# Performance quote - Mechanical and Electrical

## Issued for tender

Ref.: F2301691

**Customer's project : 4506283-1**

## Correctional Service of Canada

**January 24th, 2024**

# Replacement of a cooling unit (343-2701)

For tender

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# Replacement of a cooling unit (343-2701)


**Building mechanical**

Prepared and verified by :

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**Building electrical**

Document signé numériquement / Digitally signed document

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2024-01-24

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***This document is not to be used for construction purposes***

| Emissions register and revisions | | |
|---|---|---|
| Identification | Date | Description of issue and/or revision |
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General note : The quote in French takes precedence over the quote in English

# 1 GENERAL

## 1.1 WORK COVERED BY CONTRACT DOCUMENTS

.1 The work covered by this contract is to be performed at the Archambault Penitentiary located in Sainte-Anne-des-Plaines.

.2 Work consists of :

.1 Replace existing cooling unit no. 343-2701 located on the roof of the Centre Régional de Réception (CRR) secteur Orientation.

.2 Replace cooling coil connected to cooling unit no. 343-2701.

## 1.2 REPLACING REFRIGERATION PIPING BETWEEN UNIT AND COIL

.1 Work is to be carried out under a single lump sum contract.

.2 The relationship and responsibilities between the Contractor and subcontractors appointed by the Customer shall be in accordance with the terms of the contract. In addition, designated subcontractors shall:

.1 Provide the Contractor with bonds for subcontracted work and related payment guarantees;

.2 Obtain and maintain liability insurance to protect the Contractor against potential claims.

# 2 SCOPE OF WORK

## 2.1 GENERAL

.1 The work covered by this contract is to be performed at the Archambault Penitentiary located in Sainte-Anne-des-Plaines.

.2 The work consists of :

.1 Replacing existing cooling unit no. 343-2701 located on roof of Regional Reception Centre (RRC) in Orientation sector.

.2 Replacing cooling coil connected to cooling unit no. 343-2701. This is installed in a ventilation unit located in the basement mechanical room.

.3 Replacing refrigeration piping between unit and coil.

.4 Disconnecting the power supply from unit 343-2701 and electrically connect the new cooling unit.

.3 The existing outdoor chiller is CARRIER model 38AD-024-120, series W883230, with a capacity of 20 tons and running on halocarbon R22 refrigerant.

.4 Dimensions of cooling coil are approximately 78" x 24" (exact measurements to be confirmed by contractor prior to work).

.5 Cooling/Plumbing Contractor to contact Regulvar to coordinate disconnection of automatic control equipment from existing unit and provide for connection of new automatic control equipment for new cooling unit.

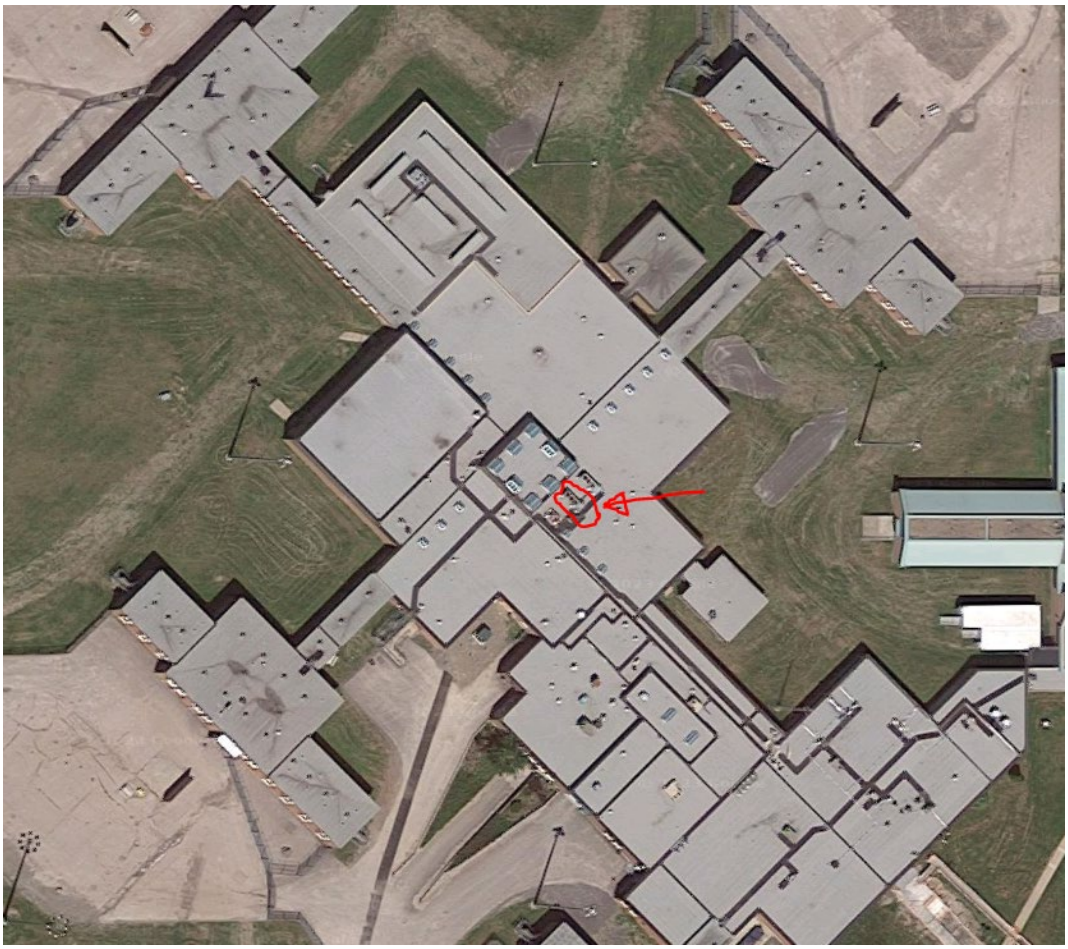
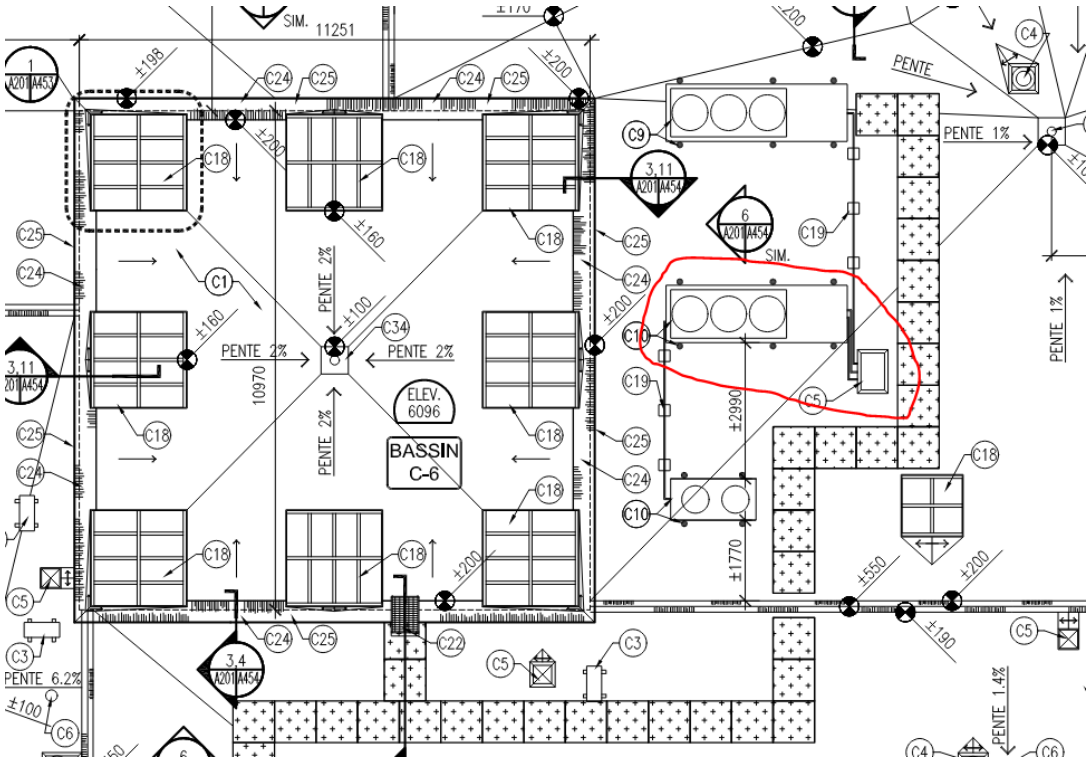


Photo 1: Cooling unit to be replaced




Architectural roof plan extract: Cooling unit to be replaced with roof box for refrigerant piping.

Photo 2: Cooling unit to be replaced

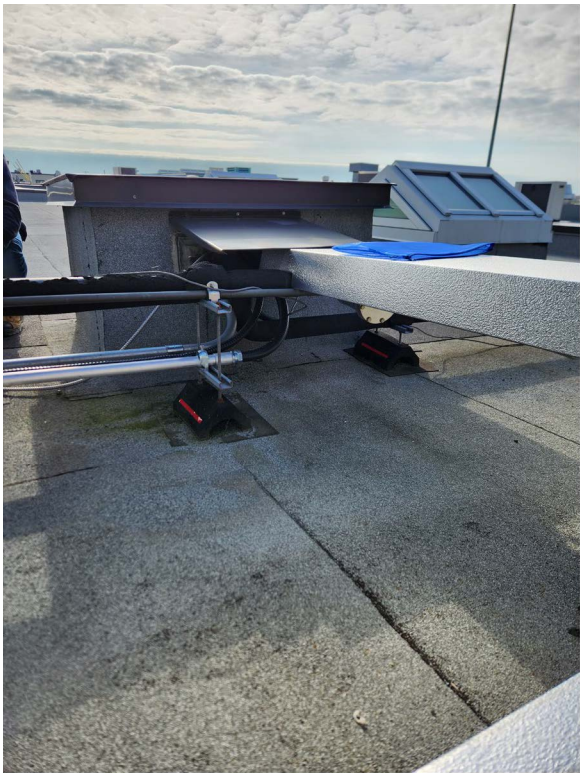


Photo 3: Roof box for refrigerant piping.


Photo 4: Cooling coil to be replaced in existing unit.

## 2.2 DEMOLITION WORK

.1 Cooling/plumbing :

.1 Coordinate cooling unit shutdown with Customer.

.2 Coordinate electrical disconnection of unit with electrical contractor.

.3 Plan and coordinate the use of lifting equipment with the Client. Contractor is responsible for crane operator and for having a lifting plan in compliance with occupational health and safety standards.

.4 Empty R22 refrigerant piping and dispose of in accordance with halocarbon regulations.

.5 Dismantle rooftop cooling unit.

.6 Open roof box to dismantle refrigerant piping to basement. These pipes run for a maximum distance of about 70 feet.

.7 Prior to dismantling cooling coil, take flow and temperature measurements upstream and downstream of coil.

.8 Dismantle condensate drain piping from coil to floor drain.

.9 When removing the coil, the contractor must measure its exact dimensions and verify its characteristics (number of rows, for example). This information will be imperative to validate the selection of the new coil.

.10 Dispose of existing coil off-site.

.11 Coordinate Regulvar's intervention for the automatic regulation work.

.2 Automatic control (Regulvar):

.1 Dismantle automatic control equipment. Cooling/Plumbing Contractor to allow access to site for Regulvar to dismantle unit and coil building controls.

.3 Electricity :

.1 Disconnect and remove all existing wiring from demolition air-conditioning unit identified as ''AC-2'' between motor control center and unit. Remove all brackets and/or accessories associated with this installation.

.2 Disconnect and remove external disconnect switch located near demolition air-conditioning unit identified as "AC-2".

.3 If required, remove the existing fuses located in the motor control center cell supplying the air-conditioning unit in order to reuse this power supply by replacing the fuses.

## 2.3 CONSTRUCTION WORK

.1 Cooling/plumbing:

.1 New cooling unit has different dimensions from existing unit. Provide for adaptation of roof base of new unit to existing roof supports. Work must not damage roof covering.

.2 Arrange and coordinate use of lifting equipment with customer. Contractor is responsible for crane operator and for having a lifting plan in compliance with occupational health and safety standards.

.3 Verify condition of mechanical shaft for passage of refrigeration piping.

.4 Supply and install new cooling unit in compliance with latest environmental standards. See section 23 64 26 for cooling unit technical specifications.

.5 Seal entire unit and base.

.6 Supply and install new cooling coil in basement unit.

.1 Acceptable products: REFPLUS model DHS-28-03-10-82-RH or approved equivalent.

.2 Total capacity: 282,000 btu/hr.

.3 Two circuits.

.4 Contractor to measure dimensions prior to ordering. Coil dimensions are approximately 78" x 24".

.5 Coil to be selected to provide, with a single coil, the required face area occupying the maximum space inside the cabinet and at the same capacity as the existing.

.6 Contractor to design coil section and select coil so that installation of condensate drip pans is not required in any downstream sections.

.7 Coil shall be constructed to provide air velocity at rated load in accordance with Air Conditioning and Refrigeration Institute (ARI) certification requirements.

.8 Top and side panels of coil section shall be removable so as to facilitate installation or removal of coil without compromising strength of assembly.

.9 Coil frame shall be 16-gauge galvanized steel. Tube plates at both ends shall be provided with collars to support tubes. Intermediate support to be provided. Frame profiles must be smooth to prevent water and contaminants from entering. Profiles shall not encroach on finned surface.

.10 Headers are to be seamless heavy gauge copper tubing, connected to tubes by silver brazing. Fittings shall be steel, male threaded and silver brazed to manifold. Each fitting shall be fitted with a plug vent and a female thread drain cock. All vents and drain cocks must be extended outside the system casing.

.7 Supply and install cooling piping in accordance with manufacturer's specifications. Pipe run is approximately 70 feet from rooftop unit to coil.

.1 Install piping in such a way as to be able to isolate the various devices and thus allow their dismantling or removal, if necessary, without interrupting the operation of other system components.

.2 Assemble piping using fittings manufactured in accordance with relevant ANSI standards.

.3 Weld components in accordance with latest standards and codes.

.8 Supply and install all accessories required for proper operation of unit. (Expansion valves, etc.).

.9 Connect coil condensate drain to nearest floor drain.

.10 Cooling/plumbing contractor will not be responsible for connection of building controls.

.11 Perform required pipe leakage tests in accordance with good engineering practice.

.12 If required, adjust refrigerant charge for proper operation.

.13 Complete commissioning and report.

.14 Coordinate Regulvar's intervention for automatic regulation work.

.2 Automatic control (Regulvar):

.1 Building controls will be supplied and installed by Regulvar Contractor prior to equipment installation. Contractor shall allow access to site for Regulvar to install building controls for new cooling unit and coil.

.3 Electricity :

.1 Connect electrical power to new air conditioning unit supplied and installed by Mechanical Division, as per manufacturer's recommendations.

.2 If required, supply and install fuses in existing fuse port of motor control center cell to power new A/C unit as per manufacturer's recommendations.

.3 Supply, install and connect 3#6 teak 90 1000V cable for main power supply connection to new A/C unit.

.4 Supply, install and connect a 60A-600V-3P fuseless disconnect switch with NEMA 3R enclosure in the vicinity of the air-conditioning unit, installed by the mechanical division.

.5 Supply, install and connect a GFCI type receptacle (5-20R) with weatherproof enclosure close to the rooftop air-conditioning unit as a power supply point in case of maintenance. Supply, install and connect a 2#12 teak 90 cable for this installation. Supply, install and connect a 20A-120V-1P-10kA circuit breaker to the nearest service panel.

## 2.4 USE OF PREMISES BY CONTRACTOR

.1 The use of the premises is restricted to the areas necessary for the execution of the work in order to permit:

.1 Occupancy of the premises by the Customer.

.2 Coordinate use of site as directed by Consultant.

.3 Upon completion of the work, the existing structure shall be in the same, equivalent or better condition than before the work began.

### 2.5 OCCUPATION OF THE PREMISES BY THE CUSTOMER

.1 The Customer will occupy the premises for the duration of the construction work and will continue its normal activities during this period.

.2 Cooperate with the Customer in scheduling the work, so as to reduce conflicts and facilitate the Customer's use of the premises.

### 2.6 MODIFICATIONS, ADDITIONS OR REPAIRS TO EXISTING BUILDINGS

.1 Carry out work with minimum interference with occupants and normal use of premises. Make necessary arrangements with Consultant to facilitate execution of work.

### 2.7 EXISTING UTILITIES

.1 Before interrupting utility services, inform the Consultant and the utility companies concerned, and obtain the necessary authorizations.

