4 Hangers

.5 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 Open isolators:

.1 Comprising one or more helical springs.

.4 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 isolators as little as possible and always after having received the approval.

.5 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.

.6 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.

.7 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.

.8 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.

.9 Flexible pipes:

.1 Generalities:

.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.

.4 For pipe NPS 2½ or larger in diameter at the suction and the discharge of the pumps:

.1 Spherical expansion joints made of treated EPDM and polyester cord. All joints have two spheres and malleable cast iron retaining rings and steel flanges. Operating pressure of 1725 kPa at 77°C. 3/1 blowout and elongation safety factors. When the piping is not anchored, use motion control rods (limit/control rods?).

.2 Safeflex models, SFDEJ, SFDCR from Mason Industries Inc.

.3 When the flexible joint serves as an elbow, use the model MFNEC from Mason Industries Inc.

2.8 BASES

.1 Generalities

.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' k_H/k_V ratio.
.17 The attenuation percentage of the base in function of the anticipated load.

.3 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.

.4 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 or open 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 static and dynamic conditions, 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 smooth 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 will 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 replacement.

.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 "MANUFACTURER LIST" from section 20 00 10 - Mechanical and Electrical General Instructions.

.2 Manufacturer list, this Section 23 05 48 -Vibration and Seismic Controls for HVAC Piping and Equipment:

.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).

.6 or a substitute product approved in an addendum in accordance with the Instructions to tenderers.

.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).

.6 or a substitute product approved in an addendum in accordance with the Instructions to tenderers.

.3 Fire protection pipe supports:

.1 Hunt

.2 Mueller Flow Control

.3 Persing

.4 Tolco Inc. (SCS Canada)

.5 or a substitute product approved in an addendum in accordance with the Instructions to tenderers.

.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).

.4 or a substitute product approved in an addendum in accordance with the Instructions to tenderers.

.5 Steel framing external to certain equipment’s cabinets:

.1 Power-Strut (Mueller Flow Control)

.2 Unistrut (Routleco Inc.)

.3 or a substitute product approved in an addendum in accordance with the Instructions to tenderers.

.6 Vibration isolators:

.1 Korfund Sampson Ltd

.2 Mason Industries

.3 Vibro-Racan (Racan Carrier)

.4 Vibron Ltd

.5 or a substitute product approved in an addendum in accordance with the Instructions to tenderers.

.7 Flexible Hoses:

.1 Flex-Hose (Enviroair)

.2 Flex-Pression

.3 Flexi-Tube

.4 Flexonics

.5 or a substitute product approved in an addendum in accordance with the Instructions to tenderers.

.8 Bases:

.1 Mason Industries

.2 Vibro Racan (Racan Carrier)

.3 Vibron Ltd

.4 or a substitute product approved in an addendum in accordance with the Instructions to tenderers.

.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 HTS Engineering

.5 EH Price

.6 or a substitute product approved in an addendum in accordance with the Instructions to tenderers

.4 Not all the manufacturers are certified to perform seismic calculations signed by an engineer. 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 holds the mechanical pipes, ventilation ducts, or electrical conduits.

.3 For equipment not fitted with attachment points, provide an attachment device or install 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, 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 (6 mm 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 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 deflexion 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 deflexion.

VIBRATION BASES AND ISOLATORS CHARACTERISTICS							
Identification		**COND-01**					
Location		Roof					
Leveling bases	Type	IX					
	Thickness	---					
	Leveling type	---					
Vibration isolators	Spring	---					
	Type	---					
	Deflexion (mm)	---					
	Cushions	Oui					
	Deflexion (mm)	---					
	Stabilizers	---					
Flexible fittings	Suction	---					
	Discharge	---					
Comments		---					

Notes :

O : open isolator

E : nested isolator

ELM : nested isolator with a motion limiter

S : Vibration isolation hangers

1 : seismic spring

2 : with stabilizer

3 : see the description in the specification

END OF SECTION

TABLE DES MATIÈRES

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 20 00 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 DOCUMENTS/SAMPLES TO SUBMIT FOR APPROVAL/INFORMATION

.1 Submit all required documents and samples in accordance with section 20 00 10 – Mechanical and Electrical General Instructions.

.2 Technical datasheet:

.1 Submit required technical datasheet, and manufacturer instructions and documentation. Technical datasheets must indicate product characteristics, performance criteria, physical size, finish and

.3 Shop drawings:

.1 Submitted shop drawings stamped and signed by professional engineer registered or licensed in Canada in the province of Québec.

.4 Certificates:

.1 Submit certificates signed by manufacturer certifying that the products, materials and equipment meet the requirements as to the physical characteristics and performance criteria.

1.4 TRANSPORTATION, STORAGE AND HANDLING

.1 Transport, store and handle materials and equipment according to Section 20 00 10 – Mechanical and Electrical General Instructions.

.2 Delivery and acceptance: deliver materials and equipment to site in original factory packaging, labeled with the name and address of the manufacturer.

.3 Waste management and disposal:

.1 Separate waste materials for reuse / re-use and recycling in accordance with Section 01 74 21 – Construction/demolition waste management and disposal.

.2 Remove from site all packaging materials and transport them to the appropriate recycling facilities.

.3 Collect and sort paper packaging, plastic, polystyrene, corrugated cardboard for recycling in accordance with Waste Management Plan.

.4 Sort steel scrap, metal, plastic for recycling and place in designated containers in accordance with Waste Management Plan.

.5 Divert unused metal materials from metal recycling facility.

1.5 ACCEPTABLE MATERIALS OR PRODUCTS

.1 When materials or products are prescribed by their trademarks, consult the instructions to tenderers in order to know the procedure concerning the request for approval of substitute's materials or products.

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 when it comes to 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 color shown below:

.1	Heating and cooling	:	yellow
.2	Plumbing	:	green
.3	Ventilation	:	black
.4	Sprinklers and fire protection	:	red
.5	Pressure conveying	:	blue
.6	Controls	:	brown
.7	Electricity	:	pink
.8	Communications	:	orange
.9	Medical gases	:	conforming to the BNQ or CSA standards

.3 Provide samples of each color for verification.

.4 In ceilings with acoustic panels, each relevant mechanical and electrical section is required to identify the panels serving as accesses with colored 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 colored plastic tag with rounded corners, displaying the letters and the numbers engraved in a different color 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 the 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 DN 25 and larger:

.1 Identify the pipe, according to the article "IDENTIFICATION OF PIPING, DUCTS, AND VENTILATION UNITS".

.2 Piping DN 20 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 THE 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 DN 50 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 DN 65 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 colored 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.

Service	Identification Legend	Back color	Secondary identification color
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	Noir
Motor exhaust	MOTOR EXH	Yellow	Noir
Combustible (indicate the type)	COMB. (TYPE)	Yellow	Orange

Service	Identification Legend	Back color	Secondary identification color
Steam (indicate the pressure)	STEAM. ... KPA	Yellow	Noir
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
Chlorine	CL	Yellow	Noir
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	Noir
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	Noir
Glycol	GLYCOL	Yellow	Noir
Halon	HALON	Rouge	White
Suction refrigerant (include refrigerant No.)	REFRIG. SUCTION. (NO ...)	Yellow	Noir
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 colors 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 DES MATIÈRES

Part 1 General

1.1 QUALIFICATION OF TAB PERSONNEL

.1 Submit names of personnel to perform TAB to the engineer within 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 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 air flows.

.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 air flow required to meet the specified quantities.

.4 Record and present the results in the form of a report.

.5 Before starting TAB, TAB firm must be approved. The firm must be a certified member of the National Environmental Balancing Bureau Ontario Inc. (NEBB) or the Associated Air Balancing Council (AABC).

.6 Before starting TAB, submit an outline of the proposed procedures required to comply with this article and a list of equipment and instruments to be used.

.7 The selected firm must, for the duration of the installation work, carry out regular site visits and submit a report indicating corrective measures required in order to adequately proceed with TAB (minimum one visit per month or more often depending on site conditions).

.8 Take corrective actions submitted by the retained specialized firm.

.9 Supply the equipment and work force required for leak tests.

.10 Perform the tests according to the methods recommended by the Associated Air Balance Council and SMACNA (HVAC Air Duct Leakage Test Manual, Third Edition, August 2002).

.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 Low pressure ducts:

.1 Conduct a 500 Pa static pressure test on the ducts.

.2 Maximum allowable loss:

.1 For each section tested: 0.48 L/s m² from duct walls.

.2 For overall system, the sum of the leakage must not exceed 3% of the fan(s) airflow.

.3 Adjustment precision:

.1 Do TAB to the following tolerances of the design values:

.1 Air flow 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 Air flow 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 Minimum outside air:

.1 Adjust static pressure in unit's mixing plenum to zero or slightly negative, following the requirements of the site conditions, when the return damper is open to its maximum position. Balancing dampers installed before the mixing plenum is used to set the static pressure in the plenum.

.2 Adjust dampers to set the outside air to a maximum of 105% of design requirement.

.4 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.

.5 Terminal equipment adjustments:

.1 Adjust air flow 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 air flow 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 air flow, 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 Variable air flow systems:

.1 General:

.1 There are two main types of systems with variable air flows:

.1 Systems that depend on pressure (pressure dependent).

.2 Systems that are independent of pressure (pressure independent).

.2 Pressure dependant systems:

.1 This type of system is composed of terminal units modulated by a thermostat signal.

.2 The supply airflow varies to maintain the temperature in the room, the temperature of the supply air remains constant. The air flow in the system and the pressure constantly vary according to the demand.

.3 Pressure independent systems:

.1 Consists of terminal units that use a signal from the thermostat to vary the airflow and on air velocity controller limits the supply air to a set minimum and maximum.

.2 The supply air flow varies to maintain the temperature in the room, the temperature of the supply air remains constant for the same position of the flow control device.

.4 The main difference between the two types of systems is that for the same flow control device position, the pressure dependant system supplies a different quantity of air in the room in function of the pressure variation upstream of the terminal unit. In the case of a pressure-dependent system, if the thermostats are not properly calibrated, some areas might overcool or overheat. When zones are overcooled and receive more air than required, it reduces the quantity of air available to supply the overheated areas. Whereas the pressure independent system is not affected by the poor calibration of the thermostat because the air speed sensor limits the quantity of air supplied to the room.

.2 Adjustment procedure:

.1 Check maximum air flow rates that must be obtained by the supply and return fans. Diversity implies that the air flow of the fans will be less than the total air flow at grilles and diffusers.

.2 Obtain fan curves and surge data.

.3 Obtain characteristics of VFD or any other airflow control device where applicable.

.4 Obtain minimum and maximum operating pressures of terminal units.

.5 Establish theoretical operating curve of the system.

.6 Adjust terminal units in accordance with maximum airflow.

.7 Adjust fans to required speed, plus 5%.

.8 Check the most representative terminal units.

.1 If the variation of static pressure is significant or if the air flow to the terminal units is below the minimum with a maximum system flow rate, check all terminal units.

.9 At main branches, read airflow with a pitot tube.

.10 If static pressure or flow is too low, increase fan speed.

.1 If flow is satisfactory, but the static pressure is too high, decrease fan speed.

.2 If static pressure is satisfactory or high, but the air flow is too low, check the fan installation for system effect.

.3 If there is no system effect re-adjust all air terminal units to required air flow.

.11 Repeat procedures 3.6.2.7 to 3.6.2.10 for the return and exhaust fans once the system is adjusted to the minimum outside air quality.

.12 Adjust airflows to the diffusers and verify design air flow when air terminal unit is fully open. Check minimum adjustment.

.13 Set terminal units to the minimum and adjust air flow rate control mechanisms at fans to obtain minimum flow and pressure.

.14 Coordinate with the Division 25 for the adjustment of air flow switches, static pressure sensors, terminal unit air flow regulators, etc.

.15 Operate the system at 100% outside air and check power and static pressure for the supply and return fans.

.6 Ventilation TAB report:

.1 For each balanced system, the balancing report shall include, as a minimum, the following information:

.1 Dated reports:

.1 On the report cover page, and on all pages of the report, clearly indicate dates when measurements and adjustments, at all stages (preliminary, corrections, and revisions) were taken.

.2 Design data:

.1 Airflows:

.1 Supply

.2 Return

.3 Exhaust

.2 Fan static pressure.

.3 Motor power (HP).

.4 Brake horsepower (BHP).

.5 Fan speed (rpm).

.6 Minimum percentage of outside air.

.3 Characteristics of installed equipment:

.1 Manufacturer, model and serial No.

.2 Unit size and dimensions.

.3 Arrangement.

.4 Construction class.

.5 Motor nameplate:

.1 Power

.2 Voltage

.3 Number of phases

.4 Frequency

.5 FLA

.6 RPM

.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 air flow.
- .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 K 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 Air flow 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 air flows measured at each grille and diffuser. Indicate the required air flows.

.7 Acceptable Contractors:

.1 Comply with article MANUFACTURER LIST from Section 20 00 10 - Mechanical and Electrical General Instructions.

END OF SECTION

TABLE DES MATIÈRES

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 DOCUMENTS/SAMPLES TO SUBMIT FOR APPROVAL/INFORMATION

.1 Submit all required documents and samples in accordance with section 20 00 10 – Mechanical and Electrical General Instructions.