### 2.8 REQUIRED DOCUMENTS

.1 Keep a copy of each of the following documents on site:

- .1 Contract drawings.
- .2 Specifications.
- .3 Addenda.
- .4 Revised shop drawings.
- .5 List of unreviewed shop drawings.
- .6 Change Orders.
- .7 Other contract changes.
- .8 Field test reports.
- .9 Copy of approved schedule.
- .10 Health and safety plan and other safety related documents.
- .11 Other documents as indicated.

## 3 PRODUCTS

### 3.1 NOT APPLICABLE

.1 Not applicable.

# 4 EXECUTION

## 4.1 NOT APPLICABLE

.1 Not applicable.

**END OF SECTION**

# 1 GENERAL

## 1.1 REFERENCE STANDARDS

.1 ASTM International (ASTM)

.1 ASTM B32-08, Standard Specification for Solder Metal.

.2 ASTM B306-02, Standard Specification for Copper Drainage Tube (DWV).

.3 ASTM C564-03a, Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings.

.2 *Groupe CSA (CSA)*

.1 *CSA B67-F1972 (C1996), Tuyaux de distribution d'eau, tuyaux de renvoi, siphons, coudes et accessoires, en plomb.*

.2 *CAN/CSA-B70-F06, Tuyaux et raccords d'évacuation d'eaux usées en fonte et méthodes de raccordement.*

.3 *CAN/CSA-B125.3-F05, Accessoires de robinetterie sanitaire.*

.3 Green Seal Environmental Standards (GSES)

.1 Standard GS-36-00, Commercial Adhesives.

.4 *Conseil national de recherches Canada (CNRC)*

.1 *Code national de la plomberie - Canada 2015 (CNP).*

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

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

## 1.2 RELATED REQUIREMENTS

.1 Section 01 11 00 - Work summary.

## 1.3 DOCUMENTS/SAMPLES TO BE SUBMITTED FOR APPROVAL/INFORMATION

.1 Technical data sheets

.1 Submit required data sheets and manufacturer's documentation for adhesives. Data sheets shall include product characteristics, performance criteria, dimensions, limitations and finish.

## 1.4 TRANSPORT, STORAGE AND HANDLING

.1 Deliver materials and equipment to site in original packaging, which must be labelled with manufacturer's name and address.

.2 Packaging waste management: recover packaging waste for reuse/recycling.

# 2 PRODUCTS

## 2.1 COPPER TUBES AND FITTINGS

.1 DWV type sanitary drainage pipes for above-ground installation: to ASTM B306 standard.

.1 Connections

.1 Cast brass fittings: to CAN/CSA-B125.3 standard.

.2 Forged copper fittings: to CAN/CSA-B125.3 standard.

.2 Soft solder: tin-lead, 50/50, type 50A, as per ASTM B32.

# 3 EXECUTION

## 3.1 APPLICATION

.1 Manufacturer's instructions: Comply with manufacturer's written recommendations, including any available technical bulletins, product handling, storage and application instructions, and data sheets.

## 3.2 TEST

.1 Hydrostatically test piping to ensure that it is not obstructed and that the slope is appropriate.

**END OF SECTION**

# 1 GENERAL

## 1.1 RELATED REQUIREMENTS

.1 Section 01 11 00 - Work summary.

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

.1 Shop drawings

.1 Shop drawings submitted must bear the seal and signature of a qualified engineer recognized or entitled to practice in Canada, in the province of Quebec.

.2 Indicate the following on drawings.

.1 Installation details.

.2 Clearances required for operation and maintenance (O&M) of equipment.

.3 Submit the following documents with shop drawings and technical data sheets.

.1 Detail drawings of pedestals, supports/suspensions and anchor bolts.

.2 Sound power data for systems and equipment, where applicable.

.3 Performance curves with indication of operating points.

.4 Manufacturer's document certifying that products in question are current models.

.5 Certificate of compliance with relevant codes.

## 1.3 DOCUMENTS/ITEMS TO BE HANDED OVER ON COMPLETION OF WORK

.1 Operation and maintenance sheets: provide operation and maintenance instructions to be incorporated into O&M manual.

.1 O&M manual to be approved prior to final inspection by Consultant who will retain final copies.

.2 Operation sheets shall include the following.

.1 Control circuit diagrams for each system, including room control circuit.

.2 Description of each system and its control devices.

.3 Description of operation of each system under various loads, including schedule of setpoint changes and indication of seasonal deviations.

.4 Operating instructions for each system and component.

.5 A description of the measures to be taken in the event of equipment failure.

.6 Table of fixtures and flow diagram.

.7 Color coding.

.2 Maintenance sheets shall include the following.

.1 Instructions for maintenance, repair, operation and troubleshooting of each component.

.2 A maintenance schedule specifying the frequency and duration of tasks, as well as the tools required to perform them.

.3 Performance sheets must include the following.

.1 Performance data supplied by the manufacturer of the equipment, specifying the operating point of each, recorded after commissioning.

.2 Results of performance testing of equipment.

.3 Any other specific performance data specified elsewhere in the Contract Documents.

.4 Approval

.1 For approval, submit to Consultant a PDF file of the draft E&E manual. Unless otherwise instructed by the Consultant, sheets are not to be submitted individually.

.2 If necessary, make the required changes to the O&M manual and resubmit to the Consultant.

.5 Additional information

.1 Prepare additional information sheets and append them to the M&E manual if, during the above-mentioned training sessions, it becomes apparent that such sheets are needed.

.6 As-built drawings

.1 Before performing TAB operations (testing, adjusting and balancing HVAC systems), complete as-built drawings.

.2 Identify each drawing in the lower right-hand corner, in letters at least 12 mm high, as follows: "AS-BUILT DRAWING: THIS DRAWING HAS BEEN REVIEWED AND SHOWS MECHANICAL SYSTEMS/DEVICES AS ACTUALLY INSTALLED". (Contractor's signature) (Date).

.3 Submit drawings to Consultant for approval, then make corrections as directed.

.4 Test, adjust and balance HVAC systems with as-built drawings in hand.

.5 Submit reproducible copies of completed as-built drawings with O&M manual.

.7 Submit sets of as-built drawings to be attached to final TAB report.

## 1.4 REPLACEMENT/MAINTENANCE MATERIALS TO BE SUPPLIED

.1 Provide a kit of all special tools required for maintenance of equipment as recommended by manufacturers.

.2 Provide one (1) commercial grade grease gun, grease and adapters suitable for all grades of grease and grease fittings used.

### 1.5 TRANSPORT, STORAGE AND HANDLING

.1 Delivery and acceptance: deliver materials and equipment to job site in original packaging, which must be labelled with manufacturer's name and address.

.2 Storage and Handling

.1 Store materials and equipment in a clean, dry, well-ventilated area in accordance with manufacturer's recommendations.

.2 Replace damaged materials and equipment with new.

## 2 EXECUTION

### 2.1 INSPECTION

.1 Verification of conditions: before proceeding with installation, ensure that the condition of surfaces/substrates previously implemented under other sections or contracts is acceptable and allows work to be carried out in accordance with manufacturer's written instructions.

.1 Carry out visual inspection of surfaces/substrates in presence of Customer's Representative and/or Consultant.

.2 Immediately inform Customer's Representative and/or Consultant of any unacceptable conditions found.

.3 Begin installation work only after unacceptable conditions have been corrected and written approval has been received from Customer's Representative and/or Consultant.

### 2.2 TOUCHING UP AND RESTORING PAINT COATINGS

.1 Prime and touch up surfaces with damaged paint finish, and ensure new finish matches original finish.

.2 Refurbish surfaces with damaged finish.

### 2.3 SYSTEM CLEANING

.1 Clean inside and outside of all components, equipment and systems, including strainers and filters, and vacuum inside air ducts and air handling equipment.

## 2.4 ON-SITE QUALITY CONTROL

.1 On-site inspections by the manufacturer

.1 Obtain a written report from the manufacturer confirming compliance of the work with specified criteria with regard to handling, implementation, application of products and protection and cleaning of the work, then submit this report in accordance with section DOCUMENTS/SAMPLES TO BE SUBMITTED FOR APPROVAL/INFORMATION, of PART 1.

.2 The manufacturer shall make recommendations for the use of the product(s), and carry out periodic visits to check that the application has been carried out in accordance with his recommendations.

## 2.5 DEMONSTRATION

.1 Customer's Representative will use certain devices, equipment and systems, for testing purposes, even before they have been accepted. Provide labor, equipment and instrumentation necessary to perform tests.

.2 Provide tools, equipment and qualified instructors to train O&M personnel during normal working hours in operation, control/regulation, adjustment, problem diagnosis/ troubleshooting and maintenance of apparatus, equipment and systems prior to acceptance.

.3 Training material shall include, but not be limited to, O&M manual, as-built drawings and audio-visual aids.

.4 Requirements for required training hours are indicated in each relevant section.

.5 Customer's Representative will videotape training sessions for future reference.

## 2.6 PROTECTION

.1 Prevent dust, dirt and other foreign matter from entering openings in appliances, equipment and systems by means of appropriate devices.

**END OF SECTION**

# 1 GENERAL

## 1.1 SUMMARY

.1 Section content

.1 Anti-vibration and seismic protection systems and devices, and related installation methods.

## 1.2 REFERENCE STANDARDS

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

.1 Safety Data Sheets (SDS)

.2 National Fire Protection Association (NFPA)

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

.3 National Research Council Canada (NRC)

.1 National Building Code of Canada 2015 (NBC).

# 2 PRODUCTS

## 2.1 GENERAL

.1 Dimensions and shape of base plates and performance characteristics of anti-vibration devices shall be as specified.

## 2.2 ELASTOMER PLATES

.1 Type EP1 - Embossed or ribbed neoprene sheets with a durometer index of 50, at least 9 mm thick, and capable of withstanding a maximum load of 350 kPa.

.2 Type EP2 - Embossed or ribbed natural rubber plates, durometer index 30, minimum thickness 9 mm, maximum load 415 kPa.

.3 Type EP3 - Mixed neoprene/steel/neoprene plates, made of two embossed or ribbed neoprene plates, durometer index 50, each at least 9 mm thick and bonded to a 1.71 mm steel plate; provided with fastening holes lined with insulating bushings and washers; capable of withstanding a maximum load of 350 kPa.

.4 Type EP4 - Mixed rubber/steel/rubber plates, made of two natural rubber plates, embossed or ribbed, durometer index 30, at least 9 mm thick each and bonded to a 1.71 mm steel plate; provided with fastening holes lined with insulating bushings and washers; capable of withstanding a maximum load of 415 kPa.

## 2.3 ELASTOMER STUDS

.1 Type M1 - Color-coded, shear-strength neoprene studs with maximum durometer hardness of 60, grooved top and bottom, with threaded bushing and two holes for anchor bolts.

## 2.4 SHOCK ABSORBER SPRINGS

.1 Rigid springs with lateral stiffness/axial stiffness ratio equal to or greater than 1.2 times the static deflection/height under load ratio; having a displacement reserve of 50% of its displacement under nominal load; equipped with levelling devices.

.2 Ratio of height under load to spring diameter between 0.8 and 1.0.

.3 Cadmium plated springs for outdoor installations.

.4 Color coded springs.

## 2.5 SPRING-LOADED STUDS

.1 Spring-loaded studs, with zinc-plated or cadmium-plated hardware and rustproof painted housing.

.2 Type M2 - Stable exposed spring-loaded studs, on glued, rubber or grooved neoprene acoustic and non-slip backing plate, at least 6 mm thick.

.3 Type M3 - Stable exposed spring-loaded studs, with top and bottom covered by an acoustic, non-slip, bonded, rubber or grooved neoprene plate, at least 6 mm thick, provided with a leveling bolt for securing to equipment.

.4 Type M4 - Stable, limited displacement, exposed spring-loaded studs, on bonded, rubber or grooved neoprene, non-slip, acoustic backing plate, at least 6 mm thick; including built-in soft displacement stops and removable spacers.

.5 Type M5 - Enclosed spring-loaded studs with shock absorbers, designed for a maximum load of 950 kg.

## 2.6 SUSPENSIONS

.1 Color-coded spring hangers, with rustproof painted housing, designed to allow 30 degrees of angular movement of housing or hanger rod without metal-to-metal contact.

.2 Type H1 - Hangers incorporating a neoprene shear element, with molded insulating sleeve, embedded in housing base.

.3 Type H2 - Suspensions comprising a stable spring, an elastomer washer and a bushing to receive the spring, with molded insulating sleeve, embedded in the housing base.

.4 Type H3 - Suspensions comprising a stable spring, an upper elastomer suspension element, a bushing to receive the spring, with molded insulating sleeve, embedded in the housing base.

.5 Type H4 - Suspensions with stable spring, elastomer upper suspension element.

## 2.7 ACOUSTIC SCREENS FOR ANCHORS AND GUIDES

.1 Acoustic screens: to be placed between a pipe and its support, made of neoprene insulating material and heavy-duty ticking at least 25 mm thick.

## 2.8 HORIZONTAL THRUST LIMITERS

.1 Horizontal thrust limiters consisting of a spring and an elastomer element housed in a rectangular casing; including rods and angles required for attachment to equipment and air ducts; adjustable to limit displacement to a maximum of 9 mm when starting and stopping insulated equipment.

.2 Limiters arranged symmetrically on either side of insulated equipment and fixed in the thrust axis.

## 2.9 BASES FOR ROOF-MOUNTED DEVICES

.1 Lower elements: rectangular steel tubes or extruded aluminum sections.

.2 Upper elements: continuous elements made of rectangular steel tubes or extruded aluminum sections providing continuous support for equipment, and incorporating 6 mm thick neoprene multidirectional damping stops capable of withstanding wind and earthquake stresses.

.3 Springs: steel, adjustable and removable, with a maximum static deformation of 25 mm and a maximum reserve displacement of 50% with respect to their displacement under load, cadmium plated, sized and positioned to ensure uniform sagging.

.4 High-frequency insulation: continuous packing on top and bottom of complete assembly or plate on and under each spring, in cellular neoprene, 6 mm thick.

.5 Weather protection: flexible, continuous aluminum base/cover counterfloors allowing access to springs.

.6 Hardware: cadmium-plated or galvanized.

## 2.10 SEISMIC PROTECTION DEVICES AND SYSTEMS

.1 General

.1 Seismic protection devices and systems must act in all directions.

.2 Fixings and connection points must be able to withstand the same maximum loads as seismic-resistant devices and systems.

.3 Use of anchors and fasteners installed with nail guns or in holes drilled for that purpose is prohibited.

.4 No devices, associated supports or studs shall fail before the framing fails.

.5 Use of cast iron or threaded pipe supports is prohibited.

.6 Seismic protection devices and systems must not compromise firewall integrity.

.2 Statically supported equipment

.1 Equipment must be secured to supports/suspensions, which must be connected to the building structure.

.2 Seismic protection devices and systems.

.1 Seismic protection devices and systems shall act smoothly and continuously.

.2 They shall never be so compressed as to lose their effectiveness.

.3 Elastically supported equipment (vibration-isolated)

.1 Seismic devices and systems must not interfere in any way with acoustic and anti-vibration systems. During normal operation, clearance between equipment and seismic devices shall be 6 to 9 mm.

.2 Seismic devices shall be incorporated into anti-vibration systems to prevent complete unloading of the latter.

.3 As specified.

.4 Piping networks

.1 Fire protection systems: as per NFPA 13.

.2 All other piping systems: suspensions greater than 305 mm must be braced.

.3 Seismic protection devices and systems must meet requirements for anchoring and guiding piping.

.5 Bracing methods and devices

.1 Methods approved by Consultant.

.2 Structural steel angles or channels.

.3 Cable restraint systems including grommets, lugs and other hardware to ensure alignment of seismic devices and to prevent bending of cables at attachment points; with neoprene elements incorporated into connections to reduce shock overloads.

# 3 EXECUTION

## 3.1 MANUFACTURER'S INSTRUCTIONS

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

## 3.2 INSTALLATION

.1 Seismic protection measures to be in accordance with Code requirements.

.2 Install anti-vibration devices in accordance with manufacturers' instructions and adjust studs so that units are level.

.3 Ensure that the connection of piping, air ducts and electrical conduits to insulated units does not reduce the flexibility of the vibration isolation system, and that piping or air ducts passing through walls or floors do not transmit vibrations.

.4 Unless otherwise specified, support piping connected to insulated units with studs or spring hangers having a static deformation of at least 25 mm. Observe the following rules:

.1 Pipe nominal diameters up to and including DN 4: 3 first support points; DN 5 to DN 8: 4 first support points; DN 10 and over: 6 first support points.

.2 The first support point must have a static sag equal to twice the sag of the insulated unit, but not exceeding 50 mm.

.5 Where anti-vibration devices are bolted to the floor, use rubber anti-vibration washers.

.6 Level pedestals with shims and blocks so that piping and air ducts can be connected to a unit already at operating level, before adjusting anti-vibration devices. Make sure there is no contact between the insulated equipment and the building structure.

## 3.3 CLEANING

.1 On completion of installation work and performance testing, remove surplus materials, waste, tools and equipment from site.