.2 Technical datasheet:

.1 Submit required technical datasheet, and manufacturer instructions and documentation. Technical datasheets must indicate product characteristics, performance criteria, physical size, finish and

.3 Shop drawings:

.1 Submitted shop drawings stamped and signed by professional engineer registered or licensed in Canada in the province of Québec.

.4 Certificates:

.1 Submit certificates signed by manufacturer certifying that the products, materials and equipment meet the requirements as to the physical characteristics and performance criteria.

1.4 TRANSPORTATION, STORAGE AND HANDLING

.1 Transport, store and handle materials and equipment according to Section 20 00 10 – Mechanical and Electrical General Instructions.

.2 Delivery and acceptance: deliver materials and equipment to site in original factory packaging, labeled with the name and address of the manufacturer.

.3 Waste management and disposal:

.1 Separate waste materials for reuse / re-use and recycling in accordance with Section 01 74 21 – Construction/demolition waste management and disposal.

.2 Remove from site all packaging materials and transport them to the appropriate recycling facilities.

.3 Collect and sort paper packaging, plastic, polystyrene, corrugated cardboard for recycling in accordance with Waste Management Plan.

.4 Sort steel scrap, metal, plastic for recycling and place in designated containers in accordance with Waste Management Plan.

.5 Divert unused metal materials from metal recycling facility.

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

.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 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 Section 23 07 13 - Duct Insulation, Section 23 07 14 Thermal Insulation for Equipment, and Section 23 07 15 -Thermal Insulation for Piping.

1.9 ACCEPTABLE MATERIALS OR PRODUCTS

.1 When materials or products are prescribed by their trademarks, consult the instructions to tenderers in order to know the procedure concerning the request for approval of substitutes materials or products.

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 TYPE C INSULATION

.1 Flexible wrap made of mineral fiber bonded with thermosetting resin with vapor barrier and reinforced aluminum, with a density of 36 kg/m³, maximum service temperature of 121°C.

.2 Maximum thermal conductivity "k": 0.042 W/m.°C at 24°C.

2.4 TYPE D INSULATION

.1 Rigid mineral fiber board 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.

2.5 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.

2.6 CEMENT INSULATION

.1 Compliant with the standard ASTM C449/C449M.

.2 Use for fittings, flanges, valves, and accessories.

2.7 FIRE PROTECTION INSULATION

.1 Gypsum protection:

.1 Fire protection work falls under the responsibility of the general contractor and his specialized subcontractors.

.2 Air duct insulation sleeves:

.1 Thin and flexible sleeves made of calcium silicate and biosoluble magnesium based fiber.

.2 The sleeves must display the test certification stamps.

.3 ULC approvals:

.1 For exhaust grease ducts: ULC-FRD-4 design.

.2 The assembly comprises two layers of insulation sleeves. The sleeves attached to the duct must have passed the tests according to the ULC protocol for 0 mm clearance from a combustible material. The tests must be certified by an accredited independent laboratory. The outer sleeve must be compliant with the standard ISO 6944 "Duct A".

.3 For ventilation air ducts, chemical exhaust ducts, linen chutes, and wrapped waste chutes:

.1 On all sides: ULC-FRD-3.

.2 On two or three sides only: ULC-FRD-5.

.4 The sleeves must comply with the standard ISO 6944 "Duct A".

.5 The installation will be subject to the requirements in Part 3 of Fire Protection for Ducts.

2.8 ACOUSTIC COATINGS

.1 Where requested, after thermal insulation is installed to the outside of the duct by the insulation contractor, the general contractor will install two 16 mm thick gypsum boards onto the ventilation ducts, both with overlapping joints. Screw the first board to the ventilation duct tee joint.

.2 The second board is glued and screwed to the first by the general contractor.

.3 Seal the edges with FSK glued aluminum foil and fireproof adhesive by the insulation contractor.

2.9 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 ABS jackets (for external use only):

.1 Preformed one piece molded jacketing.

.2 Operating temperatures:

.1 Minimum : -40°C

.2 Maximum : 82°C

.3 Permeability: 0.012 perm.

.4 Adhesive, sealant, and fastenings: Follow the manufacturer's recommendations.

.3 Canvas jackets:

.1 Cotton canvas having a density of 220 g/m² and when exposed and 120 g/m² when concealed, coated with a diluted insulating fire retardant adhesive, compliant with the standards ASTM C921 and ASTM E84.

2.10 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: 8.6×10^{-8} /°C

.6 Maximum Operating Temperature: 482°C

.7 Thermal conductivity: 0.48 W/m.°C.

.8 Foamglas from Pittsburg Corning.

2.11 MANUFACTURER LIST

.1 Comply with "MANUFACTURER LIST" from section 20 00 10.

.2 List of manufacturers, section 23 07 13:

.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.

.3 or a substitute product approved in an addendum in accordance with the Instructions to tenderers.

.2 Type C thermal insulation:

.1 Johns Manville: Microlite with a FSK vapor barrier.

.2 Knauf: sleeve for air ducts with FSK.

.3 Alley Wrap with FSK.

.4 Owens-Corning Fiberglas: 454°C (850ºF) with GTU.

.5 Note: For LEED projects, the insulation must not contain formaldehyde.

.6 or a substitute product approved in an addendum in accordance with the Instructions to tenderers.

.3 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.

.4 or a substitute product approved in an addendum in accordance with the Instructions to tenderers.

.4 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.

.4 or a substitute product approved in an addendum in accordance with the Instructions to tenderers.

.5 Insulating cement:

.1 IIG Calcoat No. 127 applied in successive 8 mm (0.3") layers.

.2 or a substitute product approved in an addendum in accordance with the Instructions to tenderers

.6 Mechanical Fasteners:

.1 Welding pins, pin fasteners, Duro-Dyne.

.2 or a substitute product approved in an addendum in accordance with the Instructions to tenderers

.7 Canvas jackets:

.1 Flexpak (Preston Phipps Inc.)

.2 S. Fattal Cotton Inc.

.3 or a substitute product approved in an addendum in accordance with the Instructions to tenderers

.8 PVC jackets:

.1 Johns-Manville

.2 Proto Corp.

.3 or a substitute product approved in an addendum in accordance with the Instructions to tenderers

.9 Aluminum jackets:

.1 Thermoclad Plus jacketing with anti-corrosion protection, Polysurlin type, Stucco finish.

.2 or a substitute product approved in an addendum in accordance with the Instructions to tenderers

.10 Fire protection insulating direct sleeves:

.1 Fire Master type Thermal Ceramics (Dispro Inc.).

.2 CL4 Fire (Glass Cell Isofab Inc.)

.3 or a substitute product approved in an addendum in accordance with the Instructions to tenderers

.11 Thermal insulation protection support:

.1 Insulgard (Master Group)

.2 Steel support (Dispro Inc.)

.3 or a substitute product approved in an addendum in accordance with the Instructions to tenderers

.12 Exterior Duct Membrane:

.1 Rubberized asphalt membrane with aluminum coating Flexclad MFM (Dispro Inc.).

.2 Self-adhering aluminized coating, five ply, Venture Clad No. 1577CW from Venture Tape.

.3 Rubberized asphalt membrane with aluminum coating, Polyguard from Alumaguard.

.4 or a substitute product approved in an addendum in accordance with the Instructions to tenderers

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 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 (20-65°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 (13-65°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.

.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 Note: PVC jackets and fittings used outdoors or exposed to fluorescent light must be resistant to ultraviolet rays.

.3 Outside air ducts and plenums (-40°C to ambient):

.1 As in "rigid insulation" above, but first applying a layer of rigid insulation without vapor barrier before applying the layer of rigid insulation with vapor barrier. All joints must be staggered.

.4 Exceptions:

.1 Unless otherwise stated, when an internal duct liner is specified, external insulation is not required.

.2 For external applications of rigid insulation, where mechanical fasteners are not suitable because of a lack of space, it is possible to substitute them for string or wire, insulation adhesive, or other suitable fastening methods.

.4 Finishes:

.1 Indoor:

.1 Rectangular ductwork with rigid insulation:

.1 Install a continuous metal corner bead at all corners. Apply vapor barrier tape on all vapor barrier joints and breaks and on every corner.

.2 Where exposed, install fire retardant canvas jacket over insulation using fabric adhesive and finish with second layer of adhesive coating.

.2 Round ductwork with rigid or flexible insulation:

.1 Apply vapor barrier tape on all joints and breaks.

.2 Where exposed, install fire retardant canvas jacket over insulation using fabric adhesive and finish with second layer of adhesive coating.

.3 Rectangular ductwork with flexible insulation:

.1 Flexible insulation is not acceptable where ductwork is exposed.

.5 Refrigerant piping:

.1 Application:

.1 Use methods recommended by the manufacturer. Seal all longitudinal and transverse joints with adhesives specified in this section. Where exposed, insulation is covered with a layer of vapor barrier paint specifically recommended for this type of insulation.

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 No.UTA-06.1 and UTA-06.2:

.1 All supply ducts from the system’s plenum boxes in the mechanical room and in shafts:

.1

.2 Up to the grilles and diffusers (only if there is no acoustic insulation)

.1 Insulation: type C (type D when exposed)

.2 Thickness: 25 mm

.3 Fire protection for ducts:

.1 See "FIRE PROTECTION INSULATION" for product and assembly type.

.2 Installation:

.1 For ducts where a one hour fire rating is required, install a 38 mm thick layer; where a two hour fire rating is required, install two layers totalling 75 mm in thickness. Provide a minimum overlap of 75 mm.

.2 For grease exhaust ducts, two layers are always required.

.3 For ducts larger than 600 mm, install pins and retaining plates at the lower part of the horizontal ducts and on the vertical ducts.

.4 Install steel strips to keep the outer sleeve in place.

.5 Where the integrity of the duct must be protected against a fire outside the duct, also independently cover the horizontal and vertical supports.

.6 Cover each duct independently.

.3 Access doors:

.1 See the article "ACCESS AND INSPECTION DOORS" in "Part 3 – EXECUTION" from Section 23 31 13.01 - Metal Air Ducts – Low Pressure, up to 500 Pa and submit the manufacturing and installation details, as required below.

.4 Instructions:

.1 The installation details will be submitted for approval, strictly according to "MANUFACTURER'S INSTRUCTIONS" and installer must receive written approval from the supplier regarding the compliance with the installation requirements. Also submit details for access doors, if required, and protection for ducts passing through a wall or a slab.

.4 Refrigerant piping:

.1 Refrigerant from 4 to 13°C:

.1 Insulation: Type B, with tubular elements

.2 Thickness: 25 mm everywhere

.2 Refrigerants under 4°C:

.1 Piping up to DN 25:

.1 Insulation: Type B, with tubular elements

.2 Thickness: 25 mm

.2 Piping up DN 32 and more:

.1 Insulation: Type B, with tubular elements

.2 Thickness: 38 mm

END OF SECTION

TABLE DES MATIÈRES

3.3 APPLICATION

3.4 PIPING INSULATION SCHEDULE – PLUMBING

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.

.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 DOCUMENTS/SAMPLES TO SUBMIT FOR APPROVAL/INFORMATION

.1 Submit all required documents and samples in accordance with section 20 00 10 – Mechanical and Electrical General Instructions.

.2 Technical datasheet:

.1 Submit required technical datasheet, and manufacturer instructions and documentation. Technical datasheets must indicate product characteristics, performance criteria, physical size, finish and

.3 Shop drawings:

.1 Submitted shop drawings stamped and signed by professional engineer registered or licensed in Canada in the province of Québec.

.4 Certificates:

.1 Submit certificates signed by manufacturer certifying that the products, materials and equipment meet the requirements as to the physical characteristics and performance criteria.

1.4 TRANSPORTATION, STORAGE AND HANDLING

.1 Transport, store and handle materials and equipment according to Section 20 00 10 – Mechanical and Electrical General Instructions.

.2 Delivery and acceptance: deliver materials and equipment to site in original factory packaging, labeled with the name and address of the manufacturer.

.3 Waste management and disposal:

.1 Separate waste materials for reuse / re-use and recycling in accordance with Section 01 74 21 – Construction/demolition waste management and disposal.

.2 Remove from site all packaging materials and transport them to the appropriate recycling facilities.

.3 Collect and sort paper packaging, plastic, polystyrene, corrugated cardboard for recycling in accordance with Waste Management Plan.

.4 Sort steel scrap, metal, plastic for recycling and place in designated containers in accordance with Waste Management Plan.

.5 Divert unused metal materials from metal recycling facility.

1.5 ACCEPTABLE MATERIALS OR PRODUCTS

1.6 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.

1.7 QUALIFICATIONS

.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.

1.8 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.

1.9 INCLUSIVE PRICE

.1 Provide an overall fixed price with the tender, covering all the work by Section 23 07 13 – Duct Insulation, and this section 23 07 15 – Thermal Insulation for Piping.

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.

2.3 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.

2.4 TYPE C INSULATION

.1 Flexible wrap made of mineral fiber bonded with thermosetting resin with vapor barrier and reinforced aluminum, with a density of 36 kg/m³, maximum service temperature of 121°C.

.2 Maximum thermal conductivity "k": 0.042 W/m.°C at 24°C.

2.5 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.

2.6 CEMENT INSULATION

.1 Compliant with the standard ASTM C449/C449M.

.2 Use for fittings, flanges, valves, and accessories.

2.7 FIRE PROTECTION INSULATION

.1 Gypsum protection:

.1 Fire protection work falls under the responsibility of the general contractor and his specialized subcontractors.