**END OF SECTION**

# 1 GENERAL

## 1.1 SUMMARY

.1 Section content

.1 Requirements for identification of piping systems, valves and control/regulation devices, methods and elements of identification used, including their location and associated installation methods.

## 1.2 REFERENCE STANDARDS

.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 Paint.

.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 BE SUBMITTED FOR APPROVAL/INFORMATION

.1 Technical data sheets

.1 Submit technical data sheets for products prescribed in this section, including color tablets.

# 2 PRODUCTS

## 2.1 MANUFACTURER NAMEPLATES

.1 Metal or laminate nameplates, mechanically attached to hardware by manufacturer.

.2 Lettering (letters and numbers) to be raised or recessed.

.3 The following information, as applicable, shall be indicated on nameplates.

.1 Device: manufacturer's name, model, dimensions, serial number, power, flow rate.

.2 Motor: voltage, frequency of supply current, number of phases, power, type of service, frame dimensions.

## 2.2 NETWORK IDENTIFICATION PLATES

.1 Colors

.1 Hazardous materials: red lettering on white background.

.2 Other materials: black lettering on white background (unless otherwise indicated in the relevant code).

.2 Material and other manufacturing characteristics

.1 3 mm thick laminate plates, matte finish, with square corners and precisely aligned letters, machine engraved to the core.

.3 Formats

.1 As indicated in the table below.

| Format number | Dimensions (mm) | Number of lines | Letter height (mm) |
|---|---|---|---|
| 1 | 10 x 50 | 1 | 3 |
| 2 | 13 x 75 | 1 | 5 |
| 3 | 13 x 75 | 2 | 3 |
| 4 | 20 x 100 | 1 | 8 |
| 5 | 20 x 100 | 2 | 5 |
| 6 | 20 x 200 | 1 | 8 |
| 7 | 25 x 125 | 1 | 12 |
| 8 | 25 x 125 | 2 | 8 |
| 9 | 35 x 200 | 1 | 20 |

.2 Maximum of 25 letters or numbers per line.

.4 Location specific format

.1 Number 5 format plates for terminal elements and control panels.

.2 Number 9 format plates for equipment located in mechanical installation rooms.

## 2.3 IDENTIFICATION ACCORDING TO THE EXISTING SYSTEM

.1 Identify added or improved structures according to existing identification system.

.2 Where the existing identification system does not provide for the identification of newly installed structures, these shall be identified in accordance with the requirements of this section.

.3 Prior to commencing work, obtain written approval of identification system from Consultant.

## 2.4 PIPING IDENTIFICATION

.1 Fluid conveyed in piping shall be identified by background color markings, pictograms (where required) and/or legends; direction of flow shall be indicated by arrows. Unless otherwise specified, piping systems must be identified in accordance with CAN/CGSB 24.3.

.2 Pictograms

.1 Where applicable, pictograms shall comply with Workplace Hazardous Materials Information System (WHMIS) requirements.

.3 Legends

.1 Upper case letters in height and color to conform to CAN/CGSB 24.3 standard

.4 Arrows indicating direction of flow

.1 Outer diameter of pipe/lining less than 75 mm: 100 mm length x 50 mm height;

.2 Outside diameter of pipe/insulation 75 mm and over: 150 mm length x 50 mm height;

.3 Double-pointed arrows when flow direction is reversible.

.5 Dimensions of background color markings

.1 Height: sufficient to cover circumference of pipe/liner;

.2 Length: sufficient to accommodate pictogram, legend and arrows.

.6 Materials for background color markings, lettering (legends) and arrows

.1 Tubes and pipes up to 20 mm in diameter: plastic, self-adhesive, water-repellent and heat-resistant labels;

.2 Other pipes: self-adhesive plasticized fabric labels, with protective coating and underside coated with water-repellent contact adhesive, designed to withstand 100% relative humidity, constant heat of 150 degrees Celsius and intermittent heat of 200 degrees Celsius.

.7 Background colors and legends

.1 Where background colors and legends are not specified, follow Consultant's instructions.

.2 Colors of legends and arrows: as per table below.

| Background color | Legends, arrows |
|---|---|
| Yellow | BLACK |
| Green | WHITE |
| Red | WHITE |

.3 Background color markings and legends for piping systems.

| **Content/ Fluid conveyed** | **Background color** | **Legend** |
|---|---|---|
| **** Add calculation temperature** | | |
| **++ Add calculation temperature and pressure** | | |
| Condensate (gravity flow) | Yellow | CONDENSATE (GRAVITY) |
| Suction - refrigerant | Yellow | ASPIRATION. FRIGORIGEN |
| Refrigerant liquid | Yellow | LIQUID REFRIGERANT |

### 2.5 IDENTIFYING NETWORKS AND CONTROL DEVICES

.1 Identify networks, devices, elements, controllers and sensors by means of identification plates complying with the requirements of this section.

.2 Identify the function of each and (where applicable) their safety setting.

### 2.6 UNILINGUAL/BILINGUAL MARKINGS

.1 System and component identification markings shall be in French.

## 3 EXECUTION

### 3.1 MANUFACTURER'S INSTRUCTIONS

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

### 3.2 INSTALLATION

.1 Unless otherwise specified, identify networks and devices in accordance with CAN/CGSB-24.3.

### 3.3 IDENTIFICATION PLATES

.1 Location

.1 Placards shall clearly identify equipment and/or piping systems and shall be installed where they are clearly visible and easily legible from the working floor.

.2 Spacers

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

.3 Protection

.1 Do not apply paint, thermal insulation or any other coating to identification plates.

## 3.4 LOCATION OF PIPE IDENTIFIERS

.1 On long pipes in open areas of boiler rooms, equipment rooms and service galleries: at intervals not exceeding 17 m, so that at least one can be easily seen from any point in the operating areas or aisles.

.2 At changes of direction.

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

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

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

.6 Where piping or air ducts are concealed in recesses, ceiling voids, shafts, galleries or other confined spaces, at entry and exit points, and near inspection openings.

.7 At the start and end of each pipe or conduit, and near each piece of equipment.

.8 Immediately upstream of major manually or automatically operated valves, otherwise as close as possible, preferably on the upstream side.

.9 In such a way that the designation is easily legible from the usual operating areas and from all easily accessible points.

.1 Perpendicular to the best possible line of sight, taking into account the usual location of operating personnel, lighting conditions, reduced visibility of colors or legends caused by accumulation of dust and dirt, and the risk of damage or breakdown.

**END OF DE SECTION**

# 1 GENERAL

## 1.1 SUMMARY

.1 This section covers the operations, methods and requirements for testing, adjusting and balancing (TAB) of HVAC systems.

.2 TAB operations are test, adjustment and balancing operations intended to ensure that the various systems operate in accordance with the requirements set out in the contract documents. TAB operations also include all other work described in this section.

## 1.2 PURPOSE OF ERE OPERATIONS

.1 Test systems for safe and proper operation, to determine the actual point of operation and to evaluate the qualitative and quantitative performance of equipment, systems and associated control/regulatory devices at rated load, medium load or low load, such load being actual or simulated.

.2 Adjust equipment and systems to meet prescribed performance requirements and to interact as prescribed with other related systems under normal and emergency load and operating conditions.

.3 Balance equipment and systems so that flow matches load over the entire operating range.

## 1.3 EXCEPTIONS

.1 Testing, adjustment and balancing of equipment and systems governed by specific standards or codes shall be carried out to the satisfaction of the appropriate authorities.

## 1.4 COORDINATION

.1 Allow time within the construction schedule for system testing, adjustment and balancing (including repairs and retesting) to be completed prior to acceptance of work.

.2 Test, adjust and balance each individual system, and then each system in relation to related systems, in the case of subject systems.

## 1.5 STARTING UP DEVICES AND SYSTEMS

.1 Unless otherwise specified, follow start-up procedure recommended by equipment and system manufacturer.

.2 Follow any special start-up procedures prescribed elsewhere in Division 23.

## 1.6 OPERATION OF EQUIPMENT AND SYSTEMS DURING TAB OPERATIONS

.1 Operate equipment and systems for the time required to perform TAB operations and for the time required by the Consultant to verify TAB reports.

## 1.7 START OF TAB OPERATIONS

.1 Notify Consultant seven (7) days prior to commencing test, adjustment and balancing operations.

.2 Undertake TAB operations only when the vessel is substantially usable, i.e. when:

.1 Ceilings and installation of doors, windows and other construction elements that may affect the outcome of operations are complete;

.2 Installation of sealants, caulking and weather stripping is complete;

.3 Pressure, leakage and other tests prescribed in other sections of Division 23 are completed;

.4 Equipment required for TAB operations is installed and in good working order;

.5 Mechanical installations and associated electrical and control/regulation systems which may affect the outcome of TIA operations are in operation and have been checked for correct operation, including the following items:

.1 Thermal overload protection for electrical equipment in place;

.6 Hydronic networks

.1 Pipes flushed, filled and vented;

.2 Pumps running in correct direction;

.3 Filters in place and baskets clean;

.4 Isolation and balancing valves in place and open;

.5 Balancing valves installed and calibrated to manufacturer's settings;

.6 Liquid treatment systems in good working order.

## 1.8 PRELIMINARY REPORT

.1 Prior to formal submission of the EIA report to the Consultant, submit, for verification and approval, a preliminary report in which the following shall be indicated:

.1 Details of instruments used;

.2 Details of TAB method used;

.3 Calculation methods used;

.4 Summaries.

## 1.9 TAB REPORTS

.1 Report format shall conform to the requirements of the applicable standard or reference document for TAB operations.

.2 Results shall be expressed in SI units in the report, and the report shall include the following:

.1 Drawings to be included in project file;

.2 Schematic diagrams of systems involved.

## 1.10 SETTINGS

.1 When TAB operations have been completed to Consultant's satisfaction, replace drive or transmission guards, close doors and hatches, lock adjusters in operating position and check that sensors are set to required set points.

.2 Permanently mark setting positions; these must not be erased or covered in any way.

### 1.11 END OF TAB OPERATIONS

.1 System testing, adjustment and balancing operations will not be considered completed until the final report has been approved by the Consultant.

## 2 PRODUCTS

### 2.1 NOT APPLICABLE

.1 Non applicable

## 3 EXECUTION

### 3.1 NOT APPLICABLE

.1 Not application

**END OF SECTION**

# 1 GENERAL

## 1.1 REFERENCE STANDARDS

.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 ASTM International (ASTM)

.1 ASTM B209M-04, Standard Specification for Aluminum and Aluminum Alloy Sheet and Plate Metric.

.2 ASTM C335-04, Standard Test Method for Steady State Heat Transfer Properties of Horizontal Pipe Insulation.

.3 ASTM C411-04, 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 C533-2004, Calcium Silicate Block and Pipe Thermal Insulation.

.6 ASTM C547-2003, Mineral Fiber Pipe Insulation.

.7 ASTM C795-03, Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel.

.8 ASTM C921-03a, Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.

.3 Canadian General Standards Board (CGSB)

.1 CGSB 51-GP-52Ma-89, Vapor impermeable jacket and covering material for thermal insulation of pipes, ducts and equipment.

.2 CAN/CGSB-51.53-95, Poly (Vinyl Chloride) Sheet for Insulated Pipe Jackets, Containers and Cylindrical Conduit.

.4 Department of Justice Canada (Jus)

.1 Canadian Environmental Assessment Act (CEAA), c.33, 1995.

.2 Canadian Environmental Protection Act (CEPA), ch. 33, 1999.

.3 Transportation of Dangerous Goods Act, 1992 (TDGA), c. 34.

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

.1 Safety Data Sheets (SDS).

.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, Standard Test Method; Surface Burning Characteristics of Building Materials and Assemblies.

.2 CAN/ULC-S701-01, Standard for Polystyrene Thermal Insulation, Boards and Pipe Coverings.

.3 CAN/ULC-S702-1997, Standard for Mineral Fiber Thermal Insulation for Buildings.

.4 CAN/ULC-S702.2-03, Thermal Insulation, Mineral Fibre for Buildings, Part 2: Applications Guidelines/Standard on mineral fiber thermal insulation for buildings.

## 1.2 DEFINITIONS

.1 For the purposes of this section, the following definitions apply.

.1 «DISSIMULATED» elements: insulated piping, ducts and mechanical appliances located above suspended ceilings or in inaccessible construction voids.

.2 «APPARENT» elements: elements that are not concealed (as specified).

.2 TIAC codes

.1 CRF : Code Rectangular Finish.

.2 CPF : Code Piping (Plumbing) Finish.

## 1.3 QUALITY ASSURANCE

.1 Qualifications

.1 Installer must be an expert in the field, with at least three (3) years' proven experience in carrying out work of the type and scope described in this section.

## 1.4 TRANSPORT, STORAGE AND HANDLING

.1 Packing, shipping, handling and unloading

.1 Transport, store and handle materials and equipment in accordance with manufacturer's written instructions.

.2 Deliver materials and equipment to job site in original packaging, which must be labeled with manufacturer's name and address.

.2 Storage and protection

.1 Protect materials and equipment from the elements and from damage caused by the movement of people, equipment and vehicles.

.2 Protect materials and equipment from damage.

.3 Store materials and equipment at temperatures and under conditions required by manufacturer.

## 2 PRODUCTS

### 2.1 FIRE RESISTANCE CHARACTERISTICS

.1 According to CAN/ULC-S102 standard

.1 Flame spread index: maximum 25.

.2 Smoke power index: maximum 50.

### 2.2 HEAT-INSULATING MATERIALS

.1 Mineral fibers referred to below include glass wool, rock wool and slag wool.

.2 Thermal conductivity coefficient ("k" coefficient) shall not exceed specified values at an average temperature of 24 degrees Celsius, as tested in accordance with ASTM C335.

.3 Thermal insulation with ACIT code number A-6: flexible tubular element, made of single-cell elastomer.

.1 Thermal conductivity coefficient "K" not exceeding 0.039 W/m-°C (0.27 Btu-in/h-pi2-°F) at an average temperature of 24°C (75°F).

.2 Temperature limit: -57°C (-70°F) to 105°C (220°F).

.3 Insulation certified by manufacturer to be free of agents likely to cause stress corrosion cracking.

.4 Acceptable products : Armaflex AP, Armaflex AP Tubes, Armaflex Shield.

### 2.3 LINERS

.1 Polyvinyl chloride (PVC) liners.

.2 One-piece molded liners and sheets to CAN/CGSB-51.53, preformed as required.

.3 Color: Consultant's choice.

.4 Minimum operating temperature: -20 degrees Celsius.

.5 Maximum service temperature: 65 degrees Celsius.

.6 Water vapor permeability: 0.02 perm.

.7 Thickness: 0.5 mm.

.8 Fixing:

.1 Solvent-based adhesive compatible with thermal insulation material, to seal joints and overlaps.

.9 Special requirements

.1 For external piping: UV-protected material, at least 0.5 mm thick.

.10 Aluminum liners

.1 According to ASTM B209 standard.

.2 Thickness: 0.50 mm sheets.

.3 Finish: textured surface.

.4 Grouting: sliding longitudinal and transverse joints, 50 mm overlaps.

.5 Connection: 0.5mm thick die-cut covers, with factory-installed interior trim.

.6 Retaining strips and seals: stainless steel, 0.5 mm thick, 19 mm wide, installed at 300 mm intervals.

## 3 EXECUTION

### 3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: Comply with the manufacturer's requirements, recommendations and written specifications, including any available technical bulletins, instructions for handling, storage and installation of products, and data sheets.

### 3.2 PREPARATORY WORK

.1 Install lagging only after hydrostatic testing of the system (piping and connected equipment) has been completed and results certified by the competent authority who witnessed the test.

.2 Ensure that surfaces to be lagged or coated are clean, dry and free of foreign matter.

### 3.3 INSTALLATION

.1 Carry out work in accordance with requirements of relevant ACIT national standards.

.2 Install lagging in accordance with manufacturers' instructions and requirements of this section.

.3 If nominal lagging thickness required is greater than 75 mm, work in two layers, staggering joints.

.4 Install vapour barrier and apply finishing coats seamlessly.

.1 Supports and hangers must not pierce vapour barrier.

.5 Supports and suspensions

.1 Install high compressive strength lagging, suitable for service conditions, where no saddle or lagging shield is provided.

## 3.4 TABLE - PIPE INSULATION

.1 Unless otherwise specified, piping insulation also includes the insulation of valves, valve caps, filters and strainers, flanges and fittings.

.2 Insulation thickness shall be in accordance with the following table.

.1 Supply lines to individual units shall not exceed 4000 mm in length.