.2 Air duct insulation sleeves:

.1 Thin and flexible sleeves made of calcium silicate and biosoluble magnesium based fiber.

.2 The sleeves must display the test certification stamps.

.3 ULC approvals:

.1 For exhaust grease ducts: ULC-FRD-4 design.

.2 The assembly comprises two layers of insulation sleeves. The sleeves attached to the duct must have passed the tests according to the ULC protocol for 0 mm clearance from a combustible material. The tests must be certified by an accredited independent laboratory. The outer sleeve must be compliant with the standard ISO 6944 "Duct A".

.3 For ventilation air ducts, chemical exhaust ducts, linen chutes, and wrapped waste chutes:

.1 On all sides: ULC-FRD-3.

.2 On two or three sides only: ULC-FRD-5.

.4 The sleeves must comply with the standard ISO 6944 "Duct A".

.5 The installation will be subject to the requirements in Part 3 of the article "FIRE PROTECTION FOR DUCTS".

2.8 JACKETS

.1 PVC jackets:

.1 Preformed one piece molded jacket 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 manufacturer's recommendations.

.2 ABS jackets (for outdoor use only):

.1 Preformed one piece molded jacket.

.2 Operating temperatures:

.1 Minimum : -40°C

.2 Maximum : 82°C

.3 Permeability: 0.012 perm.

.4 Adhesive, sealant, and fastenings: Follow manufacturer's recommendations.

.3 Canvas jackets:

.1 Cotton canvas having a density of 220 g/m² where exposed and 120 g/m² where concealed, coated with a diluted insulating fire retardant adhesive, compliant with the standards ASTM C921 and ASTM E84.

2.9 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 Pittsburgh Corning.

.2 Comply with the article "MANUFACTURER LIST" from Section 20 00 10 - Mechanical and Electrical General Instructions.

2.10 MANUFACTURER LIST

.1 List of manufacturers, Section 23 07 15- Thermal Insulation for Piping:

.1 Type A thermal insulation:

.1 Johns Manville: Micro-Lok, AP-T jacket.

.2 Knauf: insulation for 1000ºF piping, ASJ-SSL jacket.

.3 Manson: Alley K, AP-T jacket.

.4 Ottawa Fibre Inc.

.5 Owens-Corning Fiberglas: 450°C, ASJ-SSLII envelope.

.6 or a substitute product approved in an addendum in accordance with the Instructions to tenderers.

.2 Type B thermal insulation:

.1 Armaflex AP from Armacell with adhesive 520 and WB finish.

.2 Rubatex Insul-Tube 180 with adhesive R-373 from Nomaco RBX.

.3 or a substitute product approved in an addendum in accordance with the Instructions to tenderers.

.3 Type C thermal insulation:

.1 Johns Manville: Microlite with a FSK vapor barrier.

.2 Knauf: sleeve for air ducts with FSK.

.3 Alley Wrap with FSK.

.4 Owens-Corning Fiberglas: 454°C (850ºF) with GTU.

.5 Note: For LEED projects, the insulation must not contain formaldehyde.

.6 or a substitute product approved in an addendum in accordance with the Instructions to tenderers.

.4 Adhesives:

.1 To adhere 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 all service jackets, vapor barrier, flame retardant, and colorless adhesive: Bakor No. 230-06, Foster No. 85-15, or Childers No. CP85.

.3 To adhere insulation to metal surfaces: Bakor No 230-38, Foster No. 85-23, Childers No. CP89, or Mulco No. 89.

.4 or a substitute product approved in an addendum in accordance with the Instructions to tenderers.

.5 Insulating cement:

.1 IIG Calcoat No. 127 applied in successive 8 mm (0.3") layers.

.2 or a substitute product approved in an addendum in accordance with the Instructions to tenderers.

.6 Mechanical Fasteners:

.1 Gluing or welding pins, pin fasteners, Duro-Dyne.

.2 or a substitute product approved in an addendum in accordance with the Instructions to tenderers.

.7 Canvas jackets:

.1 Flexpak (Preston Phipps Inc.)

.2 S. Fattal Cotton Inc.

.3 or a substitute product approved in an addendum in accordance with the Instructions to tenderers.

.8 PVC jackets:

.1 Johns-Manville

.2 Proto Corp.

.3 or a substitute product approved in an addendum in accordance with the Instructions to tenderers.

.9 Thermal insulation protection support:

.1 Insulgard (Master Group)

.2 Steel support (Dispro Inc.)

.3 or a substitute product approved in an addendum in accordance with the Instructions to tenderers.

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 the articles "PIPING INSULATION SCHEDULE" for thicknesses.

.2 Hot piping (15 to 315°C):

.1 Piping:

.1 Pipe covering without integral jackets must be held in place with fasteners at not less than 300 mm centre to centre. Pipe insulation with integral jacket shall be held in place by stapling the tab every 75 mm centre to centre. Pipe insulation with integral self-sealing jacket does not require additional fastening.

.2 Fittings:

.1 Insulate fittings with sections of pipe insulation mitred to fit tightly, insulating cement, or with tightly placed flexible insulation covered with a reinforcing membrane stapled in place. Alternatively, insulate the fittings with tightly placed flexible insulation and PVC fitting covers.

.3 Valves and strainers:

.1 Insulate valve bodies and strainers with insulating cement, or fitted pipe insulation segments, or mitred blocks, all of the same thickness as the adjacent pipe insulation, or insulate with tightly placed flexible insulation covered with a reinforcing membrane stapled in place. Drains, drain plugs, and caps shall be left uncovered. Alternatively, insulate with tightly placed flexible insulation and apply PVC fitting covers.

.4 Flanges:

.1 Insulate flanges with oversized pipe covering or mitred blocks of the same thickness as the adjacent pipe covering. Alternatively, insulate flanges with tightly placed flexible insulation and PVC fitting covers.

.2 Insulation termination points:

.1 Terminate insulation at 75mm 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 to 15°C):

.1 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 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. Alternatively, insulate fittings with tightly fit flexible insulation then apply reinforcing membrane embedded in vapour barrier coating and apply PVC fitting cover.

.3 Valves and strainers:

.1 Insulate valve bodies, flanges, and strainers with insulating cement, fitted pipe insulation segments, or mitred blocks, all of the same thickness as the adjacent insulation and then apply a vapor barrier coated reinforcing membrane. Alternatively, insulate with tightly fitted flexible insulation, then apply a vapor barrier coated reinforcing membrane. Drains, drain plugs, and caps to be left uncovered. Alternatively, insulate with tightly fit flexible insulation, then apply a vapor barrier coated reinforcing membrane and apply PVC cover.

.4 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. Alternatively, insulate with flexible insulation covered with a vapor barrier coated reinforcing membrane and apply PVC cover.

.5 Grooved fittings:

.1 Where the use of grooved pipe fittings is accepted, the method known as "oversized" and recommended by the Association d'Isolation du Québec (AIQ) will be applied.

.6 Closed cell insulation:

.1 See paragraph "Hot Piping", subparagraph "Closed cell insulation".

.4 Buried underground piping:

.1 Install underground insulation in accordance with the manufacturer's guidelines and recommendations. See Type P in Part 2.

.5 Finishes:

.1 See article "JACKETS" of Part 2.

.2 Indoor (exposed areas):

.1 Factory applied all service jacket must be properly applied to receive the fire retardant canvas jacket. Install the jacket with an adhesive coating.

.2 Fittings (valves and strainers, if specified) not finished with a PVC cover must be covered with a layer of hard cement and finished with a fire retardant canvas applied with an adhesive coating.

.3 Finish the lining with a layer of adhesive coating.

.3 Indoor (concealed areas):

.1 Apply pipe insulation with factory applied all service jacket. Secure the jacket with appropriate fasteners at approximately 100 mm centre to centre. Cover longitudinal and circumferential joints with a tight fitted jacket finishing tape. Alternatively, secure the jacket using the integral self-sealing overlap joints and self-sealing circumferential joint bands.

.2 Fittings (valves and strainers, if specified) not finished with a PVC cover must be covered with a layer of hard cement and finished with a fire retardant canvas applied with an adhesive coating.

.4 Indoor / Outdoor (metal jacket):

.1 Apply a metal jacket over the pipe insulation and secure it with the necessary fasteners at approximately 150 mm centre to centre.

.2 On insulated fittings (valve bodies and bonnets, strainers, and flanges, if specified), apply a metal jacket or preformed metal cover to ensure complete jacketing of the system. Secure with the necessary fasteners.

.5 Indoor / Outdoor (PVC jacket):

.1 Apply a PVC sleeve (see "JACKETS") on the insulation and secure it with the necessary fasteners at 100 mm centre to centre. Cover longitudinal and circumferential joints with a tight fitted jacket and finishing tape.

.2 On insulated fittings (valve bodies and bonnets, strainers and flanges, if specified), apply a PVC jacket or fitting covers to ensure complete jacketing of the system. Secure with appropriate jacket finishing fasteners and strips.

.3 Note: PVC jackets and fittings used outdoors or exposed to fluorescent light must be resistant to ultraviolet rays.

.6 Outdoor:

.1 On insulated surfaces, apply a coat (minimum 1 liter/1.5 m²) of weather proof coating. While still humid, impregnate the reinforcing membrane and finish with a final coat (minimum 1 liter/1.5 m²) of weather proof coating. Alternatively, use Thermoclad Plus jacket type or equivalent. See "MANUFACTURER LIST" paragraph "Aluminum jackets".

3.4 PIPING INSULATION SCHEDULE – PLUMBING

.1 When specified, type A or B, the thicknesses are given for type A. For type B, use a thickness 13 mm smaller than specified.

.2 Pipe dimensions are in DN (nominal diameter).

.3 On domestic cold water piping to the devices:

.1 Insulation: Type A or B in tubular form

.2 Thickness: 25 mm throughout.

.4 Domestic hot water and 32°C domestic recirculated hot water to the devices:

.1 Insulation: Type A or B in tubular form

.2 Thickness: 25 mm throughout.

.5 Domestic hot water and recirculated water at 40 and 60°C:

.1 Piping NPS 2 and smaller:

.1 Insulation: Type A or B in tubular form

.2 Thickness: 25 mm

.2 Piping NPS 2½ and more:

.1 Insulation: Type A or B in tubular form

.2 Thickness: 38 mm

.6 On all drainage plumbing for condensate pans of chilled water and glycol cooling coils, refrigerant, fan coil units, as well as on the drainage piping for the funnels serving these systems to the connections to the sanitary risers:

.1 Insulation: Type B tubular form for copper pipes, Type C for cast iron pipes.

.2 Thickness: 10 mm for type B and 15 mm for the type C.

.7 Hot piping:

.1 Insulation with same features but without vapor barrier can be used.

END OF SECTION

TABLE DES MATIÈRES

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 07 15 - Thermal Insulation for Piping.

1.2 REFERENCES

.1 ASME:

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

.2 ASME B16.24-11 – Cast Copper Pipe Flanges and Flanged Fittings: Class 150, 300, 600, 900, 1500 and 2500.

.3 ASME B16.26-11 – Cast Copper Alloy Fittings for Flared Copper Tubes.

.4 ASME B31.5-10 – Refrigeration Piping and Heat Transfer Components.

.2 ASTM International:

.1 ASTM A307-12 – Standard Specification for Carbon Steel Bolts and Studs, and Threaded Rod 60,000 psi Tensile Strength.

.2 ASTM B280-08 – Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service.

.3 CSA Group:

.1 CSA B52-05 (C2009) – Collection B52, Mechanical refrigeration code.

.4 Environment Canada (EC):

EPS 1/RA/1-1996 – Environmental Code of Practice for Elimination of Fluorocarbon Emissions from Refrigeration and Air Conditioning Systems.

1.3 DOCUMENTS/SAMPLES TO SUBMIT FOR APPROVAL/INFORMATION

.1 Submit all required documents and samples in accordance with section 20 00 10 – Mechanical and Electrical General Instructions.

.2 Technical datasheet:

.1 Submit required technical datasheet, and manufacturer instructions and documentation. Technical datasheets must indicate product characteristics, performance criteria, physical size, finish and

1.4 DOCUMENTS/ITEMS TO GIVE AT WORK COMPLETION

.1 Submit all required documents and items in accordance with section 20 00 10 – Mechanical and Electrical General Instructions.

.2 O M Sheets: Provide instruction for OM which will be included in the OM Manuals.

1.5 TRANSPORTATION, STORAGE AND HANDLING

.1 Transport, store and handle materials and equipment according to Section 20 00 10 – Mechanical and Electrical General Instructions.

.2 Delivery and acceptance: deliver materials and equipment to site in original factory packaging, labeled with the name and address of the manufacturer.

.3 Waste management and disposal:

.1 Separate waste materials for reuse / re-use and recycling in accordance with Section 01 74 21 – Construction/demolition waste management and disposal.

.2 Remove from site all packaging materials and transport them to the appropriate recycling facilities.

.3 Collect and sort paper packaging, plastic, polystyrene, corrugated cardboard for recycling in accordance with Waste Management Plan.

.4 Sort steel scrap, metal, plastic for recycling and place in designated containers in accordance with Waste Management Plan.

.5 Divert unused metal materials from metal recycling facility.

1.6 WORK

.1 In general, the work described in this section includes, labor, supply and installation of all materials and equipment necessary for the work indicated on the plans and specifications which must comply with various codes in effect.