Exposed pipes serving sanitary appliances, as well as piping, fittings and chrome-plated fittings, must not be insulated.

| **Piping** | **Temp. degrees Celsius** | **TIAC codes** | **Nominal pipe diameter (DN) and insulation thickness (mm)** | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | **Power supply** | **Up to 1** | **From 1 1/4 to2** | **From 2 1/2 to 4** | **5 of 5 to 65** | **8 and more** |
| Refrigerant [Hot gas] [Liquid] [Suction] | 4 – 13 | A-6 | 25 | 25 | 25 | 25 | 25 | 25 |
| Refrigerant [Hot gases] [Liquid] [Suction] | Less than 4 | A-6 | 25 | 25 | 38 | 38 | 38 | 38 |

.3 Finishing

.1 Exposed piping located indoors: PVC jackets.

.2 Exposed piping located in mechanical installation rooms: PVC jackets.

.3 Exterior piping: aluminum waterproof jackets.

.4 Fasteners: stainless steel screws and straps at 150 mm centres; wing seals or sleeves.

.5 Installation: according to appropriate TIAC code number, from CRF/1 to CPF/5.

## 3.5 CLEANING

.1 On completion of installation and performance testing, remove surplus materials, waste, tools and equipment from site.

**END OF SECTION**

# 1 GENERAL

## 1.1 REFERENCE STANDARDS

.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 (ASTM)

.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 (CSA)

.1 CSA B52-05 (C2009), Collection B52, Mechanical Refrigeration Code.

.4 Environment Canada (EC)

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

## 1.2 DOCUMENTS/COMPONENTS TO BE SUBMITTED ON COMPLETION OF WORK

.1 O&M sheets: provide instructions for E&E of refrigerant circuit piping, to be incorporated in E&E manual.

## 1.3 TRANSPORT, STORAGE AND HANDLING

.1 Delivery and acceptance: deliver materials and equipment to site in original packaging, which must be labelled with manufacturer's name and address.

.2 Storage and handling

.1 Store materials and equipment in a clean, dry, well-ventilated area in accordance with manufacturer's recommendations.

.2 Replace damaged materials and equipment with new ones.

# 2 PRODUCTS

## 2.1 TUBES

.1 Treated, deoxidized, dehydrated and sealed copper tubes for refrigeration systems.

.1 Hard drawn copper tubes: to ASTM B280, type ACR.

.2 Annealed copper tubes: to ASTM B280, minimum wall thickness to CSA B52 and ASME B31.5.

## 2.2 CONNECTORS

.1 Braze-weld connectors

.1 Connection elements: wrought copper, to ASME B16.22.

.2 Flanged connectors

.1 Connecting elements: bronze or brass, to ASME B16.24, classes 150 and 300.

.2 Seals: suitable for fluid being conveyed.

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

.3 Flared connectors

.1 Connecting elements: in bronze or brass, designed for refrigeration systems, according to ASME B16.26.

## 2.3 BUSHINGS

.1 Hard-drawn copper or steel sleeves, of diameter suitable for the passage of insulated or non-insulated tubes, in either case with a 6 mm wide annular void.

## 2.4 VALVES AND FITTINGS

.1 Valves with diameter equal to or less than 22 mm: globe valves, straight or angle, class 500, category 3.5 MPa, diaphragm, non-directional, without stuffing box packing, with forged brass body and bonnet, water-repellent gasket suitable for temperatures below freezing point, and weld ends.

.2 Valves larger than 22 mm diameter: globe valves, straight or angle, class 375, category 2.5 MPa, diaphragm type, without stuffing box, with backseating of obturator, sealing cap, cast bronze body and bonnet, water-repellent gasket suitable for temperatures below freezing point, and welding ends.

# 3 EXECUTION

## 3.1 INSPECTION

.1 Verification of conditions: before proceeding with installation of refrigerant circuit piping, ensure that condition of surfaces/substrates previously implemented under other sections or contracts is acceptable and allows work to be carried out in accordance with manufacturer's written instructions.

.1 Visually inspect surfaces/supports.

.2 Immediately inform Consultant of any unacceptable conditions found.

## 3.2 MANUFACTURER'S INSTRUCTIONS

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

## 3.3 BRAZING METHOD

.1 Diffuse inert gas inside piping during brazing.

.2 Remove internal parts of valves, solenoid coils of solenoid valves, glass and glass tubes.

.3 Avoid applying heat near regulators and sensitive components.

## 3.4 PIPING INSTALLATION

.1 General

.1 Install annealed copper tubes by bending, avoiding bending or reducing diameter.

.2 Hot gas lines

.1 Install hot gas lines with a downward slope of approximately 1:240 in the direction of flow to prevent backflow of oil to the compressor during operation.

.2 Provide and install traps at the bottom of all risers over 2400 mm high, then at 7600 mm intervals.

.3 Provide inverted bucket steam traps and install at top of risers.

.4 Install double columns for power regulated compressors.

.1 Larger diameter column: install traps where previously specified.

.2 Smaller diameter column: dimensioned for a flow of 5.1 m3/s at minimum load; to be connected upstream of the traps mounted on the larger diameter column.

## 3.5 HYDROSTATIC AND LEAK TESTING

.1 Close valves mounted on factory-loaded equipment and all other equipment not to be pressure tested.

.2 Perform tests in accordance with CSA B52 before pressure relief at 2 MPa and 1 MPa on high and low pressure sides respectively.

.3 Method: raise pressure to 35 kPa with refrigerant gas on both high and low pressure sides; add nitrogen as required until required test pressure is reached. Check for leaks using an electronic detector or halide lamp. If necessary, repair any leaks detected and repeat the tests.

## 3.6 ON-SITE QUALITY CONTROL

.1 On-site testing/inspection

.1 Close service valves on factory-loaded units.

.2 Maintain ambient temperature of at least 13 degrees Celsius for at least 12 hours prior to and during dewatering.

.3 Use copper piping of largest possible diameter to minimize evacuation time.

.4 Use a two-stage vacuum pump with air ballast on the second stage, lubricated with dehydrated oil, with a draw-off capacity of 5 Pa (absolute pressure).

.5 Measure the pressure inside the system using a vacuum gauge. Before taking readings, isolate vacuum pump from network.

.6 Perform three (3) evacuations for elements which have lost their charge or contain gases other than the required refrigerant. Proceed as follows.

.1 Evacuate two (2) times to 14 Pa (absolute pressure) and hold for four (4) hours.

.2 Break vacuum with refrigerant and reduce pressure to 14 kPa.

.3 Perform final evacuation to 5 Pa (absolute pressure) and hold for at least 12 hours.

.4 Isolate pump from mains, record vacuum values and time to vacuum stabilization.

.5 Submit test results to Customer Representative and/or Consultant.

.7 Load

.1 Load system through filter drier and charging valve on high pressure side. Loading via the low-pressure side is not permitted.

.2 Stop compressors and introduce the load required for the system to operate correctly. If pressures equalize before the system is fully loaded, close the loading valve and start up the system. Complete the loading once the system is running.

.3 Re-bleed the loading line if the refrigerant container is changed during the loading operation.

.8 Controls

.1 Carry out controls (checks and measurements) in accordance with manufacturer's instructions for O&M installation.

.2 Record the measures taken and submit them to the Customer Representative and/or Consultant.

## 3.7 CLEANING

.1 Final clean-up: remove surplus materials, waste, tools and equipment from site.

**END OF SECTION**

# 1 GENERAL

## 1.1 REFERENCE STANDARDS

.1 ASTM International (ASTM)

.1 ASTM A48/A48M-03(2012), Standard Specification for Grey Iron Castings.

.2 ASTM A123/A/123M-2012, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

.3 ASTM A153/A153M-09, Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

.4 ASTM B117-11, Standard Practice for Operating Salt Spray (Fog) Apparatus.

.5 ASTM C67-12, Standard Test Methods for Sampling and Testing Brick and Structural Clay Tile.

.6 ASTM D520-00(2011), Standard Specification for Zinc Dust Pigment.

.2 CSA Group (CSA)

.1 CSA B52-05, Mechanical Refrigeration Code.

.2 CAN/CSA-Z809-08, Sustainable forest management.

.3 Cooling Technology Institute (CTI)

.1 CTI-ATC-105-00, Acceptance Test Code.

.2 CTI-STD-201-11, Standard for the Certification of Commercial Water Cooling Tower Thermal Performance.

.4 Forest Stewardship Council (FSC)

.1 FSC-STD-01-001-2004, FSC Principle and Criteria for Forest Stewardship.

.5 National Electrical Manufacturers Association (NEMA)

.1 NEMA MG 1 2011, Motors and Generators.

.6 Sustainable Forestry Initiative (SFI)

.1 SFI-2010-2014 Norm.

.7 Underwriters' Laboratories of Canada (ULC)

.1 CAN/ULC-S102.2-10, Standard Test Method - Surface Burning Characteristics of Floor Coverings and Miscellaneous Materials and Assemblies.

## 1.2 RELATED REQUIREMENTS

.1 Section 01 11 00 Summary of work

.2 Section 23 05 48 - Anti-vibration and seismic systems and devices for HVAC piping and equipment.

## 1.3 DOCUMENTS/SAMPLES TO BE SUBMITTED FOR APPROVAL/INFORMATION

.1 Technical data sheets

.1 Submit required data sheets, manufacturer's instructions and documentation. Data sheets shall include product characteristics, performance criteria, dimensions, limits and finish.

.2 Shop drawings

.1 Shop drawings submitted must bear the seal and signature of a qualified engineer recognized or licensed to practice in Canada, in the Province of Quebec.

.2 Indicate the following on drawings.

.1 Joints, piping, fittings, valves, filters, control devices, accessories, as well as identification of factory and field assemblies.

.2 Wiring (schematic and assembly diagram).

.3 Dimensions, construction details, method of installation and type of supports recommended, size and location of holes for assembly bolts and point loads.

.4 Anti-vibration and seismic devices and systems.

.5 Manufacturers' recommended clearances.

.3 Certificates: Submit documents signed by the manufacturer, certifying that products, materials and equipment comply with the physical and performance requirements.

## 1.4 DOCUMENTS/COMPONENTS TO BE HANDED OVER ON COMPLETION OF WORK

.1 O&M sheets: provide O&M instructions to be incorporated into O&M manual.

.2 Data shall include the following.

.1 Description of equipment, including manufacturers' names, type, model year and wattage.

.2 Start-up and commissioning procedures.

.3 Details of operation, repair and maintenance.

.4 List of recommended spare parts.

## 1.5 TRANSPORT, STORAGE AND HANDLING

.1 Delivery and acceptance: deliver materials and equipment to job site in original packaging, which must be labelled with manufacturer's name and address.

.2 Storage and Handling

.1 Store materials and equipment in a clean, dry, well-ventilated area in accordance with manufacturer's recommendations.

.2 Replace damaged materials and equipment with new ones.

# 2 PRODUCTS

## 2.1 GENERAL

.1 Air-cooled outdoor condensing unit using R-410A refrigerant suitable for floor or roof installation.

.2 Unit shall consist of two independent refrigeration circuits and two scroll rotary compressors.

.3 Unit to be used in refrigeration circuit with central air handling unit or with direct expansion coils.

.4 All parts are guaranteed for one year by the manufacturer. Warranty commences upon start-up of unit and shall not exceed 18 months from delivery of unit to job site. An additional 5-year warranty, parts only, must be included for compressors. The unit must be started up by a manufacturer's service technician.

## 2.2 ACCEPTABLE PRODUCTS

.1 CARRIER model 38APD0251G-3G190 or acceptable equivalent.

.2 Electrical connection: 575/3/60.

.3 Dimensions: approx. 2240 mm x 1024 mm x 1690 mm maximum height.

.4 Operating weight: maximum 530 kg.

.5 Options :

.1 Temperature probes: (x2) 33ZCSENSAT

.2 Temperature sensor: 33ZCT55SPT

.3 Deflector: 30RA-900-065

.4 Neoprene pads: 30RA-900-005

## 2.3 DESCRIPTIONS

.1 General :

.1 Factory-assembled, one-piece, air-cooled condensing unit. Unit enclosure shall contain all internal wiring, piping, controls, compressors, nitrogen pressurization charge and special features required prior to field start-up.

.2 Cabinet :

.1 Cabinet shall be galvanized steel enclosure with powder coated enamel or pre-painted finish.

.2 Control box shall be accessible by hinged panels for service access.

.3 Ventilators :

.1 Condenser fans shall be direct drive propeller type, discharging air vertically upward.

.2 All condenser fan motors shall be totally enclosed 3-phase type with permanently lubricated ball bearings, class F insulation and internal thermal overload protection with automatic reset or manually reset rated circuit breakers.

.3 Fans to be controlled by variable frequency drive.

.4 Shafts shall have inherent corrosion resistance.

.5 Fan blades shall be statically and dynamically balanced.

.6 Condenser fan openings are to be equipped with PVC coated steel safety guards.

.4 Compressors :

.1 Compressors shall be rotary scroll type.

.2 Operating oil charge and crankcase heater to control oil dilution.

.3 Compressors shall be mounted on two rails incorporating rubber in shear vibration isolators.

.4 Compressor stop/start sequence shall provide unloading capability. Digital compressor unloading shall be available as an option on one circuit.

.5 Compressor motors shall be cooled by refrigerant gases passing through the motor windings and shall be equipped with either internal line break thermal and overload current protection or external overload current modules fitted with compressor temperature sensors.

.5 Condenser coils :

.1 Coil shall consist of seamless copper tubes mechanically bonded to aluminum fins. The fins shall have corrugated enhancements. These condenser coils are recommended for remote chiller applications. These coils are not recommended for corrosive environments.

.2 Tubes to be cleaned, dehydrated and sealed.

.6 Cooling components :

.1 Cooling circuit components shall include liquid line temperature relief device, pressure transducers, liquid line shut-off valve, suction shut-off valve, suction line accumulators, nitrogen retention charge and compressor oil.

.2 Long line length check valves are required for liquid line installation on all linear line length applications over 100 feet (30.5 m) to prevent liquid migration during unit shutdown. For any size 025-030 dual circuit unit application where the evaporator is located higher than the condensing unit, check valves are required for linear line lengths greater than 55 feet (16.8 m).

.3 Units to include factory installed suction accumulator for each cooling circuit.

.7 Controls and safety :

.1 Unit controller shall include:

.1 The display panel is to be used to access condensing unit information, read sensor values and test the condensing unit. The display panel is a 4-button, 4-character, 16-segment LED (light-emitting diode) display. Eleven mode LEDs should be located on the display, as well as an alarm status LED. The display shows all codes (with 60-character expandable plain language), as well as set points, time of day, temperatures, pressures and overtemperature.

.2 Carrier Comfort Network® (CCN) system capability.

.3 Unit control with standard pressure transducer, discharge pressure transducer and suction temperature thermistors.

.4 Alarm list and history available on display.

.5 Service execution test capability.

.6 Minimum compressor run time (3 minutes) and minimum interval time (3 minutes).

.7 Service diagnostic mode.

.8 Stand-alone low voltage control circuit.

.9 Cycle control of condenser fans to maintain proper head pressure control.

.10 Capacity control with compressor start/stop sequence.

.11 Digital compressor cycling to maintain desired outlet air temperature setpoint.

.12 A relay to indicate when the unit is in alarm condition.

.2 Minimum unit safety devices shall include :

.1 Protection against compressor lockout in case of internal or external overload.

.2 Low pressure protection.

.3 High pressure protection (high pressure or internal switch).

.4 Compressor reverse rotation protection.

.5 Protection against pressure drop.

.6 Low suction overheating protection.

.7 Short cycle protection.

.8 Suction and discharge pressure transducers.

.9 Circuit breakers or fuses for compressor short circuit protection.

.3 Electrical requirements :

.1 All unit power cables must enter unit cabinet at one point only.

.4 Special features :

.1 High efficiency variable speed condenser fans :

All fans in the unit shall be for variable speed fan motors to provide higher part-load efficiency and reduced noise levels. Each fan circuit shall be equipped with an independent factory-installed variable-speed drive with display. Variable-speed drives are IP-55 and UL listed. The use of this option, with the addition of wind deflectors, shall allow running with outdoor ambient temperatures down to -20°F (-28.9°C).

.2 Optional condenser coil materials :

.1 Aluminum fins / copper tube : The coil shall consist of seamless copper tubing mechanically bonded to aluminum fins. The fins shall have corrugated enhancements. These condenser coils are recommended for remote chiller applications. These coils are not recommended for corrosive environments.

.3 Sound reduction :

.1 Low-noise fan for sound reduction available as factory-installed option.

.2 Low-noise compressor covers for additional sound reduction are available as a factory-installed option on all units with low-noise fans.

.4 Digital compressor :

.1 A digital compressor mounted on one of the 2 circuits will allow additional stages for tighter temperature control.

.2 Provide for the installation and connection of 2 temperature sensors (one at the DX coil discharge and one at the DX coil return). Connect their reading to the condensing unit with a 2-conductor 18AWG cable. (Connect to terminals 11, 19,20 of condensing unit low voltage terminal).

.3 Contractor to supply and install TXV (Thermostatic Expansion Valves) bleed port valves from 5% to 15%.

.5 Factory-fitted switch without fuses.