.2 Such work includes, without being limited to:

.1 For new systems:

.1 The installation of the units.

.2 The refrigerant piping and accessories.

.3 The refrigerant.

.4 The testing and commissioning.

.5 The thermal insulation work, as described in Section 23 07 15 - Thermal Insulation for Piping.

1.7 ACCEPTABLE MATERIALS OR PRODUCTS

.1 When materials or products are prescribed by their trademarks, consult the instructions to tenderers in order to know the procedure concerning the request for approval of substitute's materials or products.

Part 2 Product

2.1 PIPING

.1 Treated, deoxidized, dehydrated, and sealed copper piping, designed for refrigeration installations.

.1 Hard drawn copper pipe: ASTM B280, ACR type.

.2 Annealed copper pipe: ASTM B280, at a minimum wall thickness according to the standards CSA B52 and ASME B31.5.

2.2 FITTINGS

.1 Operating conditions: calculation pressure and temperature of 2070 kPa and 121°C respectively.

.2 Brazing fittings:

.1 Connectors: wrought copper, B16.22 ASME.

.2 Brazing: silver (silfos) solder, with non-corrosive flux.

.3 Flanged fittings:

.1 Connectors: bronze or brass, B16.24 ASME, class150 and 300.

.2 Sealing gaskets: appropriate to the conveyed fluid.

.3 Bolts, nuts, and washers: ASTM A307, heavy series.

.4 Flare fittings:

.1 Connecting elements: bronze or brass, designed for refrigeration networks, ASME B16.26.

2.3 SLEEVES

.1 Hard drawn copper or steel sleeves, with a diameter suitable for the passage of insulated or non-insulated tubes, for both cases, annular clearance of 6 mm in width.

2.4 VALVES

.1 Valve of diameter equal to or smaller than 22 mm: globe valves, straight or angled, class 500, 3.5 MPa category, with membrane, non-directional, without gland gasket, forged brass body and bonnet, waterproof joint suitable for temperatures lying below the freezing point, and welding ends.

.2 Valve of diameter equal to or larger than 22 mm: globe valves, straight or angled, class 375, 2.5 MPa category, with membrane, without gland gasket, with sealing device behind the plug, sealing cap, cast bronze body and bonnet, waterproof joint suitable for temperatures lying below the freezing point, and welding ends.

2.5 ACCESSORIES

.1 All accessories required and shown in the diagrams, including solenoid valves, moisture indicator, desiccant-dryer filter, valves, including isolation valves for repairs and maintenance, etc., from Sporlan or Alco.

Part 3 Execution

3.1 INSTALLATION

.1 Install piping in accordance with the standards CSA B52 and ASME B31.5, the document 1/RA/1 issued by EPS and Section 23 05 05 – Installation of Pipework.

.2 Perform refrigeration work according to the codes in effect and the diagrams outlined in the drawings. The work must be performed by accredited refrigeration contractors.

.3 Welding:

.1 During welding, maintain a nitrogen flow in the piping, provided by a cylinder with a regulator.

3.2 SUPPORTS

.1 Firmly support piping every 3 m, primarily on the exterior using a wood frame treated with a fungicide product meeting the environmental standards.

3.3 TESTING AND FILLING

.1 Testing pressurized piping:

.1 Close the valves to isolate the factory-loaded devices and all devices that are not to be tested to prevent their deterioration.

.2 Raise the pressure, high and low pressure sides, with nitrogen, according to the standard CSA B52 and the applicable provincial code.

.3 After 24 hours, check for leaks using a soap solution or dye based indicator. Repair leaking joints and resume testing.

.2 Testing piping under vacuum:

.1 By means of a vacuum pump specifically designed for this purpose, perform the first vacuum test at a pressure of at least 500 µm Hg (absolute pressure) and maintain this vacuum for at least four hours.

.2 Break the vacuum by introducing nitrogen.

.3 Perform a second vacuum test at a pressure of 300 µm Hg.

.4 If after twelve hours the pressure goes back to over 500 µm Hg, retest.

.5 Isolate the network pump and note the values under vacuum and the time until the vacuum stabilizes.

.6 These tests must be carried out when the ambient temperature is at least 4°C.

.3 Filling and replacement of the desiccant-dryer filter:

.1 Introduce the refrigerant through the charging valve, high pressure side.

.2 With the compressor stopped, add the amount of refrigerant required to operate the system via a desiccant-dryer used for this purpose only.

.3 Complete the charge, once the system is in operation.

.4 After a week of operation, replace the desiccant-dryer filter used during the tests with the final filter.

3.4 THERMAL INSULATION

.1 All relevant clauses from Section 23 07 15 - Thermal Insulation for piping that apply to this section’s work.

END OF SECTION

TABLE DES MATIÈRES

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 20 00 10 – Mechanical and Electrical General Instructions.

.2 Section 23 05 29 – Hangers and Supports for HVAC Piping and Equipment.

.3 Section 23 33 00 – Air Duct Accessories.

1.2 REFERENCES

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

.2 ASTM International:

.1 ASTM A480/A480M-12 – Standard Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet and Strip.

.2 ASTM A635/A635M-09b – Standard Specification for Steel, Sheet and Strip, Heavy-Thickness Coils, Hot-Rolled, Alloy, Carbon, Structural, High-Strength Low-Alloy, and High-Strength Low-Alloy with Improved Formability, General Requirements.

.3 ASTM A653/A653M-11 – Standard Specification for Steel Sheet, Zinc Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-Dip Process.

.3 Green Seal Environmental Standards (GS):

.1 GS-36-11 – Standard for Adhesives for Commercial Use.

.4 National Fire Protection Agency Association (NFPA):

.1 NFPA 90A-12 – Standard for the Installation of Air-Conditioning and Ventilating Systems.

.2 NFPA 90B-12 – Standard for the Installation of Warm Air Heating and Air-Conditioning Systems.

.3 NFPA 96-11 – Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations.

.5 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA):

.1 SMACNA HVAC – Duct Construction Standards - Metal and Flexible, 2005.

.2 SMACNA HVAC – Air Duct Leakage Test Manual, 2012.

.3 IAQ – Guideline for Occupied Buildings Under Construction 2007.

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

.1 SCAQMD Rule 1168-A2005 – Adhesives and Sealants Applications.

1.3 DOCUMENTS/SAMPLES TO SUBMIT FOR APPROVAL/INFORMATION

.1 Submit all required documents and samples in accordance with section 20 00 10 – Mechanical and Electrical General Instructions.

.2 Technical datasheet:

.1 Submit required technical datasheet, and manufacturer instructions and documentation. Technical datasheets must indicate product characteristics, performance criteria, physical size, finish and

.3 Shop drawings:

.1 Submitted shop drawings stamped and signed by professional engineer registered or licensed in Canada in the province of Québec.

.4 Certificates:

.1 Submit certificates signed by manufacturer certifying that the products, materials and equipment meet the requirements as to the physical characteristics and performance criteria.

1.4 DOCUMENTS/ITEMS TO GIVE AT WORK COMPLETION

.1 Submit all required documents and items in accordance with section 20 00 10 – Mechanical and Electrical General Instructions.

.2 O M Sheets: Provide instruction for OM which will be included in the OM Manuals.

1.5 TRANSPORTATION, STORAGE AND HANDLING

.1 Transport, store and handle materials and equipment according to Section 20 00 10 – Mechanical and Electrical General Instructions.

.2 Delivery and acceptance: deliver materials and equipment to site in original factory packaging, labeled with the name and address of the manufacturer.

.3 Waste management and disposal:

.1 Separate waste materials for reuse / re-use and recycling in accordance with Section 01 74 21 – Construction/demolition waste management and disposal.

.2 Remove from site all packaging materials and transport them to the appropriate recycling facilities.

.3 Collect and sort paper packaging, plastic, polystyrene, corrugated cardboard for recycling in accordance with Waste Management Plan.

.4 Sort steel scrap, metal, plastic for recycling and place in designated containers in accordance with Waste Management Plan.

.5 Divert unused metal materials from metal recycling facility.

1.6 ACCEPTABLE MATERIALS OR PRODUCTS

.1 When materials or products are prescribed by their trademarks, consult the instructions to tenderers in order to know the procedure concerning the request for approval of substitutes materials or products.

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 Round and oval ducts:

.1 For diameters of up to 150 cm, these ducts must be manufactured from helicoidally wound sheet metal with spiral joints, four ply lockseam (outside wall) for excellent rigidity, operating pressure up to 2500 Pa, as manufactured by Spiro Mega Inc.

.3 For stainless steel pipes, see the article "SPECIAL DUCTS".

.4 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.

.5 To ensure the rigidity to the ducts, the sheet will be marked with transverse ribs (stop beads) when manufacturing the pipes. The spacing between the ribs is 300 mm at most. The method of marking two diagonal plies (cross breaking) on all flat surfaces 200 mm and more in width is also acceptable. For either method, the sheet gauge required will be the same.

.6 In the ducts with dimensions having a greater ratio than 4 to 1, install a sheet division in the center of the longest dimension.

.7 For energy saving needs, seal the joints of ducts conveying treated air.

.8 At the places 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 leaktight and withstand the static pressures of the relevant systems.

.9 Ducts exiting service shafts: installed inside the shaft, a collar securely fastened to the duct and to the shaft wall. Seal the joints.

.10 Definitions:

.1 Low pressure ducts:

.1 Ducts with a static pressure less than 500 Pa and an air velocity below 610 m/min.

.2 Medium pressure ducts:

.1 Ducts with a static pressure greater than 500 Pa, but less than 1500 Pa and an air velocity below 700 m/min. Refer to section 23 31 13.02 – Metal Ducts – High Pressure to 2500 Pa.

.3 High pressure ducts:

.1 Ducts with a static pressure greater than 1500 Pa up to 2500 Pa and/or an air velocity greater than 700 m/min up to 1220 m/min. Refer to Section 23 31 13.02 – Metal Ducts – High Pressure to 2500 Pa.

.4 Treated air ducts:

.1 Ducts supplying heated or conditioned air.

.11 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.

.12 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, round, and oval ducts, see the details in the drawings.

.2 Connections:

.1 All branch connections must have 45° angle lateral outlets, of 150 mm in length.

.2 For any branch connections serving a power grid placed within 600 mm of the main duct and any other branch connected at right angles without transformation, install extractor type fans with adjustment rod and lock screw inside or outside the duct, according to the ceiling type. The extractor must be able to completely close off the branch. If the air speeds are greater than 365 m/min, it must be manufactured to withstand these speeds.

.3 For the air supply terminal units and the diffusers, when connected by a flexible duct with adjustable damper, as well as for connecting a duct to a plenum, see the details in the drawings.

.3 Joints:

.1 Round ducts:

.1 See details in the drawings.

.2 Rectangular ducts:

.1 All corners of the tee joints will be sealed by a 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 steel sheet's galvanizing 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, this section 23 31 13.01 - Metal Ducts - Low Pressure to 500 Pa.

.1 Rigid ducts:

.1 Alcan (aluminum)

.2 Algoma Steel Inc.

.3 Dofasco

.4 Stelco

.5 or a substitute product approved in an addendum in accordance with the Instructions to tenderers.

.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)

.4 or a substitute product approved in an addendum in accordance with the Instructions to tenderers.

.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)

.5 or a substitute product approved in an addendum in accordance with the Instructions to tenderers.

.4 Gaskets:

.1 Hardcast Carlisle (Flange Gasket 1902)

.2 Multifeutre du Quebec Ltd

.3 3M Ltd (LC-105 Gaskets)

.4 or a substitute product approved in an addendum in accordance with the Instructions to tenderers.

.5 Prefabricated round and oval ducts:

.1 J.P. Lessard

.2 Les Industries Mégatube Canada Inc.

.3 Spiro Méga Inc.

.4 Spiro Métal Inc.

.5 or a substitute product approved in an addendum in accordance with the Instructions to tenderers.

.6 Flexible ducts:

.1 Boflex Inc. (types AS and AI)

.2 Trans-Continental Equipment Ltd (AI-U-Flex)

.3 Flexmaster Co. Ltd (Triple Lock)

.4 or a substitute product approved in an addendum in accordance with the Instructions to tenderers.

.7 Resilient sealant:

.1 Minnesota Mining Mfg. from Canada (3M)

.2 Tremco

.3 or a substitute product approved in an addendum in accordance with the Instructions to tenderers.

.8 Protective paint:

.1 Sico (Corostop, Crown Diamond)

.2 ZRC Products Co. (Kerry Industries Ltd)

.3 or a substitute product approved in an addendum in accordance with the Instructions to tenderers.

.9 Bolts and anchors:

.1 Hilti

.2 Phillips Red-Head

.3 Ucan

.4 or a substitute product approved in an addendum in accordance with the Instructions to tenderers.

.10 Seismic restraint systems:

.1 Racan-Carrier (Vibro)

.2 Mason Industries Inc.

.3 Unistrut (Routle Co. Inc.)

.4 or a substitute product approved in an addendum in accordance with the Instructions to tenderers.

Part 3 Execution

.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 profile 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 aluminum based paint.

.4 Install additional hangers at every bend, every change of direction, the connections fittings, and any additional steel required to support the pipes in the shafts.

.2 Round ducts:

.1 Construct the supports out of a 25 mm wide steel ring with tightening screw and a 6.4 mm steel rod. Before installation, apply a layer of aluminum based paint to all the rings and rods.