.6 BACnet communication shall provide factory installed communication capability with a BACnet MS /TP network. Allows integration with i-Vu® Open control system or BACnet building automation system.

.7 BACnet MS/TP translator to be supplied and installed by manufacturer.

.8 Energy Management Module (EMM) to control setpoint via 4-20Ma analog input. The module can also be used to limit device demand in %.

.9 Standard anti-vibration neoprene pads:

.1 Pads (24" x 3" x 1/4") shall be provided to reduce the transmission of compressor vibrations through the support structure.

.10 The wind deflector facilitates unit operation down to -20°F (-29°C).

## 3 EXECUTION

### 3.1 INSPECTION

.1 Verification of conditions: before proceeding with installation of condensers, chillers, ensure that condition of surfaces/substrates previously implemented under other sections or contracts is acceptable and allows work to be carried out in accordance with manufacturer's written instructions.

.1 Visually inspect surfaces/substrates in presence of Consultant.

.2 Immediately inform Consultant of any unacceptable conditions found.

### 3.2 GENERAL

.1 Mount units on base plates and anti-vibration pads and in accordance with manufacturer's recommendations.

.2 Provide necessary clearances for repair and maintenance in accordance with manufacturer's recommendations.

### 3.3 ON-SITE QUALITY CONTROL

.1 On-site testing

.1 Carry out tests under actual operating conditions in compliance with the requirements of CTI-ATC-105, in order to verify that equipment performance complies with specifications.

### 3.4 CLEANING

.1 Final clean-up: remove surplus materials, waste, tools and equipment from site.

**END OF SECTION**

# 1 GENERAL

.1 This section contains requirements common to the various sections of the Special Technical Clauses - Electrical and serves as a complement to the requirements of the "General Clauses and Conditions", in order to carry out the complete installation of the project. The general requirements apply to the work described in this discipline

.2 Statement of work

.1 No additional compensation will be allowed for the relocation of installed or uninstalled conduits and equipment which is deemed necessary due to structural or other normal considerations.

.2 The Engineer reserves the right to relocate equipment without charge or credit provided relocation does not exceed 5 m and notice of relocation is given prior to installation.

.3 The Contractor who, during the tendering period, becomes aware of an omission or discrepancy in the specifications shall immediately notify those responsible for tendering during the tendering period. During the execution of the work, he shall immediately notify the Engineer who, after validation with the City, will send a written change directive to the Contractor.

.4 The Engineer's interpretation must then be obtained before the work is carried out, as the Engineer will order that the work be undone and redone correctly, at the expense of the Contractor who has incorrectly anticipated the Engineer's decision.

.5 All work shall be perfectly executed, and the installation of any item shall be carried out with due regard to the fact that ease of reading, calibration, access, inspection and repair will be essential. The Engineer will require relocation of any item installed without regard to this clause at the Contractor's sole expense.

.6 The Contractor shall supply, install and connect all materials or accessories necessary for a complete installation even if not specifically shown in the specifications.

.7 In undertaking to perform the work described in the specifications, the Contractor acknowledges and accepts that the specifications do not contain a description or even mention of all accessories, details, minor works, etc. required for the complete performance of the work, and undertakes to accept the Engineer's decision as to what is to be supplied and how the work is to be performed to meet the requirements of the specifications.

.8 The names of the disciplines mentioned in the identification of a drawing or under the title heading of the drawing serve only to facilitate the work of each section and should not be considered as restrictive.

## 1.2 CODES AND STANDARDS

.1 All federal, provincial, municipal or other laws, codes, standards and regulations pertaining to the work specified apply and the electrical contractor is required to comply with them without additional compensation. Always use latest current edition.

.2 Complete installation in accordance with ACNOR C22.10, "Code de construction du Québec, Chapitre V - Électricité (Code Canadien de l'électricité, Première partie et modifications du Québec)", latest edition in force.

.3 Complete installation in accordance with Quebec Construction Code, Chapter I - Building, and National Building Code - latest edition (modified).

.4 Complete installation in accordance with National Fire Code - latest edition.

.5 Complete installation in accordance with National Energy Code for Buildings - latest edition.

.6 Perform all underground network installation in accordance with CSA C22.3, latest edition.

.7 Comply with CSA Z462 "Electrical Safety in the Workplace".

.8 Comply with certification standards, applicable NFPA standards and CSA bulletins on electricity and hazardous space classification in effect at time of tender.

## 1.3 RATED VOLTAGES

.1 Comply with CAN3 C235 for operating voltages.

.2 Verify that all lighting fixtures and their controls, electrical equipment and materials operate satisfactorily at 60 Hz frequency and within the limits prescribed by the above standard. They must be able to operate under the extreme conditions defined in this standard without suffering damage.

## 1.4 EQUIPMENT AND MATERIAL CERTIFICATION

.1 Ensure equipment and materials are CSA approved.

## 1.5 ACCEPTABLE PRODUCTS

.1 The term "Acceptable Products" or "Required Quality" means that the prescribed product is identified by manufacturer's name, supplier's name and/or catalog number, that it serves as a prescription and defines the criteria for yield, performance, quality of equipment and materials and quality of workmanship and that, where reference is made to a reference standard, the latter is to be considered as supplementary.

## 1.6 MANUFACTURERS' INSTRUCTIONS

.1 All appliances, accessories and equipment, etc. are to be installed, connected and operated strictly in accordance with the latest instructions and recommendations of the appliance manufacturers. Where the specifications do not show details of the accessories required or connections to be made for the installation of an appliance, it

is because the appliance manufacturer's recommendations apply to the installation in question, and these accessories and connections are included in the specifications as if they were specifically mentioned therein. If the Contractor has any doubts, he will submit the case to the Engineer, whose decision will be final.

.2 Fittings, flexible joints, anti-vibration pads, supports, thermal insulation, soundproofing, valves and all accessories required in accordance with the appliance manufacturer's instructions and recommendations, even if not mentioned in the specifications and addenda, must be supplied and installed correctly in accordance with all the most recent standards in force and the requirements relating to these standards.

## 2 PRODUCTS

.1 All materials installed inside the grit room, screen rooms and waste room shall be suitable for a Class 1 Division 1 location.

### 2.1 PAINTING AND SEALING

.1 Apply at least one coat of corrosion-resistant primer and one coat of paint to match surrounding finish on ferrous metal substrates/suspensions and on field fabricated equipment.

.2 Prime and touch-up surfaces where painted finish has been damaged, ensuring that new finish matches original finish.

.3 If required by Engineer, completely paint surfaces with severely damaged finish.

### 2.2 FINISHING

.1 Shop finish metal enclosure surfaces with rust-inhibiting primer inside and out and at least two coats of enamel paint finish, unless otherwise specified.

.1 Paint switchboards and equipment enclosures light gray, as per AMEEC 2Y 1 1958.

.2 Clean and touch-up shop-painted surfaces that have been scratched or damaged during shipping and installation. Use paint to match original paint.

.3 Clean and prime non-galvanized hooks, brackets, fasteners and other exposed fastening devices to protect against rust.

### 2.3 EQUIPMENT AND MATERIAL IDENTIFICATION

.1 To identify electrical equipment and materials, use nameplates designed as follows:

.1 Engraving plates in Lamicoid plastic or approved equivalent, 3 mm thick, 50 mm high and 100 mm wide, mechanically fastened with self-tapping screws.

.1 Panels and transformers:

.1 Lettering on these plates will be a minimum of 12.7 mm high. All panels and transformers will have two (2) types of identification. In all cases, equipment and source shall be identified.

.2 First identification:

.1 This first identification corresponds to the NAME of the panel or transformer, and consists of a plate as described above on which one or more letters or groups of letters and numbers will be printed. This plate will be placed on the visible part of the device.

.2 Refer to one-line diagram for panel or transformer name.

.3 Second identification:

.1 This second identification designates the power source and its physical location, which will consist of a plate as described above on which two groups of letters and numbers separated by a hyphen will be printed.

.2 The first group = the supplying equipment (source).

.3 The second group = the physical location of this source.

.2 Other equipement:

.1 All other electrical equipment (switches, disconnectors, starters, main breakers, etc.) shall always be identified with two elements, the name (abbreviated) of the equipment and the location of its power source or in some cases the equipment controlled and its location.

.2 Safety switches:

.1 All safety switches and/or circuit breakers will be identified by two plates, if this switch is not the same part as the controlled equipment and its source. A first plate bearing the name of the equipment inspected and its location. A second plate identifying its source and location.

.2 Nameplates affixed to switchboards and other equipment must indicate their identification and voltage.

## 2.4 WIRE IDENTIFICATION

.1 Permanently and indelibly identify, using Thomas&Betts "PO-068TW on SMOH" type markers, or approved equivalent, both ends of phase conductors of each feeder and branch circuit, interconnection boxes and terminal blocks.

.2 Use communication cables with uniformly color-coded conductors throughout the network.

.3 Maintain the same phase order and color code for each phase throughout the installation, and verify compliance with the following color code.

.1 CSA C22.10 color code shall be used for identification of conductors in 600 volt, 347/600 volt and 120/208 volt distribution and branch systems.

## 2.5 SOCKET IDENTIFICATION

.1 All outlets shall be identified by an approved 12.7 mm by 12.7 mm P-Touch sticker or equivalent with circuit number and power panel number.

.2 Inscription to be installed on cover plate.

## 2.6 IDENTIFICATION OF CONDUITS AND CABLES

.1 Colour code ducts, boxes and wire sheathed cables.

.2 Apply plastic tape or paint, as a means of marking, to cables or ducts every 15 m and through walls, ceilings and floors.

.3 Base colour strips must be 25mm wide and complementary colour strips must be 20 mm wide.

| Base Colour | Complementary Colour #1 | Complementary Colour #2 |
|---|---|---|
| Up to V | Yellow | |
| Up to 600 V | Yellow | Green |
| Up to 5 kV | Yellow | Blue |
| Up to 15 kV | Yellow | Red |
| Telephone | Green | |
| Other communication networks | Green | Blue |
| Fire Alarm | Red | |
| Emergency Communication | Red | Blue |
| Other safety systems | Red | Yellow |

.4 Ducts and cables shall be color coded to allow easy identification of duct contents. The identification will be done through two bands: the base color and the complementary color.

## 2.7 WIRE TERMINATIONS

.1 Ensure that the terminals, terminals and screws of the wiring terminations are suitable for both copper and aluminum conductors.

## 2.8 LOCKOUT

.1 Machinery, systems and equipment shall be designed, manufactured and supplied with energy isolating devices. Energy source isolation devices must be lockable.

.2 Energy source isolation devices must have the ability to control or dissipate hazardous energy. A means of dissipation or safe containment of accumulated or individual energy shall be incorporated into the machine, system or equipment. Devices for dissipating

accumulated energy shall be designed to incorporate a means or method for verifying their position and condition.

.3 The procedures for the installation of machinery, systems and equipment shall include provisions for the local isolation of the parts or systems comprising the machinery, systems or equipment where those parts or systems are to be repaired or maintained separately. The number and location of energy isolating devices shall be determined according to the configuration of the machine, system or equipment and its intended use.

## 2.9 ANCHORING

.1 Brick Wall and Masonry Expandable Fasteners, Powers Fasteners 9440 (Series), 9350 (½") or approved equivalent.

.2 Expansion Fasteners for Poured Concrete, SS HDI Series, SSHDI ½", Hilti or approved equivalent.

.3 High performance stud anchor for cracked concrete and stainless-steel seismic zone such as Hilti Kwik Bolt TZ SS 304 or approved equivalent.

.4 Flush anchor for shallow anchoring depths in cracked concrete and seismic applications such as Hilti HDI-P TZ or approved equivalent.

.5 High performance concrete screw with hexagonal head, seismic area, CSA A23.3 compliant, such as Hilti HUS-HR or approved equivalent.

.6 High performance anchor screw with internal threaded head, 316 stainless steel for cracked concrete and seismic area, such as Hilti KH-EZ or approved equivalent.

.7 Tapcon or plastic type fasteners are prohibited.

# 3 EXECUTION

.1 This section specifies certain requirements, obligations and responsibilities during the performance of the work of this specialty:

.1 Perform, at own expense and responsibility, all openings and blanks required for cable and conduit passage.

.2 Dispose of all waste from the execution of the work on a daily basis.

.3 Remove from the premises all tools, debris, surplus materials and waste resulting from the work, once the work is completed, and ensure that the equipment, equipment and accessories installed are not damaged; if they are, repair or replace them.

.4 Store all equipment, equipment, accessories and ducts in appropriate locations and without obstructing traffic.

.5 Protect its installation from damage until the complete installation has been approved by the appropriate authority.

.6 Seal all ends of installed ducts.

.7 Protect floors from deposits or debris that can damage them when work benches are installed inside the building.

.2 The drilling of holes by pneumatic or electric hammer with vibratory action as well as the drilling by hand and any other process by mechanical shock are prohibited. The holes must be drilled using a water rotary drill or any other device accepted by the Engineer.

## 3.2 INSTALLATION

.1 All electrical equipment installed on floor or floor shall be installed on concrete cleanliness bases.

.2 Unless otherwise specified, all electrical enclosures and cabinets in hazardous or outdoor locations shall be NEMA 4X stainless steel.

.3 Penetrating ducts in classified location shall be provided with EYS fittings.

.4 Complete the entire installation within hazardous locations in accordance with certification standards, applicable NFPA standards, CSA bulletins and CSA C22.10, “Code de construction du Québec, Chapter V – Électricité”, current standards.

.5 Armoured cables entering hazardous locations must pass through the access walls using a sealed sleeve with Roxtec or approved equivalent stainless-steel frame.

.6 Unless otherwise specified, complete the entire installation in accordance with CSA C22.1.

.7 Unless otherwise specified, install overhead and underground systems in accordance with CAN/CSA-C22.3 No. 1.

## 3.3 LOCATION OF OUTLETS AND POWER OUTLETS

.1 Back-to-back exits, outlets and power outlets may not be installed in a wall; leave a minimum horizontal clearance of 150 mm between boxes.

.2 The location of outlets and power outlets may be changed, at no additional cost or credit, provided that travel does not exceed 5 m and notice has been given prior to installation.

## 3.4 MANUFACTURERS AND CSA LABELS

.1 Ensure that manufacturer and CSA labels are clearly visible and legible once equipment and equipment is installed.

## 3.5 MOUNTING HEIGHT

.1 Mounting heights are measured, unless otherwise specified, from the finished floor to the centre of the unit or outlet.

.2 Equipment mounting heights will be validated on site.

.3 If the mounting height of an appliance is unknown, check with the Engineer before installation.

## 3.6 DRILLINGS, OPENINGS AND SLEEVES AND PATCHING

.1 Make all required drilling and sealing in floors, ceilings and walls. The Contractor shall not drill into beams, columns or structure in general without prior approval from the Engineer.

.2 Pre-locate all reinforcing steel and electrical conduit in the drill area (with Hilti Canada “Ferroscan” or equivalent approved and used by a qualified workforce) so as not to cut or damage existing reinforcing bars during drilling work. Any damage to existing ducts must be repaired as soon as possible by the Contractor, at its expense.

.3 Drill concrete structures using a rotary diamond drill.

.4 Submit all cores to Engineer for verification.

.5 Install stainless steel sleeves for locations that require fire and PVC sealing at other locations.

.6 Resurface all existing floors, ceilings, walls or other, damaged by the passage of pipes, cable shelves or installation of equipment.

.7 All drills to be completed outside of building occupancy hours. Engineer to be notified at least 48 hours in advance.

.8 Install appropriate sleeves and accessories. Unless otherwise specified, the sleeves must extend 50 mm beyond the concrete surface on each side. Seal openings to ensure tightness with concrete without shrinkage for wet or hazardous locations, when constructing walls and slabs.

## 3.7 FIRE AND SMOKE SEALING

.1 In accordance with the Quebec Construction Code, Chapter I Building, and National Building Code Canada 2015, at all places where pipes, conduits, conductors, cables, cable trays or pipes pass through a fire-rated separation, floor or other fire barrier, provide and install a fire and smoke sealing system that complies with CAN4-S115 and according to the application to restore the degree of fire resistance, original or more.

.2 The free space between these elements and the opening must be sealed using 3M or Hilti fireproof products or approved equivalent: CP25WB+ caulking or approved equivalent, FS195 wrapping tapes or approved equivalent, CS 195 composite sheet or equivalent approved and silicone sealants 2000 or 2003 or equivalent approved. The installation must comply with the manufacturer’s specifications according to the degree of fire resistance required.

.3 Use HILTI CP 680 sleeves with watertight module or approved equivalent when installing ducts and install prior to concrete placement.

.4 The Contractor shall provide the installation methods specified by the manufacturer for each type of fire barrier in the Contract.

.5 Fire barrier installation must have a beautiful finish and be free of burr.

## 3.8 ATTACHMENT OF EQUIPMENT

.1 Fix all electrical equipment including those on the ground with anchors that can withstand 150% of the load and provide seismic protection according to the requirements of the earthquake engineer.