.2 Use the external reinforcements as attachment point for the oval ducts having a major axis larger than 580 mm.

.3 For oval ducts without reinforcement, install the supports starting as close as possible to a joint. Construct the supports from a continuous metal strip.

3.2 ELBOWS

.1 Rectangular ducts:

.1 Wherever pipes change direction with an average radius smaller than 1.5 times the dimension of the pipe, install directional vents arranged proportionately to ensure a pressure loss that is not greater than that caused by a change in direction respecting the ratio R/D = 1.5. For square elbows, install double-walled vents, with aerodynamic blades. Submit manufacturing details, performance details, and samples.

.2 Round ducts:

.1 Construct elbows with a radius of curvature (measured from the center of the pipe) equal to at least 1½ times the diameter of the duct. Construct them in five sections or more for 280 mm or larger diameters and three sections for 250 mm and smaller.

.3 Oval ducts:

.1 Construct elbows with a radius of curvature measured at the center of the axis and equal to 1½ times the major axis or 1½ times the minor axis, depending on whether the change of direction is in the plane of the major axis or in the plane of the minor axis.

3.3 SECTION CHANGE

.1 The section changes must have a maximum angle of 15º.

.2 Install ducts as straight as possible.

.3 When there is an obstruction caused by piping and it is impossible to relocate the conduit or the pipe, install a contoured envelope around the pipe passing through the ventilation duct. Install an access door for visual inspection.

.4 If the obstruction is greater than 10% of the duct's section, proportionally increase the dimensions of the duct in order to maintain the effective area.

.5 For circular ducts, use prefabricated transformer sections in medium and high pressure systems, to allow maximum static recuperation.

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 20 00 10 – Mechanical and Electrical General Instructions.

3.6 ACCESS AND INSPECTION DOORS

.1 Provide access doors at the locations indicated on the drawings and where required.

.2 Provide inspection doors 450 mm x 450 mm or of equivalent dimensions, depending on the dimensions of the duct (unless otherwise indicated), at proximity of each motorized or manual damper, at each control instrument, at each fire damper, each combustion product analyzer, at each humidifier, upstream and downstream of each coil and other equipment.

.3 Place the doors for easy access.

.4 Reinforce the contour and perfectly adjust the doors. Seal the doors using a permanently installed flexible rubber seal (foam rubber not accepted).

.5 In the 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.

.6 See the article "SPECIAL DUCTS" in part 2 "Products" for the access doors in ducts with Firemaster type insulating wrap.

END OF SECTION

TABLE DES MATIÈRES

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 20 00 10 – Mechanical and Electrical General Requirements.

.2 Section 23 05 00 – Common Work Results for HVAC

1.2 REFERENCES

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

.2 ASTM International:

.1 ASTM A653/A653M-11 – Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

.2 ASTM C423-09a – Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method.

.3 ASTM E90-09 – Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.

.4 ASTM E477-06a – Standard Test Method for Measuring Acoustical and Airflow Performance of Duct Liner Materials and Prefabricated Silencers.

.3 National Building Code of Canada (NBC) 2011.

.4 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA).

1.3 DOCUMENTS/SAMPLES TO SUBMIT FOR APPROVAL/INFORMATION

.1 Submit all required documents and samples in accordance with section 20 00 10 – Mechanical and Electrical General Instructions.

.2 Technical datasheet:

.1 Submit required technical datasheet, and manufacturer instructions and documentation. Technical datasheets must indicate product characteristics, performance criteria, physical size, finish and

.3 Shop drawings:

.1 Submitted shop drawings stamped and signed by professional engineer registered or licensed in Canada in the province of Québec.

.4 Certificates:

.1 Submit certificates signed by manufacturer certifying that the products, materials and equipment meet the requirements as to the physical characteristics and performance criteria.

1.4 DOCUMENTS/ITEMS TO GIVE AT WORK COMPLETION

.1 Submit all required documents and items in accordance with section 20 00 10 – Mechanical and Electrical General Instructions.

.2 O M Sheets: Provide instruction for OM which will be included in the OM Manuals.

1.5 TRANSPORTATION, STORAGE AND HANDLING

.1 Transport, store and handle materials and equipment according to Section 20 00 10 – Mechanical and Electrical General Instructions.

.2 Delivery and acceptance: deliver materials and equipment to site in original factory packaging, labeled with the name and address of the manufacturer.

.3 Waste management and disposal:

.1 Separate waste materials for reuse / re-use and recycling in accordance with Section 01 74 21 – Construction/demolition waste management and disposal.

.2 Remove from site all packaging materials and transport them to the appropriate recycling facilities.

.3 Collect and sort paper packaging, plastic, polystyrene, corrugated cardboard for recycling in accordance with Waste Management Plan.

.4 Sort steel scrap, metal, plastic for recycling and place in designated containers in accordance with Waste Management Plan.

.5 Divert unused metal materials from metal recycling facility.

1.6 ACCEPTABLE MATERIALS OR PRODUCTS

.1 When materials or products are prescribed by their trademarks, consult the instructions to tenderers in order to know the procedure concerning the request for approval of substitutes materials or products

Part 2 Product

2.1 PERFORMANCE REQUIREMENTS

.1 Technical data

.1 Provide the required technical data, which must be certified by an engineer or by a recognized testing laboratory and be based on calculations and tests that were conducted according to reference standards with respect to the following.

.1 Silencer: attenuation capacity in decibels (insertion loss), transmission loss in nominal conditions, generated noise level.

.2 Acoustic plenums: transmission loss and sound absorption.

.3 The performance of acoustic materials for soundproofing installations must be measured according to the ASTM standards E447, E90, and C423, unless otherwise indicated.

2.2 INSULATING AND ABSORBANT MATERIALS

.1 Mineral fibre acoustic materials, resistant to bacteria and mold, free of corrosive agents or agents promoting corrosion, compressed to the density corresponding to the performance requirements, compliant with the NBC requirements for fire protection or those from competent authorities governing inner duct linings.

2.3 ACOUSTIC STANDARDS

.1 Select the noise and vibration attenuation devices according to the lowest frequencies that could cause problems.

.2 During the start-up and the operation of the equipment, the vibration generated must not add to the expected noise level in the serviced and/or adjacent rooms, so as to not affect the comfort of the occupants.

.3 Unless otherwise specified, the maximum noise criteria to be met are those used in standard practice and recommended by ASHRAE.

2.4 SILENCERS

.1 General:

.1 For each type of silencer:

.1 Provide shop drawings and the results of tests carried out and certified by a recognized organization, namely:

.1 Noise attenuation in decibels at the frequency bands referred to in the tables. Attenuations measured according to the method of substitution into a duct leading to a reverberation chamber with air flow inside the duct (at the speeds indicated in the tables).

.2 The pressure loss through the silencer in function of the air flow.

.2 Noise attenuation through the walls at least equal to that obtained in the direction of the air flow.

.3 Construct them for an operating pressure of at least 500 Pa higher than the test pressure of the considered system.

.4 The dimensions given in tables and the drawings are the nominal external dimensions. Take exact measurements on-site, taking into account the openings in concrete and plenums, the physical bulk of the other devices, and the local architectural and structural conditions. Some silencers have different dimensions than the ducts. Provide fittings on these silencers adapting to the dimensions of the ducts it is attached to.

.5 Some silencers are composed of modules. These modules are assembled on-site by the division 23. Group these silencers inside the ventilation ducts. Provide the details for the supports and the assembly. Bind the modules together with galvanized steel strips provided by this section.

.6 For the silencer characteristics, see the tables. The requested attenuations are the minimum and the pressure losses requested are the maximum.

.2 Frame:

.1 Galvanized steel outer plates, 0.853 mm (22 gauge) minimum.

.2 Adapt the fittings to the types of ducts that connect to it.

.3 With lifting rings.

.3 Acoustic media:

.1 Mineral or inorganic fibreglass, with a minimum density of 72 kg/m³ in open air. Compress it at a rate of 20% in the silencer.

.2 Fully wrap the acoustic insulation with a fiberglass cloth.

.3 Protect the acoustic media in the outer walls, the cores, and the baffles with a galvanized and perforated metal wall, 0.853 mm (22 gauge) minimum.

.4 The perforation of the sheets is such as to provide maximum attenuation while preventing erosion of the acoustic material.

.4 Locations: see drawinds.

.2 Calculations:

.1 Identification:

.2 The output speed.

.3 The power.

.4 The static pressure and the sound power level in the eight octave bands.

.5 The silencer's physical dimensions.

.6 The silencer's dynamic noise attenuation.

.7 The sound attenuation of the conduits, the connections, the gratings, etc.

.8 The room's sound attenuation.

.9 The noise level in the room.

.10 Note: do the calculations using the method from the ASHRAE manual, latest edition.

.3 Air transfer silencers CT-01:

.1 Construct SIL I identified silencers using 457 mm x 305 mm x 1525 mm in length modules. Provide a maximum static pressure loss of 12.5 Pa at 70 L/s and obtain the following attenuation:

Frequency bands (Hz)	125	250	500
Attenuation in dB	16	24	35

.2 Construct SIL II identified silencers using two SIL I modules, fix them with special clips.

2.5 MANUFACTURER LIST

.1 Comply with the article "MANUFACTURER LIST" from section 20 00 10 - Mechanical and Electrical General Instructions.

.2 List of manufacturers, this section 23 32 48 – Acoustical Air Plenums:

.1 Silencers:

.1 Ingénia

.2 Vibro Racan (Racan Carrier)

.3 Vibron Ltd

.4 Vibro-Acoustics (PGAL)

.5 or a substitute product approved in an addendum in accordance with the Instructions to tenderers.

.2 Resilient sealant:

.1 Duro-Dyne

.2 Vulkem 616 (Mameco)*

.3 or a substitute product approved in an addendum in accordance with the Instructions to tenderers.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 GENERAL

.1 Stored, then assembled and installed by Division 23 "VENTILATION - AIR CONDITIONING", under this section's direction and supervision.

3.3 SUPPLY AND INSTALLATION

.1 This section's manufacturer supplier must provide:

.1 The shop drawings.

.2 The erection drawings.

.3 The structural drawings and calculations.

.4 The panels and all accessories.

.5 The joints.

.6 The access doors.

.7 The inspection windows.

.8 The removable panels.

.9 The framework required for plenums.

.10 The resilient sealant.

.2 The installation work for the acoustic plenums and the silencers is done by division 23 "VENTILATION - AIR CONDITIONING", under the directions and the supervision of this section's manufacturer supplier.

END OF SECTION

TABLE DES MATIÈRES

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 DOCUMENTS/SAMPLES TO SUBMIT FOR APPROVAL/INFORMATION

.1 Submit all required documents and samples in accordance with section 20 00 10 – Mechanical and Electrical General Instructions.

.2 Technical datasheet:

.1 Submit required technical datasheet, and manufacturer instructions and documentation. Technical datasheets must indicate product characteristics, performance criteria, physical size, finish and

.3 Shop drawings:

.1 Submitted shop drawings stamped and signed by professional engineer registered or licensed in Canada in the province of Québec.

.4 Certificates:

.1 Submit certificates signed by manufacturer certifying that the products, materials and equipment meet the requirements as to the physical characteristics and performance criteria.

1.4 DOCUMENTS/ITEMS TO GIVE AT WORK COMPLETION

.1 Submit all required documents and items in accordance with section 20 00 10 – Mechanical and Electrical General Instructions.

.2 O M Sheets: Provide instruction for OM which will be included in the OM Manuals.

1.5 TRANSPORTATION, STORAGE AND HANDLING

.1 Transport, store and handle materials and equipment according to Section 20 00 10 – Mechanical and Electrical General Instructions.

.2 Delivery and acceptance: deliver materials and equipment to site in original factory packaging, labeled with the name and address of the manufacturer.

.3 Waste management and disposal:

.1 Separate waste materials for reuse / re-use and recycling in accordance with Section 01 74 21 – Construction/demolition waste management and disposal.

.2 Remove from site all packaging materials and transport them to the appropriate recycling facilities.

.3 Collect and sort paper packaging, plastic, polystyrene, corrugated cardboard for recycling in accordance with Waste Management Plan.

.4 Sort steel scrap, metal, plastic for recycling and place in designated containers in accordance with Waste Management Plan.

.5 Divert unused metal materials from metal recycling facility.

1.6 ACCEPTABLE MATERIALS OR PRODUCTS

.1 When materials or products are prescribed by their trademarks, consult the instructions to tenderers in order to know the procedure concerning the request for approval of substitutes materials or products

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 ADJUSTABLE VOLUME EXTRACTORS

.1 Locations:

.1 Install an adjustable extractor at each branch connected at a right angles without transformation on the main ducts to allow proportional control of the flow in the ducts. See also Section 23 31 13.01 – Metal Ducts – Low Pressure to 500 Pa. The extractor must be able to completely close off the branch. Where necessary, the extractor must be manufactured to withstand air velocities greater than 365 m/min.

.2 Construction:

.1 EH Price Ltd. No. AE-2 Extractor with adjustment lever.

2.4 MANUFACTURER LIST

.1 Comply with the article "MANUFACTURER LIST" in Section 20 00 10 - Mechanical and Electrical General Requirements.

.2 List of manufacturers, this section 23 33 00 Air Duct Accessories:

.1 Openings for air velocity and air temperature readings:

.1 Duro-Dyne

.2 Lawson Taylor Ltd

.2 Adjustable volume dampers:

.1 Anémostat

.2 E.H. Price Ltd

.3 Nailor Industries Inc.