.2 Electrical equipment weighing more than 150 kg, such as electrical panels, switches, transformers or cable trays, etc. should not be attached directly to the walls. It is recommended to attach this equipment to a U-shaped structure that will be attached to the floor and the structure that supports the roof. This structure must meet the requirements of the seismic engineer, engaged by the contractor, to provide adequate seismic protection.

## 3.9 COORDINATION OF PROTECTIVE DEVICES

.1 Ensure that circuit protection devices such as overcurrent triggers, relays and fuses are installed, are of the desired size and set to the required values.

## 3.10 ON SITE QUALITY CONTROL

.1 General

.1 Provide 48 hours written notice to Engineer prior to test date;

.2 Perform all tests specified in this specification. The requirements listed below are in addition to those specified in the specification;

.3 Perform all tests in the presence of the Engineer and to his (her) satisfaction;

.4 Obtain written permission for temporary testing, start-up and testing of permanent facilities and equipment prior to acceptance by the Engineer;

.5 Provide measuring devices, indicators, devices and personnel required to perform the tests during and upon completion of the work;

.6 The Engineer may require testing of facilities and equipment prior to acceptance;

.7 Do not conceal work until tested and approved. Follow work schedule and arrange for testing;

.8 If a piece of equipment or apparatus does not meet the manufacturer's specifications or the performance specified in a test, replace the defective unit or part without delay and pay all costs incurred by such replacement. Adjust system to achieve the desired yield. Assume all costs, including new trials and refurbishment;

.9 Prevent dust, dirt and other foreign material from entering facility and device openings during testing;

.10 Ensure that the values obtained are within the limits prescribed by the Quebec Electrical Code, otherwise take corrective action;

.11 Submit test results to Engineer in writing;

.12 Complete test forms provided in appendix for each equipment.

.2 Load Balancing

.1 Measure phase current of distribution panels under normal loads (lighting) at time of work receipt. Distribute branch circuit connections to obtain the best current balance between the various phases and note changes to the original connections;

.2 Measure the phase voltages to the devices and adjust the transformer sockets so that the resulting voltage is 2% close to the rated voltage of the devices;

.3 When measurements are complete, return Load Balancing Report. This report shall indicate the RPM currents under normal loads recorded on the phases and neutrals of distribution panels, dry transformers and motor control centers. Specify the time and date each load was measured, and the circuit voltage at the time of measurements.

.3 Test the following :

.1 Power distribution system, including phase, voltage and ground control, and load balancing;

.2 Circuits from bypass panels;

.3 Disconnectors, transformers, contactors and bypass panels;

.4 Engines and associated control/control devices, including sequential system operation controls, if applicable;

.5 Insulation resistance measurement:

.1 Measure, using a 500 V megohmmeter, the isolation value of circuits, distribution cables and devices with a rated voltage of not more than 350 V;

.2 Measure, using a 1000 V megohmmeter, the isolation value of circuits, arteries and devices with a rated voltage between 350 and 600 V;

.3 Check ground resistance value before power up.

## 3.11 START-UP

.1 Instruct operating personnel on the operation and maintenance methods of the facility, its equipment and components.

.2 Retain and pay for the services of an engineer seconded from the manufacturer's plant to monitor the start-up of the facility, to check, adjust, balance and calibrate the various components, and to instruct operating personnel.

.3 Provide these services for a sufficient period of time, including the number of visits required to activate the devices and ensure that operating personnel are aware of all aspects of their maintenance and operation.

## 3.12 CLEANING

.1 Leave areas clean at the end of each work day.

.2 Final Clean-up: Remove surplus materials/equipment, waste, tools and equipment from site.

.3 Remove recycling bins and dumpsters from site and dispose of materials at appropriate facilities.

## 3.13 HIDDEN WORKS

.1 Advise the Engineer in writing at least three (3) days in advance that some work will be hidden.

.2 Ensure that no facility is hidden before verification and substantial completion of the work, otherwise assume the costs incurred to discover the facility and rebuild the coatings.

**END OF SECTION**

# 1 GENERAL

.1 The content of all tender documents such as specifications, general clauses and conditions, special administrative clauses, special technical clauses for each discipline and all sections constitute the specifications.

.2 Supply and install all equipment, material and materials and provide all labor and tools necessary for the execution, supervision and quality control of all work.

.3 Obtain all permits from authorities having jurisdiction and pay all expenses incurred in obtaining said permits.

.4 Provide manpower and tools required to perform all tests required by authorities having jurisdiction and/or specifications. Repeat tests until satisfactory results are obtained. Defray costs of approval of tests carried out by authorities.

.5 Commission all installed equipment and systems once tested, adjusted and balanced.

.6 Include in scope of work complete work as defined in specifications, in accordance with Section 26 05 00 - "Electrical - General Requirements".

## 1.2 COORDINATION

.1 All equipment must be installed in such a way as to allow access to the various pieces of equipment and mechanical accessories. In general, the location of the largest equipment or equipment with the most location restrictions will take precedence over the smallest equipment or equipment with the least location restrictions.

.2 Coordinate work in this section with mechanical work for equipment location and connection, and for inspection work.

.3 Exact location of equipment to be determined on site.

.4 Dispose of temporary installations upon completion of work.

## 1.3 SCOPE OF WORK

.1 Electrical work includes, but is not limited to, supervision, tools, equipment, machinery, scaffolding, supports, materials, transportation and other incidentals necessary to complete the work described in these specifications and including receiving, unloading, handling and storage of materials supplied by the Customer, all of which must be operational. In general, major portions of the work include but are not limited to:

.1 Disconnection of electrical installations of cooling unit identified as ''AC-2'' located on roof. The cooling unit being demolished will be removed by the mechanical division once disconnected, along with all existing supports and accessories.

.2 Disconnect and remove exterior roof disconnect switch and power wiring from cooling unit being demolished.

.3 Modification of existing "AC-2" TLC cell (Cell#2 / Column #5) for reuse of this power supply for new cooling unit. The electrical contractor must ensure that the existing protection device located in the cell is 50A 600V 3P for the connection of the new unit. If this is not the case, the electrical contractor must disconnect and remove the existing protective device in order to replace it.

.4 If the protective device is not 50A-600V-3P, the electrical contractor must supply, install and connect a 50A-600V-3P circuit breaker in the drawer of the CCM cell modified for this work in order to supply the new cooling unit.

.5 Supply, install and connect 3#6 AWG teck90 1000V cable and boxes including all hardware for connection to new cooling unit.

.6 Supply, installation and connection of a 60A-600V-3P fuseless padlockable disconnect switch with weatherproof enclosure in the vicinity of the cooling unit supplied by the mechanical division.

.7 Supply, install and connect a GFCI type power socket (5-20R) with weatherproof enclosure close to the rooftop cooling unit as a power supply point in case of maintenance. Supply, install and connect a 2#12 teak 90 cable for this installation. Supply, install and connect a 20A-120V-1P-10kA circuit breaker to the nearest service panel.

.1 Feed power from outlet through existing roof access.

.2 If ducting is not possible, check with the customer whether the roof has a roofing warranty before proceeding with drilling. Make sure the roof is properly sealed, and provide a 1-year warranty.

.8 Identification labels to identify all system components.

.9 All supports and structural steel required to support conduits, cables, fixtures and equipment.

.10 Provide all skilled labor, equipment, materials and tools required for all wall and/or floor penetrations and other work required for installation of electrical equipment.

.11 Provide all required firestopping, acoustical and air sealing for all electrical and/or communication wiring and conduit penetrations through walls, floors and other partitions.

## 1.4 TEMPORARY POWER DISTRIBUTION FOR CONSTRUCTION

.1 Supply and install all temporary electrical distribution equipment (lighting and sockets) required for construction work. No surcharge will be granted for incorrect assessment of the extent of temporary installation by the Contractor.

## 1.5 DELIVERY TIMES

.1 From the outset of the contract, check delivery times for all materials and equipment to be supplied.

.2 Promptly order equipment with long lead times.

**END OF SECTION**

# 1 GENERAL

## 1.1 SUMMARY

.1 This section includes requirements for the selective demolition and removal of electrical installations, including the removal of conduit, junction boxes and panels and accessories required to complete the work described in this section and allow construction work to commence.

## 1.2 DEFINITIONS

.1 Demolish: To remove elements of existing structures and dispose of them from the site in accordance with laws and regulations, unless they are intended to be removed and salvaged or removed and reinstalled.

.2 Remove: Planned deconstruction and disassembly of electrical items from existing structures including removal of conduit, junction boxes, wiring and cabling from electrical components to panels, avoiding damage to adjacent items which are to remain in place; remove items from site in accordance with laws and regulations, unless otherwise specified to be removed and salvaged or removed and reinstalled.

.3 Remove and reinstall: Remove items from existing structures, prepare for reuse and reinstall where indicated.

.4 Existing item that must remain in place: Existing structures that must remain in place.

.5 Hazardous Materials: Hazardous substances, goods, commodities and products which may include, but are not limited to, asbestos, mercury and lead, PCBs, poisons, corrosives, flammable materials, radioactive substances and all other materials which, if improperly used, may adversely affect health or welfare or the environment, as defined by the federal government in the Hazardous Products Act (R.S.C. 1985), including the latest amendments.

## 1.3 DOCUMENTS/SAMPLES TO BE SUBMITTED FOR APPROVAL/INFORMATION

.1 Documents/samples to be submitted for approval/information prior to commencement of work under this section:

.1 Landfill records: Obtain evidence that a licensed landfill has accepted selected demolition and hazardous wastes.

### 1.4 IMPLEMENTATION CONDITIONS

.1 Existing conditions : Condition of materials to be salvaged or demolition materials, prior to submission of tender.

.2 Hazardous materials present: Analysis of power transformer insulating liquid determined presence of Hazardous Materials.

.1 Hazardous materials will be removed by the Contractor as part of the project.

.3 Discovery of hazardous materials: Hazardous materials are not expected to be discovered during work; notify Engineer immediately if materials likely to contain hazardous materials are discovered and perform the following tasks:

.1 Hazardous materials are defined in the Hazardous Products Act.

.2 Stop work in area where hazardous materials are suspected.

.3 Take appropriate preventive measures to limit exposure of users and workers. Install barriers and other safety devices and refrain from moving hazardous materials.

.4 Continue work only after receiving written instructions from Engineer.

## 2 PRODUCTS

### 2.1 MATERIALS

.1 Electrical Repair: Use only new CSA Group or ULC approved materials and related components for work associated with removal or demolition of elements.

.2 Firestop repair materials: Use materials compatible with existing firestop systems when removal and demolition work involve fire-rated elements; restore elements to provide existing fire resistance.

## 3 EXECUTION

### 3.1 INSPECTION

.1 Verification of existing conditions: Before inviting bids, visit site, inspect thoroughly and become familiar with conditions that may affect the work called for in this section; the Engineer will reject requests for additional work or materials to meet the contract that a site visit would have identified.

## 3.2 PREPARATORY WORK

.1 Protect existing systems that must remain in place: Protect systems and components that must remain in place during selective demolition operations. Proceed as follows:

- .1 Prevent movement and bracing to prevent settlement or breakage of adjacent services and components of existing buildings that must remain in place.
- .2 Notify Engineer and cease activities when safety of buildings being demolished, adjacent structures or services appears to be threatened. Wait for further instructions before resuming demolition work as outlined in this section.
- .3 Prevent debris from clogging drainage channels.
- .4 Protect mechanical systems that must remain functional.

.2 Protection of building occupants : Schedule demolition work to minimize interference with users' use of building:

- .1 Prevent debris from threatening access to or evacuation of occupied buildings.
- .2 Notify Engineer and cease activities when safety of occupants appears to be threatened. Wait for further instructions before resuming demolition work under this section.

## 3.3 EXECUTION

.1 Investigate all existing circuits supplying equipment retained or removed in work area or supplied by circuits passing through work area.

.2 When modifications to existing electrical installation affect areas adjacent to work, supply and install conduits, conductors and accessories necessary for permanent redistribution of services.

.3 Seal all openings in boxes and enclosures with approved devices.

.4 Replace at no cost to Owner, any existing equipment to be moved or removed temporarily damaged during work.

.5 Supply and install conduit, conductors and accessories required to maintain a permanent power supply to any equipment to be replaced or relocated.

.6 Deliver salvaged materials to the location designated by the Engineer within the Saint-Hyacinthe territory.

.7 Disconnect electrical circuits and panel feeders; maintain power supply and retain main distribution panel for work to be performed.

.8 Perform demolition work in accordance with good engineering practice.

- .1 Remove tools and equipment upon completion of work; clean site and prepare for future renovation work.

.2 Repair and restore surfaces damaged during the execution of work in this section; repaired and restored surfaces must be compatible with existing materials and finishes.

.9 Disconnect electrical bypass from cooling unit being demolished by mechanical division and identify each TLC cell with the term "on standby".

.10 Grind pipes embedded in concrete until flush with concrete surface; permanently seal pipe openings with silicone sealant.

.11 Permanently seal pipe openings that are inaccessible or cannot be removed without damaging adjacent structures with silicone sealant.

## 3.4 UPGRADING

.1 Upon approval of the Engineer, it is permissible to reuse existing conduits which would have to be removed during dismantling provided they are:

.1 Minimum size required;

.2 Type suitable for use described in this specification;

.3 Not obstructed;

.4 Not damaged;

.5 Not rusted or corroded;

.6 Used with new fittings appropriate for new conduit or boxes;

.7 Left in current position.

## 3.5 ACTIVITIES RELATED TO COMPLETION OF WORK

.1 Demolition waste disposal: Dispose of site waste in accordance with laws and regulations. Ship demolition materials to provincially certified landfill or reclamation site (recycling center).

**END OF SECTION**

# 1 GENERAL

## 1.1 REFERENCES

.1 CSA International

.1 CAN/CSA-C22.2 No 18.1-04 (2013), Metallic outlet boxes.

.2 CAN/CSA-C22.2 No 65 (2018), Wire connectors (trinational standard with UL 486A-486B and NMX-J-543-ANCE-03).

.2 Electrical and Electronics Manufacturers Association of Canada (EEMAC)

.1 EEMAC 1Y-2-1961, Connectors for feed-through terminals and aluminum adapters (1200 A current rating).

.3 National Electrical Manufacturers Association (NEMA).

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

.1 Submit required documents and samples in accordance with specifications.

.2 Technical data sheets

.1 Submit required technical data sheets, manufacturer's instructions and documentation. Data sheets shall include product characteristics, performance criteria, dimensions, limits and finish.

## 1.3 DOCUMENTS/ITEMS TO BE HANDED OVER ON COMPLETION OF WORK

.1 Submit required documents/components as per specification.

.2 Operation and maintenance sheets: provide instructions for operation and maintenance of cable and box connectors, to be incorporated in operation and maintenance manual.

## 1.4 TRANSPORT, STORAGE AND HANDLING

.1 Transport, store and handle materials and equipment in accordance with the general clauses of these Special Technical Clauses - Electricity and the manufacturer's written instructions.

.2 Delivery and acceptance: deliver materials and equipment to job site in original packaging, which must be labeled with manufacturer's name and address.

.3 Storage and Handling

.1 Store materials and equipment off the floor, in a clean, dry, well-ventilated area, in accordance with manufacturer's recommendations.

.2 Store cable connectors and boxes in such a way as to protect them from marks, scratches and abrasions.

.3 Replace damaged materials and equipment with new ones.

## 2 PRODUCTS

### 2.1 MATERIEL

.1 Pressure connectors for cables with copper current-carrying elements, of appropriate size for copper conductors, as required.

.2 Feed-through terminal connectors consisting of the following components:

- .1 Connector body and clamp for stranded, round or copper busbar conductor.
- .2 Clamping flange for stranded conductor, round conductor or copper busbar.
- .3 Clamp bolts.
- .4 Bolts for copper busbar conductor.
- .5 Gauge suitable for busbar conductors, as specified.

.3 Clamps or connectors for armoured cable, TECK cable, flexible conduit or non-metallic sheathed cable, as required.

## 3 EXECUTION

### 3.1 EXAMINATION

.1 Verification of conditions: before proceeding with installation of cable and box connectors, ensure that the condition of surfaces/substrates previously implemented under other sections or contracts is acceptable and allows work to be carried out in accordance with manufacturer's written instructions.

- .1 Inform Engineer immediately of any unacceptable conditions found.
- .2 Begin installation work only after unacceptable conditions have been corrected and written approval has been received from Engineer.

### 3.2 INSTALLATION

.1 Carefully strip the ends of conductors and cables and then, as appropriate, proceed as follows:

- .1 Apply a coat of zinc-based joint compound to aluminum cable splices before installing connectors;
- .2 Install pressure connectors and tighten using manufacturer's recommended compression tool;

### 3.3 CLEANING

.1 On-site cleaning: carry out cleaning work in accordance with specifications.

- .1 Leave the premises clean at the end of each working day.

.2 Final clean-up: remove surplus materials, waste, tools and equipment from site in accordance with specifications.

**END OF SECTION**

# 1 GENERAL

## 1.1 RELATED REQUIREMENTS

.1 Section 26 05 00 - Electrical - General Requirements for Work Results.

.2 Section 26 05 20 - Cable and Box Connectors 0 - 1000 V.

.3 Section 26 05 34 - Conduit, Conduit Fixings and Fittings.

## 1.2 TECHNICAL DATA SHEETS

.1 Soumettre les fiches techniques requises conformément au devis.

## 1.3 TRANSPORT, STORAGE AND HANDLING

.1 Packaging waste management: recover packaging waste for reuse and take-back of pallets, crates, padding and other packaging materials by the manufacturer.

# 2 PRODUCTS

## 2.1 BUILDING WIRING

.1 Conductors: stranded if 10 AWG and larger; minimum size: 12 AWG.

.2 Copper conductors of indicated size, under cross-linked thermosetting polyethylene insulation, for 600V voltage for networks of less than 300V and type RW90 XLPE.

.3 Copper conductors of indicated size, under cross-linked thermosetting polyethylene insulation, for 1000V voltage for networks over 300V and type RW90 XLPE.

.4 Copper conductors of indicated size, under cross-linked thermosetting polyethylene insulation, for 1000V voltage and type RWU90 XLPE for use in underground conduits or outdoors.

.5 Load-bearing neutral cables with 3 insulated copper phase conductors and one steel-reinforced copper neutral conductor, size as indicated and type NS90 for rated voltage 600 V.

## 2.2 TEAK 90 CABLES

.1 Cables: as per section 26 05 00 - Electricity - General requirements for work results.

.2 Conductors

.1 Grounding conductor: copper.

.2 Supply conductors: copper, of specified gauge.

.3 Insulation

.1 Ethylene propylene rubber (EP).

.2 Cross-linked polyethylene (XLPE).

.3 Rated voltage: 1000 V.

.4 Sheathing: polyvinyl chloride.

.5 Metal armor: aluminum strip.

.6 Outer jacket: thermoplastic polyvinyl chloride.

.7 Approved for use in Class 1 Division 1 locations.

.8 Fasteners

.1 One (1) hole clamps, aluminum, for exposed cables 50 mm or less. Two (2) hole mounting brackets, steel, for cables over 50 mm.

.2 U-shaped brackets for groups of two (2) or more cables, placed at 1500 mm centres.

.3 Threaded suspension rods: 6 mm diameter, for "U" brackets.

.4 When fasteners are used in screen room or grit room, use one (1) hole stainless steel clamps for exposed cables 50 mm or less. Two (2) hole stainless steel clamps for cables over 50 mm.

.9 Connectors

.1 Waterproof and explosion-proof models approved and suitable for cables.

## 2.3 REINFORCED CABLES

.1 Conductors: insulated, copper, size as indicated.

.2 Cables type AC90.

.3 Metal armor: aluminum strip.

.4 Cables type ACWU90, with flame retardant PVC jacket (FT4) covering thermoplastic armour, conforming to building code requirements for building class of this project.

.5 Connectors: short-circuit proof connectors.

## 2.4 NON-METALLIC SHEATHED CABLES

.1 Non-metallic sheathed copper cables of type, size and number of conductors indicated.

## 2.5 TEAK-TYPE CONNECTORS

.1 Cable fittings to comply with ACNOR C22.2 N° 188.

.2 Cable fittings shall be suitable for copper cables.

.3 Specified descriptions and catalog numbers apply to 13 mm (½") diameter cables. For all other cable sizes, fittings shall be of the same series.

.4 Watertight models with sealing washer, approved and suitable for TECK, Thomas & Betts Star Teck ST series cables or approved equivalent.

.5 Explosion-proof class 1, division 1 models, approved and suitable for TECK, Thomas & Betts Star Teck XP series cables with SC65 or SC4-KIT-1 series sealant according to application or approved equivalent.

### 2.6 CABLE TIES

.1 Cable clamps for cable trays:

.1 CPC075SS6 series stainless steel from Thomas & Betts or approved equivalent;

.2 Profile cable clamps:

.1 Series 701-088SS6 stainless steel from Thomas & Betts or approved equivalent;

.2 CH118-081SS series stainless steel from Thomas & Betts or approved equivalent;

.3 Series PBC105-½ Plasti-Bond Red Hot from Robroy Industries or approved equivalent;

.4 CPC075SS6 series stainless steel from Thomas & Betts or approved equivalent.

.3 Thomas & Betts Ty-Rap cable ties or approved equal will be used when other tie systems cannot be used. Black Ty-Rap types to be submitted for approval and approved prior to installation.

.4 All Ty-Rap cable ties shall have the type of corrosion protection required for the installation location. TYS12-470C, TYS6-470 and TYS6-470C from Thomas & Betts, or approved equivalent. For attachment of small cables or conductors without required tensile strength: TY-5275M and TYC-27MX, or approved equivalent.

### 2.7 SPLITS

.1 Connections shall be in accordance with ACNOR C22.2 N° 65.

.2 For voltages up to 750 V.

.3 Screening and other fittings used to connect conductors shall be suitable for copper and aluminum conductors. Shall be marked for such use.

.4 Teck cable splice kit with cold shrink for 3 or 4 conductor power cable with 1000 V armour and insulation, 3M series 5730C / AC, or approved equivalent.

.5 Cable splice kit for power cable with cold shrink 1,000 V insulation from 3M series 8420 or approved equivalent.

## 3 EXECUTION

### 3.1 ON SITE QUALITY CONTROL

.1 Test in accordance with Section 26 05 00 - Electrical - General Requirements for Work Results.

.2 Perform tests using methods appropriate to local conditions, and approved by Engineer and local authorities having jurisdiction.

.3 Perform tests before energizing electrical installation.

## 3.2 CABLE INSTALLATION - GENERAL

.1 Lay cables in cable trays in accordance with section 26 05 36 - Cable trays for electrical installations.

.2 Terminate cables in accordance with section 26 05 20 - Cable and Box Connectors 0 - 1000 V.

.3 Use cable color coding in accordance with section 26 05 00 - Electricity - General Requirements for Work Results.

.4 Handle all conductors and cables with great care. No installation of conductors or cables will be permitted in temperatures below those recommended by manufacturers.

.5 Take necessary precautions to avoid abrasion and crushing of conductors or cables.

.6 Use lubricants conforming to CSA standard and compatible with conductor or cable sheath material, to reduce tensile stress.

.7 Always observe minimum bending radii when installing cables and conductors.

.8 Respect cable or conductor pulling capacities. Upon Engineer's request, Contractor shall submit cable or conductor pulling calculations.

.9 Parallel feeders must be of the same length.

.10 Attach feeder cables to distribution centers, pull boxes and terminations.

.11 Concealed wiring in walls shall be routed downhill or in vertical loops to facilitate subsequent work.

.12 All wiring to be identified with permanent markers to show source and destination.

.13 Permanently and indelibly mark with colored plastic tape the (2) conductor ends for each feeder circuit.

.14 Contractor to identify phases A-B-C and neutral with appropriately colored conductors (red, black, blue and white respectively) at all points on 347/600 V and 120/208 V systems.

.15 Use pressure connectors of appropriate size for conductors.

.16 All cables are to be clamped to wall or ceiling mounted U-profiles. No cables are to be attached directly to building partitions.

.17 No wire leads are permitted in box covers.

.18 Use Thomas & Betts Ty-Rap cable ties (or approved equivalent) when other fastening systems cannot be used.

.19 Secure to cable trays or supports with cable ties installed in accordance with Quebec Electrical Code requirements; install sufficient cable ties to ensure rigidity of installation and to adequately support cable weight in vertical runs.

.20 Secure all electrical cables with appropriate fasteners. Never use suspended ceilings, plumbing piping, ventilation and/or air-conditioning ducts, mechanical equipment supports or any other device as a means of fastening electrical cables. Steel wire and metal strips with holes will not be tolerated.

.21 All cables connected to a cabinet or box should preferably be connected from below. If this is not possible, cables shall be connected from the sides. Otherwise, cables shall be routed through the top of the box or cabinet. In this case, the Contractor should use nylon gaskets to seal the installation.

.22 Within boxes, panels and motor control centers, conductors shall be formed and tied together with Thomas & Betts Ty-Rap type wire ties (or approved equal).

.23 Within boxes, panels and motor control centers, conductors shall be formed and bonded together using Thomas & Betts Ty-Rap type clamps (or approved equal).

.24 Separate Neutral.

## 3.3 BUILDING WIRING INSTALLATION

.1 Laying the wire :

.1 In conduits;

.2 In cable trays.

## 3.4 TECK90 CABLE INSTALLATION (0 - 1000 V)

.1 Whenever possible, group cables on U-shaped supports. Comply with Quebec Electrical Code requirements for cable spacing to maintain 100% conductor carrying capacity.

.2 Fasten with clamps on U-profiles, wall or ceiling. No cables are to be attached directly to building partitions.

.3 Use cable trays where indicated.

.4 Lay concealed cables where possible, securing them firmly.

.5 Terminate cable ends with approved waterproof model connectors suitable for TECK type cables.

.6 Terminate both (2) ends of TECK cables with explosion-proof connectors when passing through zone 1 (class 1, division 1 or division 2).

## 3.5 INSTALLATION OF ARMOURED CABLES

.1 Whenever possible, group cables on U-shaped supports. No cables on suspended ceilings, mechanical supports or conduits.

.2 In general, all electrical installation is in conduit. However, the following options are permitted in the following special cases:

.1 When ceilings are accessible (removable tiles), the basic layout of lighting circuits must be sub-conducted with junction boxes anchored to the building structure and evenly distributed over the entire surface of the installation in question. From the junction boxes, it is permissible to connect each luminaire individually with AC90 armoured cable over a maximum horizontal distance of 3 m. Fix the AC90 cables to the slab up to the point of descent to the luminaire.

.3 Spread cables wherever possible.

.4 Terminate cable ends with armoured cable connectors.

.5 Unless otherwise specified, all wiring will be concealed within architectural elements. No surface installation will be permitted without prior approval of the Engineer.

## 3.6 INSTALLATION OF ALUMINUM-SHEATHED CABLES

.1 Whenever possible, group cables on "U" shaped supports.

## 3.7 INSTALLATION OF 4 TO 20 mA ANALOGUE SIGNAL CABLES

.1 Analog signal transmission cables are used between control box, PLC box and instruments, and other boxes.

.2 Lay cables in cable tray or dedicated conduit as specified.

.3 Install cable clamps and connectors to junction boxes as required.

.4 Ground metal armor of control cables.

## 3.8 INSTALLATION OF 24-VOLT D.C. DISCRETE SIGNAL CABLES

.1 Discrete signal transmission cables are used between control cabinet, PLC cabinet and instruments, and other cabinets.

.2 Lay cables in cable tray or dedicated conduit as specified.

.3 Install cable clamps and connectors to junction boxes as required.

.4 Ground metal armor of control cables.

## 3.9 INSTALLATION OF NON-METALLIC SHEATHED CABLES

.1 Lay cables.

.2 Install cable clamps and connectors to junction boxes as required.

**END OF SECTION**

# 1 GENERAL

.1 Not applicable.

# 2 PRODUCTS

## 2.1 U-SECTION BRACKETS

.1 U-profile brackets, for surface or suspended installation.

.2 U-channel, 41 x 41 mm (1⅝" x 1⅝"), 2.5 mm thick, 12-gauge hot-dip galvanized (HDGC) steel, 1200 series, Superstrut by Thomas & Betts, or approved equal.

.3 U-channel, 41 x 41 mm (1⅝" x 1⅝"), 2.5 mm thick, 12-gauge 316 stainless steel (SS), 1200 series, Superstrut by Thomas & Betts, or approved equivalent.

## 2.2 U-SECTION STRUCTURE

.1 Site-built self-supporting structure for installation of electrical equipment erected with U-sections.

.2 Self-supporting structure is built with capacity and rigidity required for installation of all specified electrical equipment.

## 2.3 HARDWARE

.1 AP235SQ series bases for double posts, or approved equivalent.

.2 Protective end caps for Unistut P2860 series U-channel, or approved equivalent.

.3 Main vertical structure is composed of type 02 double channels.

.4 Fastening hardware is electrogalvanized steel in electrical rooms and dry areas, stainless steel in all other areas and outdoors. Tapcon or plastic type fasteners are prohibited.

.5 Expansion fasteners for poured concrete, SS HDI ⅜" series, SSHDI ½", Hilti or approved equal.

.6 High performance dowel anchor for cracked concrete and seismic zone in stainless steel such as Hilti Kwik Bolt TZ SS 304 or approved equal.

.7 Hot-dipped galvanized steel square washer in electrical rooms and dry areas, stainless steel elsewhere and on concrete walls.

.8 Fittings and supports are hot-dipped galvanized steel in electrical rooms and dry areas, stainless steel elsewhere and on concrete walls.

.9 Stainless steel U-channels in wet areas, outdoors and on concrete walls.

.10 13 mm diameter hot-dipped galvanized steel threaded rods in electrical rooms and dry areas, in stainless steel, elsewhere and on concrete walls.

# 3 EXECUTION

## 3.1 INSTALLATION

.1 Secure material to solid masonry, ceramic and plaster surfaces, using Kwik Bolt dowel type anchors, or approved equivalent.

.2 Secure material to hollow masonry and plaster surfaces, using anchors recommended by manufacturer and approved by Engineer.

.3 Secure material to poured concrete surfaces, using expansion anchors.

.4 Support conduits or cables with staples, spring bolts and cable ties designed as U-channel accessories.

.5 Install brackets, mounts, hooks, clamps and other types of metal supports where indicated and where necessary to support conduits and cables.

.6 Do not use binding wire or perforated strapping to support or secure conduit or cable.

.7 Do not use brackets and hardware installed for other trades as conduit or cable supports unless permission is obtained from other trades and approved by Engineer.

.8 Install brackets and supports as required for each type of equipment according to manufacturer's recommendations.

.9 To surface mount two or more conduits, use U-channels installed to code requirements.

.10 Suspended support systems

- .1 Support each cable or conduit with 6 mm diameter threaded rods and spring clips.
- .2 Support a minimum of two (2) cables or conduits on U-channels supported by 13 mm diameter threaded suspension rods, where direct attachment to building structure is not possible.
- .3 Use stainless steel dowel anchors for cracked concrete and seismic zones.

.11 Install supports according to seismic requirements as specified in fascicule 26 05 30. The Contractor is responsible for carrying out his work in full and in accordance with the requirements of specification 26 05 30.

**END OF SECTION**

# 1 GENERAL

## 1.1 REFERENCE STANDARDS

.1 Codes, standards and regulations

.1 All laws, codes, standards and federal, provincial, municipal or other regulations relating to the specified works are applicable and the Contractor is obliged to comply to them without additional.

.2 Carry out the entire installation in accordance with CSA standard C22.10, « Code de construction du Québec, Chapitre V – Électricité (Code Canadien de l'électricité, Première partie et modifications du Québec) », latest edition in force.

.3 Carry out the entire installation in accordance with the «Code de construction du Québec, Chapitre I - Bâtiment, et Code national du bâtiment - Canada 2015».

## 1.2 GENERAL

.1 Electrical components and their anchorages must be designed to withstand a lateral force in accordance with articles 4.1.8 of chapter 4 "Loads and effects due to earthquakes" of the CCQ 2015.

.2 The "IE" risk coefficient is 1.5, i.e. for the "civil protection" category as specified in table 4.1.8.5 of QCC 2015.

.3 Seismic class of soil on construction site is D.

.4 Buildings and internal equipment components are subject to the same seismic criteria.

.5 The design of the seismic protection system must be carried out by an engineer specialized in seismic protection, member of the Ordre des ingénieurs du Québec. Upon completion of the work, the same engineer shall make a site visit and submit a report to validate and certify installation of all seismic-resistant equipment.

.6 Services of seismic engineer to be included in Contractor's bid. Any modifications required according to seismic requirements are at Contractor's expense.

.7 Anchorage devices as well as anti-seismic elements, such as motion limiters, vibration isolators, stabilizing devices and others, must be designed and installed to resist the minimum acceleration forces described in "Design Criteria" in all directions.

.8 During an earthquake, anti-seismic devices must prevent permanent displacement and damage due to horizontal, vertical and overturning movements.

.9 During an earthquake, anti-seismic devices must prevent permanent displacement as well as damage due to horizontal, vertical and overturning movements.

.10 Certain services considered critical require special measures. Critical services are: emergency power supply, fire alarm, power supply to pumping systems.

.11 In the case of equipment, electrical conduits and suspended cable racks, anti-seismic anchoring and stabilizing (bracing) devices are in addition to those provided for vertical support of the component.