.4 Titus

2.5 ACCESS DOORS

.1 Non-insulated ducts: double-walled doors (sandwich panels), the same material as used for the ducts, but of the next larger thickness, which, however, must not be thinner than 0.6 mm, in frame with angle irons.

.2 Insulated ducts: double-walled doors (sandwich panels), the same material as used for the ducts, but of the next larger thickness, which, however, must not be thinner than 0.6 mm, with angle iron frame and rigid insulation, fiber glass, 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 1,000 mm side: a piano hinge and two (2) handles operable from the inside and from the outside.

.5 Device to hold the open position.

Part 3 Execution

3.1 ADJUSTABLE VOLUME DAMPERS

.1 Install the extractors according to the manufacturer's recommendations and the article "ADJUSABLE VOLUME DAMPERS" in Part 2.

END OF SECTION

TABLE DES MATIÈRES

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 20 00 10 – Mechanical and Electrical General Requirements.

1.2 REFERENCES

.1 National Fire Protection Association (NFPA):

.1 NFPA 90A-12 – Standard for the Installation of Air Conditioning and Ventilating Systems.

.2 Underwriters' Laboratories of Canada (ULC):

.1 CAN/ULC-S112-10 – Standard Method of Fire Test of Fire Damper Assemblies.

.2 CAN/ULC-S112.2-07 – Standard Method of Fire Test of Ceiling Firestop Flap Assemblies.

.3 ULC-S505-1974 – Standard for Fusible Links for Fire Protection Service.

1.3 REPLACEMENT EQUIPMENT TO BE SUPPLIED

.1 Replacement materials/equipment

.1 Supply the following.

.1 Six (6) fusible links of each type.

1.4 DOCUMENTS/SAMPLES TO SUBMIT FOR APPROVAL/INFORMATION

.1 Submit all required documents and samples in accordance with section 20 00 10 – Mechanical and Electrical General Instructions.

.2 Technical datasheet:

.1 Submit required technical datasheet, and manufacturer instructions and documentation. Technical datasheets must indicate product characteristics, performance criteria, physical size, finish and

.3 Shop drawings:

.1 Submitted shop drawings stamped and signed by professional engineer registered or licensed in Canada in the province of Québec.

.4 Certificates:

.1 Submit certificates signed by manufacturer certifying that the products, materials and equipment meet the requirements as to the physical characteristics and performance criteria.

1.5 DOCUMENTS/ITEMS TO GIVE AT WORK COMPLETION

.1 Submit all required documents and items in accordance with section 20 00 10 – Mechanical and Electrical General Instructions.

.2 O M Sheets: Provide instruction for OM which will be included in the OM Manuals.

1.6 TRANSPORTATION, STORAGE AND HANDLING

.1 Transport, store and handle materials and equipment according to Section 20 00 10 – Mechanical and Electrical General Instructions.

.2 Delivery and acceptance: deliver materials and equipment to site in original factory packaging, labeled with the name and address of the manufacturer.

.3 Waste management and disposal:

.1 Separate waste materials for reuse / re-use and recycling in accordance with Section 01 74 21 – Construction/demolition waste management and disposal.

.2 Remove from site all packaging materials and transport them to the appropriate recycling facilities.

.3 Collect and sort paper packaging, plastic, polystyrene, corrugated cardboard for recycling in accordance with Waste Management Plan.

.4 Sort steel scrap, metal, plastic for recycling and place in designated containers in accordance with Waste Management Plan.

.5 Divert unused metal materials from metal recycling facility.

1.7 ACCEPTABLE MATERIALS OR PRODUCTS

.1 When materials or products are prescribed by their trademarks, consult the instructions to tenderers in order to know the procedure concerning the request for approval of substitutes materials or products.

Part 2 Product

2.1 FIRE DAMPERS

.1 General:

.1 Construction:

.1 According to the classification UL 555, ULC certified.

.2 Compliant with the requirements of the NFPA-90A and the NFPA-90B brochures.

.3 Galvanised steel: 24 gauge blades, 20 gauge frame.

.4 Protection rated time as required by the current applicable codes.

.5 Fusible melting at 75ºC.

.2 When in the open position, they should allow the free passage of air through the ventilation duct (negligible static loss and noise generation) and be capable of operating at and withstanding the operating pressure of the system in which they are installed.

.3 See Part 3 "Execution", article "FIRE DAMPERS".

.2 Access doors:

.1 For fire dampers installed behind or incorporated in the grilles, they will serve as accesses. Elsewhere, at every fire damper, install access doors for inspection, adjustment, and replacement of the flap, and fusible link.

.3 Fire damper types:

.1 FD:

.1 Leak-proof, for round or oval ducts, allowing free passage of air (95-100% free area), IBD type from Ruskin, CR or CO style.

.2 Leak-proof, for square or rectangular ducts, allowing free passage of air (80-90% free area), IBD type from Ruskin, BC style

.1 In special cases where it is impossible to install the BC style, because of limited height, the A style can be used.

.3 For horizontal installations, provide a stainless steel 301 spring and latch.

2.2 MANUFACTURER LIST

.1 Comply with the article "MANUFACTURER LIST" in Section 20 00 10 - Mechanical and Electrical General Requirements.

.2 List of manufacturers, this section 23 33 16 Dampers- Fire and Smoke:

.1 Fire dampers:

.1 American Warming & Ventilating

.2 Controlled Air

.3 Nailor Industries Inc.

.4 Ruskin Manufacturing Co.

.5 or a substitute product approved in an addendum in accordance with the Instructions to tenderers

Part 3 Execution

3.1 FIRE DAMPERS

.1 General:

.1 To meet the damper’s certification, the installation will be equivalent to that used by the manufacturer during testing, according to the UL safety standard 555.

.2 Install the fire dampers as required by ULC S-112 and NFPA and according to the manufacturer's instructions, so that in the event of duct damage by the fire, the damper remains in place and ensures complete protection of the opening in the wall or the floor.

.3 Use an appropriate sleeve. Seal the spaces between the ducts and the fire walls, as required by the NFPA.

END OF SECTION

TABLE DES MATIÈRES

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 20 00 10 – Mechanical and Electrical General Requirements.

1.2 REFERENCES

.1 American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE).

.2 National Fire Protection Association (NFPA):

.1 NFPA 90A-12 – Standard for the Installation of Air-Conditioning and Ventilating Systems.

.2 NFPA 90B-12 – Standard for Installation of Warm Air Heating and Air-Conditioning Systems.

.3 Sheet Metal and Air-Conditioning Contractors' National Association (SMACNA):

.1 SMACNA HVAC – Duct Construction Standards - Metal and Flexible, 2005.

.2 SMACNA IAQ – Guideline for Occupied Buildings under Construction, 2005.

.4 Underwriters' Laboratories (UL):

.1 UL 181-2005 – Standard for Factory-Made Air Ducts and Air Connectors.

.5 Underwriters’ Laboratories of Canada (ULC):

.1 CAN/ULC-S110-2007 – Standard Methods of Test for Air Ducts.

1.3 DOCUMENTS/SAMPLES TO SUBMIT FOR APPROVAL/INFORMATION

.1 Submit all required documents and samples in accordance with section 20 00 10 – Mechanical and Electrical General Instructions.

.2 Technical datasheet:

.1 Submit required technical datasheet, and manufacturer instructions and documentation. Technical datasheets must indicate product characteristics, performance criteria, physical size, finish and

.3 Shop drawings:

.1 Submitted shop drawings stamped and signed by professional engineer registered or licensed in Canada in the province of Québec.

.4 Certificates:

.1 Submit certificates signed by manufacturer certifying that the products, materials and equipment meet the requirements as to the physical characteristics and performance criteria.

1.4 DOCUMENTS/ITEMS TO GIVE AT WORK COMPLETION

.1 Submit all required documents and items in accordance with section 20 00 10 – Mechanical and Electrical General Instructions.

.2 O M Sheets: Provide instruction for OM which will be included in the OM Manuals.

1.5 TRANSPORTATION, STORAGE AND HANDLING

.1 Transport, store and handle materials and equipment according to Section 20 00 10 – Mechanical and Electrical General Instructions.

.2 Delivery and acceptance: deliver materials and equipment to site in original factory packaging, labeled with the name and address of the manufacturer.

.3 Waste management and disposal:

.1 Separate waste materials for reuse / re-use and recycling in accordance with Section 01 74 21 – Construction/demolition waste management and disposal.

.2 Remove from site all packaging materials and transport them to the appropriate recycling facilities.

.3 Collect and sort paper packaging, plastic, polystyrene, corrugated cardboard for recycling in accordance with Waste Management Plan.

.4 Sort steel scrap, metal, plastic for recycling and place in designated containers in accordance with Waste Management Plan.

.5 Divert unused metal materials from metal recycling facility.

1.6 ACCEPTABLE MATERIALS OR PRODUCTS

.1 When materials or products are prescribed by their trademarks, consult the instructions to tenderers in order to know the procedure concerning the request for approval of substitutes materials or products

Part 2 Product

2.1 FLEXIBLE DUCTS

.1 General:

.1 Flexible ducts according to the standards NFPA-90A, NFPA-90B, and ULC.

.2 The pressure loss coefficients listed below are based on a reference coefficient of 1.00 established for metal ducts.

.3 The flame spread index must not exceed 25 and the smoke development index must not exceed 50.

.4 Submit a sample of each type.

.5 When required, use the proper tool to give the end of the flexible duct an oblong shape.

.6 Install a maximum length of 1500 mm.

.2 Low, medium, and high pressure:

.1 Aluminum, single ply, 0.15 mm thick, with mechanical joints, minimum radius of curvature at the center of the duct equal to the diameter of the conduit, minimum operating pressure of 3000 Pa, minimum collapsing pressure of 365 N/linear meter and puncture resistance with 3.175 mm diameter ball, 187 N.

.2 If insulation is required:

.1 In factory covering, 25 mm minimum thickness, fiberglass, density of 12 kg/m³, with integrated vinyl or PVC envelope having a resistance of 0.2 perm. This envelope must be protected by a sleeve made of galvanized sheet metal with a thickness of 0.551 mm (26 gauge), whenever a flexible duct passes through a wall. The sleeve must extend 100 mm past each side of the wall.

.3 Include fireproof wrapping where required, in accordance with the requirements of the local authorities.

.3 Joints between rigid and flexible ducts:

.1 Attach the flexible ducts to the rigid ducts, air supply terminal units, and diffusers using metal screws or metal clamping bands, make airtight with a sealant, and cover everything with tape. The sealant must have a VOC content below 250 g/l.

2.2 MANUFACTURER LIST

.1 Comply with the article "MANUFACTURER LIST" from Section 20 00 10 - Mechanical and Electrical General Requirements.

.2 List of manufactures, this section 23 33 46 Flexible Ducts:

.1 Sealant (less than 250 gr/l of VOCs):

.1 Duro-Dyne (DDS-181)

.2 Hardcast Carlisle (Duct-Seal 321)

.3 Trans Continental Equipment Ltd (Multipurpose MP)

.4 or a substitute product approved in an addendum in accordance with the Instructions to tenderers.

.2 Tape:

.1 Duro-Dyne (fiberglass FT-2)

.2 Trans Continental Equipment Ltd (Simple Seal and Simple Tape)

.3 Flexmaster (Duct Bond)

.4 Hardcast Carlisle (Foil Grip)

.5 or a substitute product approved in an addendum in accordance with the Instructions to tenderers.

.3 Gaskets:

.1 Hardcast Carlisle (Flange Gasket 1902)

.2 Multifeutre du Quebec Ltd

.3 3M Ltd (LC-105 Gaskets)

.4 or a substitute product approved in an addendum in accordance with the Instructions to tenderers.

.4 Flexible ducts:

.1 Boflex Inc. (types AS and AI)

.2 Trans Continental Equipment Ltd (AI-U-Flex)

.3 Flexmaster Co. Ltd (Triple Lock)

.4 or a substitute product approved in an addendum in accordance with the Instructions to tenderers.

.5 Protective paint:

.1 Sico (Corostop, Crown Diamond)

.2 ZRC Products Co. (Kerry Industries Ltd)

.3 or a substitute product approved in an addendum in accordance with the Instructions to tenderers.

Part 3 Execution

3.1 INSPECTION

.1 Conditions verification: prior to proceeding to the installation of flexible air ducts, ensure that the state of the surfaces/supports previously implemented under the constraints of other sections or contracts is acceptable and permits the execution of the work in accordance with manufacturer's written instructions.

.2 Make a visual inspection of surfaces/supports in the presence of the Engineer.

3.2 FLEXIBLE DUCT INSTALLATION

.1 Install flexible air ducts in accordance with CAN/ULC-S110, NFPA-90A and NFPA-90B.

END OF SECTION

TABLE DES MATIÈRES

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 20 00 10 – Mechanical and Electrical General Requirements.

.2 Section 23 05 53.01 – Mechanical Identification.

.3 Section 23 33 46 – Flexible Ducts.

1.2 REFERENCES

.1 American National Standards Institute/Air Movement and Control Association (ANSI/AMCA):

.1 ANSI/AMCA – Standard 210-2007/(ANSI/ASHRAE 51-07), Laboratory Methods of Testing Fans for Aerodynamic Performance Rating.

.2 International Organization for Standardization (ISO):

.1 ISO 3741-2010 – Acoustics – Determination of sound power levels and sound energy levels of noise sources using sound pressure – Precision methods for reverberation test rooms.

.3 National Fire Protection Association (NFPA):

.1 NFPA 90A-12 – Standard for the Installation of Air Conditioning and Ventilating Systems.

.4 Underwriter's Laboratories (UL):

.1 UL 181-2005(R2008) – Factory-Made Air Ducts and Air Connectors.

1.3 DOCUMENTS/SAMPLES TO SUBMIT FOR APPROVAL/INFORMATION

.1 Submit all required documents and samples in accordance with section 20 00 10 – Mechanical and Electrical General Instructions.

.2 Technical datasheet:

.1 Submit required technical datasheet, and manufacturer instructions and documentation. Technical datasheets must indicate product characteristics, performance criteria, physical size, finish and

.3 Shop drawings:

.1 Submitted shop drawings stamped and signed by professional engineer registered or licensed in Canada in the province of Québec.

.4 Certificates:

.1 Submit certificates signed by manufacturer certifying that the products, materials and equipment meet the requirements as to the physical characteristics and performance criteria.

1.4 DOCUMENTS/ITEMS TO GIVE AT WORK COMPLETION

.1 Submit all required documents and items in accordance with section 20 00 10 – Mechanical and Electrical General Instructions.

.2 O M Sheets: Provide instruction for OM which will be included in the OM Manuals.

1.5 TRANSPORTATION, STORAGE AND HANDLING

.1 Transport, store and handle materials and equipment according to Section 20 00 10 – Mechanical and Electrical General Instructions.

.2 Delivery and acceptance: deliver materials and equipment to site in original factory packaging, labeled with the name and address of the manufacturer.

.3 Waste management and disposal:

.1 Separate waste materials for reuse / re-use and recycling in accordance with Section 01 74 21 – Construction/demolition waste management and disposal.

.2 Remove from site all packaging materials and transport them to the appropriate recycling facilities.

.3 Collect and sort paper packaging, plastic, polystyrene, corrugated cardboard for recycling in accordance with Waste Management Plan.

.4 Sort steel scrap, metal, plastic for recycling and place in designated containers in accordance with Waste Management Plan.

.5 Divert unused metal materials from metal recycling facility.

1.6 ACCEPTABLE MATERIALS OR PRODUCTS

.1 When materials or products are prescribed by their trademarks, consult the instructions to tenderers in order to know the procedure concerning the request for approval of substitutes materials or products.

Part 2 Product

2.1 STANDARDS

.1 All types of units will be the type that is independent of the air network's pressure.

.2 The standards and the norms to be respected are given in the component descriptions.

.3 The catalog data must be certified by an independent laboratory, member of the ADC (Air Diffusion Council).

2.2 DOCUMENTS TO BE PROVIDED

.1 Shop Drawings:

.1 For each type of supply air terminal units, provide shop drawings specifying the following:

.1 Models.

.2 Dimensions and construction details of each model.

.3 Minimum operating pressure required at the inlet of the unit.

.4 Sound power transmitted and radiated to each of the frequency bands from 2 to 7 inclusively.

.5 Curves modulating the amount of air.

.6 Air leak curves when the unit is closed.

.7 Characteristics of the thermal acoustic insulation and protection against erosion.

.8 Controls diagram, component characteristics, and description of operation for each type of unit.

.2 List of supply air terminal units:

.1 The list of supply air terminal units must provide the following information:

.1 Identification on drawings and the unit, according to the article "CODIFIED IDENTIFICATION" from Section 23 05 53.01– Mechanical Identification.

.2 Model of the unit.

.3 Flow in L/s for units with variable air flow, the minimum and the maximum quantities of air.

.4 Orientation (left or right) for dual air intake units.

.5 Static pressure loss through the unit.

.3 Samples:

.1 Provide a sample of each type of unit to be able to demonstrate the quality of the construction.

2.3 CONSTRUCTION

.1 Rigid galvanized steel construction, 0.853 mm (22 gauge) minimum. The construction of the joints, the gaskets, and the dampers must ensure a maximum leakage of 2% of the unit’s rated capacity when a pressure of 750 Pa is applied at the input of the unit and according to the ASHRAE test method 130.

.2 Heavy gauge galvanized steel air flow control damper with self-lubricating steel or brass shaft and bearings, shaft with position indicator, damper stops with neoprene gaskets to minimize air leakage.

.3 The inner walls of the terminal unit will be insulated acoustically with an erosion protective coating. The insulation must meet the NFPA-90A standards, and the requirements of the local authorities.

.4 Operating pressure of 75 to 1000 Pa.

.5 The air inlet and outlet dimensions must be such that normal air velocities can be measured effectively by the flow sensors.

.6 Ensure easy access to the modulation and control mechanisms.

.7 Protect the controls using an easily removable steel sheet.

.8 See the article "CALIBRATION".

.9 Acoustic insulation:

.1 On the inner walls of the terminal unit, 72 kg/m³ type MD104 insulation, covered with a plain weave fiberglass cloth (warp: 12.6 strands/cm and weft: 10.6 strands/cm), 0.125 mm thick, 81 g/m², puncture resistant. Glue the cloth using a type of adhesive with a low VOC content. The process should allow to conserve the entire acoustic attenuation by the insulation in the first four frequency bands and at least 70% of the attenuation in other bands while protecting the insulation against surface erosion.

.2 The adhesive and the fabric must be UL or ULC approved, have undergone testing according to the ASTM-E-84-814 method and respect the following maximum indexes:

.1 Flame spread : 25

.2 Combustibility : 50

.3 Smoke developed : 50

.3 At the longitudinal seams, the cloth must cover the insulation and be folded under the edge over a length of 25 mm before being glued.

.4 At the ends, the cloth must be folded and glued to the sheet metal to be fixed by the joint.

.10 The units must bear the ARI seal.

2.4 TERMINAL UNIT TYPES

.1 See the articles "CONSTRUCTION" and "CONTROLS".

.2 Types:

.1 TU-2 - Single duct, variable air flow:

.1 Acoustic insulation: unless otherwise specified, apply a thickness of 13 mm, see the article "ACOUSTIC INSULATION".

.2 The velocity reading sensors located at the inlet of the units will be the multiport type.

.3 Similar to the model SDV from E.H. Price Ltd.

.2 TU-6 - Single duct, constant air flow, with electric heating coil:

.1 Same construction as the type TU-1 and comprising:

.1 Electric coils, of the capacity specified in the table included in the specification or in the drawings.

.2 Factory assembled, so that the entire unit receives the UL95 and CSA approvals.

.3 Heavy gauge galvanized frame and housing for a robust assembly with an access door to the coil, the assembly being an integral of the unit.

.4 Elements:

.1 Superior quality and low density wires to avoid overheating at the maximum, which would cause the cycling of the thermal protection, and insulated from the frame with ceramic rings.

.5 Protection:

.1 First thermal protection by an automatic reset circuit breaker, second protection with a manual reset. Circuit breakers with fuses are unacceptable.

.2 Differential pressure switch ensuring a sufficient air flow before the powering the element.

.2 Provide the connection terminals and a low-voltage transformer in the control box. Coordinate with the Division 25.

.3 The controls must all be accessible from the same side.

2.5 CONTROLS

.1 The supply air terminal unit controls are digital and compatible with the building management and control system. These controls are for: digital controllers, actuators, flow transmitters, flow sensors.

.2 The flow sensors provided and installed in the unit must be placed in areas representative of the air flow and where the flow is laminar to obtain reliable and accurate measurements.

.3 When the sensor controller must control the total air flow of a dual air input unit, the location of the sensor and the dimensions of the unit must be such that the controller can readjust the air flow modulating mechanism(s) to obtain the amounts of air within the limits prescribed by supply air terminal unit tables.

.4 The following equipment will be supply by the control contractor but will be installed, adjusted and calibrated at the terminal unit manufacturer’s production plant: electronic regulators, currant transformers, velocity transducer and servomotors.

2.6 TESTS

.1 General:

.1 Before proceeding to the mass production of supply air terminal units, build a complete sample of each type to perform the required tests and demonstrate that the operation meets this specification’s requirements.

.2 Tests:

.1 With the collaboration of the controls contractor and in the presence of the owner’s representatives, execute the tests described below on all types of units requested in the specification, on the construction site.

.2 Before the tests, submit for comments the proposed procedure and the description of the installations and the equipment used to conduct these tests.

.3 Once testing is complete, submit a full report of the results.

.1 Noise level:

.1 At a static pressure of 500 Pa, the PWL-NC index of the terminal unit for the radiated noise and the noise at the discharge.

.2 Resistance to leaking:

.1 At 500 Pa, show that the maximum acceptable leakage is respected.

.3 Volume control:

.1 Demonstrate the accuracy of the air flow control mechanism from 125 to 500 Pa (5% over the whole static pressure range).

.4 Temperature control:

.1 With a constant pressure at the inlet, establish the graph for the flow variation in function of the motor power.

.5 Operating sequences:

.1 Demonstrate that the operating sequences are followed.

.6 Graph:

.1 Provide the following graphs:

.1 Output signal of the detector tube as a function of the air flow.

.2 Calibration graph showing the changes in capacity, following the adjustment of the flow controllers.

2.7 CALIBRATION

.1 Adjust and calibrate the units in factory so as to obtain the specified air quantities.

.2 To permit the calibration on-site after the installation, provide a barbed type T fitting on the tubes that transmit the sensor readings to the controller.

2.8 NOISE LEVEL CONTROL

.1 Include in the tender, all the elements required to maintain the required noise levels, silencer at the discharge, special acoustic treatment against radiated noise, etc. Demonstrate through tests performed by an independent competent laboratory that each model of each type of unit meets the specified requirements.

2.9 CHOICE OF AIR SUPPLY TERMINAL UNITS

.1 The contractor is responsible for the final selection of supply air terminal units so that the following requirements are met.

.1 Noise level in the rooms supplied.

.2 Supplied air quantity.

.3 Modulation of the amounts of air according to the variables indicated in the diagrams.

2.10 MANUFACTURER LIST

.1 Comply with the article "MANUFACTURER LIST" from Section 20 00 10 - Mechanical and Electrical General Instructions.

.2 List of manufacturers, this section 23 36 00 - Air Terminal Units:

.1 Air supply terminal units:

.1 Carnes

.2 E.H. Price Ltd

.3 Nailor Industries Inc. (QAT)

.4 Titus (Distributions Valois & Beaulieu Inc.)

.5 Krueger (Distributions Bruno Valois Inc.)

.6 or a substitute product approved in an addendum in accordance with the Instructions to tenderers.

Part 3 Execution

3.1 INSTALLATION

.1 At the inputs of each unit, install the flexible ducts as described in 23 33 46 – Flexible Air Ducts and according to the manufacturer's recommendations.

.2 The installation will be done so as to facilitate access to the control devices and the access doors.

.3 Use separate supports from those used for the ducts.

.4 Directly upstream of each terminal unit, provide a straight length of duct equal to at least four (4) times the diameter of the duct used, which must have the same diameter as the entry of the element.

.5 Install the terminal elements so as to facilitate access to controls/regulation devices, dampers, and access doors.

AIR SUPPLY TERMINAL UNIT CHARACTERISTICS							
Identification							
Type							
Air flow (L/s)	Hot						
	Cold						
	Minimum						
	Maximum						
Model							
Comments							
Notes :							

AIR SUPPLY TERMINAL UNIT CHARACTERISTICS							
Identification							
Type							
Air flow (L/s)	Hot						
	Cold						
	Minimum						
	Maximum						
Model							
Comments							
Notes :							

END OF SECTION

TABLE DES MATIÈRES

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 20 00 10 - Mechanical and Electrical General Instructions.

1.2 EQUIPMENT TO BE GIVEN TO OWNER

.1 Also provide the following.

.1 Keys for flow control.

.2 Keys for air pattern adjustment.

1.3 DOCUMENTS/SAMPLES TO SUBMIT FOR APPROVAL/INFORMATION

.1 Submit all required documents and samples in accordance with section 20 00 10 – Mechanical and Electrical General Instructions.

.2 Technical datasheet:

.1 Submit required technical datasheet, and manufacturer instructions and documentation. Technical datasheets must indicate product characteristics, performance criteria, physical size, finish and

.3 Shop drawings:

.1 Submitted shop drawings stamped and signed by professional engineer registered or licensed in Canada in the province of Québec.

.4 Certificates:

.1 Submit certificates signed by manufacturer certifying that the products, materials and equipment meet the requirements as to the physical characteristics and performance criteria.

1.4 DOCUMENTS/ITEMS TO GIVE AT WORK COMPLETION

.1 Submit all required documents and items in accordance with section 20 00 10 – Mechanical and Electrical General Instructions.

.2 O M Sheets: Provide instruction for OM which will be included in the OM Manuals.

1.5 TRANSPORTATION, STORAGE AND HANDLING

.1 Transport, store and handle materials and equipment according to Section 20 00 10 – Mechanical and Electrical General Instructions.

.2 Delivery and acceptance: deliver materials and equipment to site in original factory packaging, labeled with the name and address of the manufacturer.

.3 Waste management and disposal:

.1 Separate waste materials for reuse / re-use and recycling in accordance with Section 01 74 21 – Construction/demolition waste management and disposal.

.2 Remove from site all packaging materials and transport them to the appropriate recycling facilities.

.3 Collect and sort paper packaging, plastic, polystyrene, corrugated cardboard for recycling in accordance with Waste Management Plan.

.4 Sort steel scrap, metal, plastic for recycling and place in designated containers in accordance with Waste Management Plan.

.5 Divert unused metal materials from metal recycling facility.

1.6 ACCEPTABLE MATERIALS OR PRODUCTS

.1 When materials or products are prescribed by their trademarks, consult the instructions to tenderers in order to know the procedure concerning the request for approval of substitutes materials or products

Part 2 Product

2.1 GENERAL

.1 Grilles and diffusers conforming with 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 cannot be changed without authorization. When two or more grilles and diffusers are connected to the same unit and do not have integrated balancing dampers, supply and install a balancing damper in a branch. For the diffuser types AL, AN, ANC, AQ, CQA, and AS, see the connection details for a diffuser.

.2 With neoprene gasket around the edge, allowing a very tight seal.

.3 The return grilles are also used for evacuation.

.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 At the architect’s request, baked enamel finish, color and texture at the architect’s choice.

.10 Provide shop drawings and a sample of each type of grille and diffuser used.

.11 Fixation with exposed or concealed screws.

.12 All grilles and diffusers must be equipped with seismic restraint systems.

.13 Refer to drawings for models of grilles and diffuser.

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 flathead screws and screw them into the countersunk holes.

END OF SECTION

TABLE DES MATIÈRES

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 DOCUMENTS/SAMPLES TO SUBMIT FOR APPROVAL/INFORMATION

.1 Submit all required documents and samples in accordance with section 20 00 10 – Mechanical and Electrical General Instructions.

.2 Technical datasheet:

.1 Submit required technical datasheet, and manufacturer instructions and documentation. Technical datasheets must indicate product characteristics, performance criteria, physical size, finish and

.3 Shop drawings:

.1 Submitted shop drawings stamped and signed by professional engineer registered or licensed in Canada in the province of Québec.

.4 Certificates:

.1 Submit certificates signed by manufacturer certifying that the products, materials and equipment meet the requirements as to the physical characteristics and performance criteria.

1.4 DOCUMENTS/ITEMS TO GIVE AT WORK COMPLETION

.1 Submit all required documents and items in accordance with section 20 00 10 – Mechanical and Electrical General Instructions.

.2 O M Sheets: Provide instruction for OM which will be included in the OM Manuals.

1.5 TRANSPORTATION, STORAGE AND HANDLING

.1 Transport, store and handle materials and equipment according to Section 20 00 10 – Mechanical and Electrical General Instructions.

.2 Delivery and acceptance: deliver materials and equipment to site in original factory packaging, labeled with the name and address of the manufacturer.

.3 Waste management and disposal:

.1 Separate waste materials for reuse / re-use and recycling in accordance with Section 01 74 21 – Construction/demolition waste management and disposal.

.2 Remove from site all packaging materials and transport them to the appropriate recycling facilities.

.3 Collect and sort paper packaging, plastic, polystyrene, corrugated cardboard for recycling in accordance with Waste Management Plan.

.4 Sort steel scrap, metal, plastic for recycling and place in designated containers in accordance with Waste Management Plan.

.5 Divert unused metal materials from metal recycling facility.

1.6 ACCEPTABLE MATERIALS OR PRODUCTS

.1 When materials or products are prescribed by their trademarks, consult the instructions to tenderers in order to know the procedure concerning the request for approval of substitutes materials or products.

Part 2 Products

2.1 COIL SPECIFICATIONS

.1 For specific characteristics, see the coil tables.

2.2 ELECTRIC HEATING COILS

.1 Standards:

.1 Manufactured according to the standards ARI 410, ASHRAE 33, and UL Laboratories for "Zero Clearance", and CSA approved.

.2 Obtain from the manufacturer, a warranty letter that their products can operate at the required conditions.

.3 Provide electrical diagrams.

.2 Basic criteria:

.1 Maximum capacity: 242 kW/m²

.2 Maximum capacity of a single stage internal circuit, 48 A, or:

.1 208 V, single phase : 5 kW

.2 347 V, single phase : 16.7 kW

.3 600 V, three phase : 49.8 kW

.3 The coils must undergo, with success, the dielectric tests at 2000 V before delivery.

.4 When the air flow is variable or that the air velocity is less than 2.02 m/s, provide a coil composed of low density elements with adequate protection.

Minimum air velocity m/min	27.4	38.1	42.7	45.7	61
Maximum element density W/mm²	0.023	0.031	0.039	0.046	0.054

.5 Maximum element capacity of 0.039 W/mm².

.6 When a coil is composed of several modules, the assembly must function as a single coil.

.7 Heating elements, the full surface types (FFD), having at least one vertical layer of heating elements per stage.

.8 Electric coils equipped with automatic reset primary sensor. In case of overheating, the action of these sensors will cause the simultaneous opening of all the power supply circuits to the coil. In the case of horizontal ventilation ducts, this sensor must be installed on top of the coil.

.9 Coils 30 kW or less are equipped with a manual reset secondary discoid sensor, calibrated at a higher temperature than the primary sensor.

.10 The primary and secondary coil sensors 1200 mm wide or less and fitted with contactors must be accessible from the terminal box and can be easily replaced without having to remove the ventilation duct coils.

.11 Protective screen upstream and downstream, made of expanded aluminum.

.12 The static pressure loss of air passing through the coil must include losses due to protective screens.

.3 Enclosure:

.1 Install all connections, contactors, and coil controls in a suitably sized enlcosure with a cover.

.2 This enclosure must include, among others:

.1 The electrical connection terminals, the identified connection blocks, the control transformers, the protection fuses for the control circuit, the protection fuses for the elements, the magnetic contactors, the thermal protectors, and the controls.

.2 All assembled and pre-wired in factory. Adapt the dimensions of the metal enclosures to the site conditions, install the coil and enclosure assembly so as to leave a clearance (clearance of 1 m at the access doors and cover).

.3 For capacities of 25 kW and less, supply and install a coil with an integrated enclosure containing primary controls, contactors, SSR or SCR, etc.

.3 Connector panel complete with sleeve to cross the insulation. Galvanized steel frame with flanges for connection to the ventilation ducts.

.4 Controls:

.1 Provide the coil with the following controls:

.1 An adjustable differential pressure controller or a flow switch to protect the coil.

.2 When required, SSR or SCR controllers cooled by the surrounding air and not by the ventilation duct air. The SCR heat sink must dissipate its heat to the exterior of the housing so as not to overheat the control circuits, unless the enclosure is ventilated for this purpose.

.3 The magnetic contactors of special model approved by the CSA and certified for over 250,000 operating cycles.

.4 For coils operating at 347 V, a thermomagnetic circuit breaker is provided and installed by the division 26 in the connector panel to protect the coil.

.5 Supply and install a manual switch, without fuses, united, bipolar or tripolar, in the enclosure from the coil manufacturer.

.6 Important:

.1 When using a mixed control, meaning proportional and cascade, the proportional stage capacity must be at least equal to 120% of the individual capacity of other stages.

.5 Open type coils:

.1 The heating elements are exposed coils, 80% nickel and 20% chromium, premium quality and without a traces of iron.

.2 The coils will always be installed horizontally and insulated from the intermediate supports by ceramic sleeves retained in position. These sleeves, however, will be free to expand according to temperature variations of the elements to withstand the thermal and mechanical shocks.

.3 The ends of the elements will be connected to the enclosure of the electrical connections with end terminals secured to ceramic anti-swivel sleeves passing through the enclosure.

2.3 MANUFACTURER LIST

.1 Comply with the article "MANUFACTURER LIST" in Section 20 00 10- Mechanical and Electrical General Requirements.

.2 List of manufacturers, this section 23 73 12 – Heating and Cooling Coils:

.1 Electric heating coils:

.1 Delta (Q.A.T.)

.2 Gess Co.

.3 Neptronic

.4 Thermolec Manufacturing Ltd

.5 or a substitute product approved in an addendum in accordance with the Instructions to tenderers.

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 For systems serving hospitals, clean rooms, factories, pharmaceutical laboratories, and similar facilities, to reduce the risk of contamination, the coils supports are made with the hollow structural section (HSS) type.

.3 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.

.4 Submit installation drawings.

END OF SECTION

TABLE DES MATIÈRES

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 Heating, Refrigeration and Air-Conditioning Engineers (ANSI/ASHRAE):

.1 ANSI/ASHRAE 52.2-2007 – Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particulate Size.

.2 ANSI/ASHRAE 127-2007 – Method of Testing for Rating Computer and Data Processing Room Unitary Air-Conditioners.

.2 ASTM International:

.1 ASTM C547-11 – Specification for Mineral Fiber Pipe Insulation.

.3 CSA International:

.1 CSA B52-05(C2009) – Mechanical refrigeration code.

.2 CAN/CSA-C656-05(C2010) – Performance standard for split-system and single-package air conditioners and heat pumps.

1.3 DOCUMENTS/SAMPLES TO SUBMIT FOR APPROVAL/INFORMATION

.1 Submit all required documents and samples in accordance with section 20 00 10 – Mechanical and Electrical General Instructions.

.2 Technical datasheet:

.1 Submit required technical datasheet, and manufacturer instructions and documentation. Technical datasheets must indicate product characteristics, performance criteria, physical size, finish and

.3 Shop drawings:

.1 Submitted shop drawings stamped and signed by professional engineer registered or licensed in Canada in the province of Québec.

.4 Certificates:

.1 Submit certificates signed by manufacturer certifying that the products, materials and equipment meet the requirements as to the physical characteristics and performance criteria.

1.4 DOCUMENTS/ITEMS TO GIVE AT WORK COMPLETION

.1 Submit all required documents and items in accordance with section 20 00 10 – Mechanical and Electrical General Instructions.

.2 O M Sheets: Provide instruction for OM which will be included in the OM Manuals.

1.5 TRANSPORTATION, STORAGE AND HANDLING

.1 Transport, store and handle materials and equipment according to Section 20 00 10 – Mechanical and Electrical General Instructions.

.2 Delivery and acceptance: deliver materials and equipment to site in original factory packaging, labeled with the name and address of the manufacturer.

.3 Waste management and disposal:

.1 Separate waste materials for reuse / re-use and recycling in accordance with Section 01 74 21 – Construction/demolition waste management and disposal.

.2 Remove from site all packaging materials and transport them to the appropriate recycling facilities.

.3 Collect and sort paper packaging, plastic, polystyrene, corrugated cardboard for recycling in accordance with Waste Management Plan.

.4 Sort steel scrap, metal, plastic for recycling and place in designated containers in accordance with Waste Management Plan.

.5 Divert unused metal materials from metal recycling facility.

1.6 ACCEPTABLE MATERIALS OR PRODUCTS

.1 When materials or products are prescribed by their trademarks, consult the instructions to tenderers in order to know the procedure concerning the request for approval of substitutes materials or products

Part 2 Product

2.1 ACCESSOIRES

.1 All required accessories: valves, including isolation valve for maintenance and repair, etc. will be Sporlan, Alco or a substitute product approved in an addendum in accordance with the Instructions to tenderers.

2.2 SYSTÈME DE CLIMATISATION À EXPANSION DIRECTE

.1 Mitsubishi direct expansion split unit made of a condenser unit and a wall evaporator unit.

.2 For each evaporator unit, supply a Mitsubishi no PAR-21MAA remote control.

.3 The condenser unit will have a minimum static pressure of 0.3" of water.

.4 The unit will have to operate at -40°C/°F.

.5 Characteristics:

.1 Condenser Unit no CDN-1:

.1 Location: roof

.2 Model: Mitsubishi no PUZ-A30NHA4

.3 Refrigerant: R-410a

.4 Electricity: 208 V/1/60, MCA: 25 A

.5 Dimensions: 950 mm x 330 mm x 943 mm

.2 Evaporator unit no UAC-1:

.1 Location: server room

.2 Model: Mitsubishi no PKA-A30HA

.3 Electricity: 208V/1/60, MCA: 1 A

.4 Cooling capacity: 8.78 kW

.5 Dimensions: 1170 mm x 295 mm x 365 mm

2.3 ACCOUSTIC PADS

.1 Made of 30 or 50 durometers neoprene, waffled face of 16 mm thickness. Glue a galvanized steel plate of 6.4 mmm thickness on both face.

.2 Calculate the dimensions of each pads for an optimal de 275 kilonewtons/m² representing a static deflexion of mm.

2.4 MANUFACTURER LIST

.1 Manufacturer list, this section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment.

.2 Manufacturer list section 23 81 23:

.1 Isolateurs de vibrations:

.1 Korfund Sampson Ltée

.2 Mason Industries

.3 Vibro-Racan (Racan Carrier)

.4 Vibron Ltée

.5 or a substitute product approved in an addendum in accordance with the Instructions to tenderers.

Part 3 Execution

3.1 GENERAL

.1 Install according to the indications, the manufacturer's recommendations, and according to the requirements from the document SPE 1/RA/2F.

.2 The manufacturer must approve the installation.

3.2 INSTALLATION

.1 Perform refrigeration work according to codes. Work must be done by accredited refrigeration mechanics.

.2 Welding: When welding, in the pipes, keep a nitrogen flow coming from a cylinder equipped with a regulator.

END OF SECTION