## 2 PRODUCTS

### 2.1 SLAB-MOUNTED EQUIPMENT

.1 Where vibration isolators are not provided, anchorage devices shall be designed and installed to withstand minimum acceleration forces.

.2 Install anti-seismic motion limiters where standard vibration isolators are used, i.e. not designed for seismic protection.

.3 If vibration isolators specifically designed for seismic protection are used, then these must be designed and installed to withstand the minimum acceleration forces. Refer to "Vibration Isolation" in this section for description of anti-seismic vibration isolators.

.4 In case of large equipment, suspension elements or wall attachments may be added to stabilization.

.5 The clean slab must be anchored to the structural slab in accordance with CSA A23.3 standard, as recommended by the engineer specializing in seismic protection.

### 2.2 HANGING EQUIPEMENT

.1 Where vibration isolators are not provided, anchorage and stabilization (bracing) devices shall be designed and installed to withstand minimum acceleration forces.

.2 If vibration isolators are used, then install seismic cable stabilization system.

### 2.3 ELECTRICAL CONDUITS AND CABLE RACKS

.1 For electrical conduits, install anchoring and stabilizing devices (spacer) in accordance with "Seismic Restraint Manual: Guidelines for Mechanical Systems", 1991 edition, as published by SMACNA. The use of an anti-seismic cable stabilization system is also acceptable.

### 2.4 STABILIZING ELECTRICAL CONDUITS

.1 Stabilize :

.1 Conduits 25 mm (1") diameter and larger of the above-mentioned critical services;

.2 All electrical conduits 65 mm (2½") diameter and larger, everywhere.

.2 Do not stabilize :

.1 Electrical conduits whose vertical distance between the point of attachment to the structure and the top of the suspended element is less than 300 mm (12");

.2 Electrical conduits not required in preceding articles.

.3 Install anchoring and stabilizing devices (spacer) at the following frequency for electrical conduits :

.1 For transverse stabilization, every 12 m (40') maximum, except for critical service piping (described above), every 6 m (20') maximum;

.2 For longitudinal stabilization, every 24 m (80') maximum, except for critical service piping (described above), every 12 m (40') maximum.

.4 Install flexible joints where electrical conduits pass through rigidly supported seismic building joints or expansion joints and connect to equipment installed on anti-vibration springs.

.5 Also install flexible joints where conduits are rigidly supported and connect to equipment installed on anti-vibration springs.

## 2.5 ANTI-SEISMIC MOTION LIMITERS

.1 General: designed to withstand a minimum acceleration force of 1.0 g with elastomer cushion to prevent violent impacts. Depending on type selected, supply in sufficient quantity and arranged to stabilize component in all directions.

.2 Type LS-1: One direction, in horizontal plane only;

.3 Type LS-2: All directions, in horizontal plane only;

.4 Type LS-3: Vertical and all directions in the horizontal plane;

.5 Type LS-4: Vertically as well as one direction in the horizontal plane;

.6 Acceptable products: Vibron models HS-1 (type LS-1), HS-2 (type LS-2), HS-3 (type LS-3) and HS-4 (type LS-4); VMC SR/SRD series (Racan); Mason or approved equivalent.

## 2.6 ANTI-SEISMIC CABLE STABILIZATION SYSTEMS

.1 Systems pre-designed for application using "aviation cables".

.1 Acceptable products: Vibron, VMC SCR series (Racan); Mason, Hilti or approved equivalent.

.2 Shop Drawings - Seismic Protection :

.1 Provide shop drawings of seismic protection system components;

.2 Provide drawings indicating position of elements for stabilization of equipment and electrical conduit networks;

.3 Indicate for each stabilizing element, and in the case of each piece of equipment as well as in the case of electrical conduit networks :

.1 Weight of stabilized component;

.2 Acceleration force;

.3 Corresponding horizontal and vertical force;

.4 Type of stabilizing element and direction(s) of action;

.5 Where applicable, number of stabilizing elements and arrangement;

.6 Type of anchorage;

.7 Distance of anchors from edges of slabs, joints, cracks, etc.

.3 Where anchorages and stabilizing elements are not of the pre-designed type, provide calculations demonstrating their effectiveness.

.2 All the above-mentioned elements and information requested must be validated and sealed by the engineer specializing in seismic protection. Following installation, the same person shall inspect the work and provide an inspection report.

## 3 EXECUTION

### 3.1 INSTALLATION

.1 Anchor points in slabs must be away from edges, follow ASTM E-488 standard in this chapter.

.2 Follow manufacturer's recommendations for anchoring devices pre-designed for application.

.3 For equipment not provided with attachment points, provide for addition of such points, by welding or other means of attachment, or provide for installation of attachment belts.

.4 Structural bases of equipment must be stabilized to prevent overturning of anti-seismic devices. Installation of equipment on two simple beams, for example, is unacceptable.

.5 Oblong holes for bolt adjustment are prohibited.

.6 Follow manufacturer's recommendations for spacing between motion limiters and component to be stabilized. Maximum spacing is 6 mm (¼"). Install the motion limiters after the component is in operating position, all to respect the required spacing.

**END OF SECTION**

# 1 GENERAL

## 1.1 REFERENCES

.1 Canadian Standards Association (CSA)/CSA International

.1 Distribution boxes: comply with CSA C22.2 No. 76-14.

.2 Junction boxes, pull boxes and cabinets: comply with CSA C22.2 No. 40.

.3 PVC boxes and fittings: to CSA C22.2 No. 85.

.4 All boxes shall conform to dimensions required by the Quebec Electrical Code.

# 2 PRODUCTS

## 2.1 GENERAL

.1 Supplied by a single manufacturer.

.2 Manufacture CSA type 12 in dry locations.

.3 Manufacture of CSA type 4X, stainless steel in underground structures, all other locations or outdoors.

## 2.2 DISTRIBUTION BOXES

.1 Construction: sheet metal or stainless-steel enclosures, depending on location, with welded corners and formed hinged covers, lockable in closed position.

.2 Terminations: terminal blocks to correspond to size and number of input and output conductors connected to them, as indicated.

.3 Spare terminals: Provide a minimum of three (3) spare terminals for each terminal block or terminal block rated below 400A.

## 2.3 JUNCTION AND PULL BOXES

.1 Steel or stainless-steel boxes according to location, without opening, welded.

.2 Covers, for flush mounting with covers with edge protruding at least 25 mm.

.3 Hinged covers for surface mounting, screw-on.

.4 Junction boxes complete with terminal blocks, rail-mounted for cable connection, with hinged door, latch. Provide 100% free terminal blocks for junction boxes intended for equipment connection.

## 2.4 CABINETS

.1 Welded sheet steel or stainless-steel cabinets, depending on location, with mounting plate, hinged door, handle and CORBIN 5R6352 lock. Supply (2) keys.

.2 E type cabinets in sheet steel, for surface mounting, with folded edges, hinged doors, handle fitted with CORBIN 5R6352 lock or latch as specified, fitted with mounting plate. Supply (2) keys.

## 3 EXECUTION

### 3.1 GENERAL

.1 Install all boxes or cabinets on U-channels, attached to floor and ceiling.

.2 Secure boxes so that they are supported independently of the conduits connected to them.

.3 Boxes of sufficient size for the number of cables to be installed.

.4 Affix identification labels showing voltage, number of phases and input current.

### 3.2 INSTALLATION OF DISTRIBUTION BOXES

.1 Install distribution boxes as indicated, plumb, aligned and square to building lines.

.2 Unless otherwise specified, extend distribution boxes the full length of equipment served.

### 3.3 INSTALLATION OF CABINETS, JUNCTION BOXES AND PULL BOXES

.1 Install pull boxes or junction boxes in concealed areas accessible after all work is completed.

.2 Unless otherwise specified, install cabinets so that top is no more than 2 m above finished floor.

.3 Place terminal board as indicated in cabinets.

.4 Only main junction and pull boxes are indicated. Install additional boxes as required by CSA C22.1.

.5 Install 19 mm thick fire-retardant plywood for distributor transformer cabinet, equivalent in width to cabinet width and 600 mm higher than cabinet height. The plywood must be fastened to U-profiles fixed to the floor and ceiling. Plywood must not be fastened directly to building partitions.

### 3.4 IDENTIFICATION LABELS

.1 Supply and fit equipment identification labels in accordance with Section 26 05 00 - "Electrical - General Requirements".

**END OF SECTION**

# 1 GENERAL

## 1.1 REFERENCE STANDARDS

.1 CSA Standard C22.10-latest edition. Enclosures shall be stainless steel for outdoor equipment (NEMA 3R).

## 1.2 RELATED SECTIONS

.1 Section 26 05 00 - General requirements

.2 Section 26 27 26 - Wiring Devices

# 2 PRODUCTS

## 2.1 OUTLET AND JUNCTION BOXES (GENERAL)

.1 Box sizes to comply with CSA C22.18.

.2 Outlet boxes with lateral length of 102 mm or more, as required, for specific devices.

.3 Group boxes when multiple wiring devices are installed in the same location.

.4 Solid covers for boxes without wiring devices.

.5 347 V outlet box for 347 V switching devices.

.6 Combination boxes with partitions when outputs from more than one network are grouped together.

## 2.2 SHEET STEEL OUTLET BOXES

.1 Electrolytically galvanized steel boxes, for single or multiple device mounting, flush, minimum dimensions 76 x 50 x 38 mm, or as specified. Outlet boxes 102 mm square when more than one conduit enters the same side, with extension frames and plastering frames as required.

.2 Outlet boxes in electro-galvanized steel, for connections to surface-mounted EMT pipes, minimum dimensions 102 x 54 x 48 mm.

.3 Outlet boxes: square 102 mm square, or octagonal for light fixture outlets.

.4 Extension frames and plastering frames, for flush mounting in finished walls or integrated furniture.

## 2.3 MASONRY INSTALLATION BOXES

.1 Electrolytically galvanized steel outlet boxes for single or multiple flush mounting of wiring devices recessed in exposed block masonry walls.

### 2.4 BOXES FOR MOUNTING IN CONCRETE

.1 Outlet boxes in electro-galvanized steel, for flush mounting, embedded in concrete, with matching extension frames and plaster frames, as required.

### 2.5 SURFACE-MOUNTED JUNCTION BOXES (FOR CONDUITS)

.1 Cast aluminum FS, FD or GRF type boxes with factory-threaded sleeves and mounting brackets for surface mounting of switches and outlets, lighting fixtures, pull boxes and junction boxes.

.2 Weatherproof type boxes designed to be fitted with 4-screw plates and gasket.

### 2.6 FITTINGS - GENERAL INFORMATION

.1 Sleeves and connectors with nylon insulated collars.

.2 Pressure pads to prevent debris from entering knockouts.

.3 Access fittings for conduits up to 32 mm diameter, and pull boxes for larger conduits.

.4 Double locknuts and insulated sleeves on sheet metal boxes.

## 3 EXECUTION

### 3.1 INSTALLATION

.1 Secure boxes so that they are supported independently of connected conduits.

.2 Fill boxes with paper, sponge, foam or similar material to prevent debris from entering during construction. Remove plugs when work is complete.

.3 In case of outlet boxes installed flush with finished wall, use plastering frames to allow wall covering edges to be made 6 mm or less from opening.

.4 Box openings are to be sized to match conduit and armored cable connections. Reduction washers are not permitted.

.5 Use FS or FD type boxes in wet locations, where splashing may occur. FS type boxes to be used in all workshop areas.

.6 Locate outlet boxes as required.

**END OF SECTION**

# 1 GENERAL

## 1.1 REFERENCES

.1 Canadian Standards Association (CSA)/CSA International

.1 CAN/CSA-C22.2 Number 18, Outlet Boxes, Conduit Boxes, Fittings and Accessories, National Standard of Canada.

.2 CSA C22.2 Number 45, Rigid Metal Conduit.

.3 CSA C22.2 Number 56, Flexible Metal Conduit and Liquidtight Flexible Metal Conduit.

.4 CSA C22.2 Number 83, Electrical Metal Tubing.

.5 CSA C22.2 Number 211.2, Rigid Unplasticized Polyvinyl Chloride Conduit.

## 1.2 DOCUMENTS/SAMPLES TO BE SUBMITTED

.1 Technical data sheets: submit the required technical data sheets, together with the manufacturer's specifications and documentation for the products concerned.

.1 Submit the manufacturer's documentation concerning the cables in question.

# 2 PRODUCTS

## 2.1 CONDUITS

.1 Rigid metal conduit: to CSA C22.2 No. 45, galvanized steel, screw-in.

.2 Epoxy coated conduit: to CSA C22.2 No. 45, with zinc coating and epoxy resin anticorrosive topcoat, interior and exterior. Acceptable product: Greenguard II from Columbex inc. or approved equivalent.

.3 Steel electrical metallic tubing (TME or EMT): to CSA C22.2 No. 83.

.4 Rigid PVC conduit type DB2/ES2: to CSA C22.2 No. 211.1.

.5 Rigid PVC conduit for concrete bedrock type EB1 or DB2/ES2: to CSA C22.2 no. 211.1.

.6 Liquidtight flexible metal conduit: to CSA C22.2 no. 56, liquidtight, in steel or aluminum, covered with PVC jacket.

.7 Highly flexible polyamide 6 conduits model PMAFLEX CYL, black from ABB.

.8 PVC-coated rigid steel conduit: conforms to CSA C22.2 No. 45, steel with grey PVC outer coating and urethane inner coating. Acceptable product; Plasti-Bond Red Hot or approved equivalent.

## 2.2 CONDUIT FASTENERS

.1 Conduit clamps, flanges, anchors and fasteners shall be of the same material as the conduit with which it is used.

.2 One-hole malleable iron flanges for securing exposed conduit with nominal diameters of 50 mm or less.

.1 One-hole malleable iron flanges, Thomas & Betts series 1276 or approved equivalent.

.3 One-hole, malleable iron, PVC-coated clamps for securing exposed stainless-steel conduit with a nominal diameter of 50 mm or less.

.1 One-hole malleable iron flanges, Thomas & Betts 1275CR series or approved equivalent.

.4 Two hole flanges, steel or stainless steel, to secure conduits with nominal diameters greater than 50 mm.

.5 Hot-dipped galvanized malleable iron conduit clamps, Thomas & Betts 1350 series or approved equivalent.

.6 Beam clamps to secure conduit to exposed steelwork.

.1 Hot-dipped galvanized (HDG) and stainless-steel RC, EC, PC series Thomas & Betts conduit clamps or approved equivalent.

.7 Hot-dipped galvanized and stainless steel "U" channels to support multiple conduits, spaced according to Quebec Electrical Code.

.8 Stainless steel hardware and threaded suspension rods, diameter according to load to be supported, minimum 13 mm (½") gauge.

.9 Flanges for cables and conduits on profiles; series 701-088 SS6 stainless steel, series CH118-081SS stainless steel Thomas & Betts or approved equivalent.

## 2.3 CONDUIT CONNECTIONS

.1 Fittings: to CAN/CSA C22.2 No. 18, specially manufactured for specified conduits. Coating: same as for conduit.

.2 PVC conduit fittings: to CAN/CSA C22.2 No. 85.

.3 Factory prefabricated elbows for conduits 21 mm (¾") diameter and larger.

.4 Catalog numbers given below refer to 13 mm (½") conduit. For all other gauges, fittings will be of the same series.

.1 Hot-dip galvanized steel rigid metal conduit, threaded:

.1 Locknut T & B No. 141, Iberville CI-1704 or approved equivalent;

.2 Stainless steel sealing washers Thomas & Betts, No. 5302 or approved equivalent;

.3 Thomas & Betts #1222 insulated groove metal ferrules, Iberville CI 2404 or approved equivalent;

.4 Thomas & Betts #370 series bullet fittings or approved equivalent;

.5 Threaded fittings type "C" "L" "T" will be "form 7" with covers and seals (neoprene).

.2 Connections to boxes and cabinets as well as coupling joints shall all be covered with the same coating as the pipes.

.5 Flexible, watertight metal conduit with PVC covering :

.1 T & B No. 5332 fittings in electrical rooms and dry areas or approved equivalent;

.2 T & B No. 5332 SST fittings in all other locations or approved equivalent.

.6 TME or "EMT" type conduit:

.1 Raintight compression fittings 5123, 5120 from Thomas & Betts or approved equivalent;

.2 Pressure screw joints are prohibited.

.7 PMAFLEX highly flexible conduit fitting:

.1 Threaded nickel-plated brass fitting.

.2 1/2" NPT conduit 3/8(NW12) = NVNV-N022.

.3 1/2" NPT conduit ½ (NW17)= NVNV-N027.

.4 3/4" NPT conduit ¾ (NW23)= NVNV-N043.

.5 1" NPT conduit 1"(NW29) = NVNV-N069.

.6 1 - 1/4" NPT conduit 1-¼"(NW36) = NVNV-N076.

.7 1 - 1/2" NPT conduit 1-1/2"(NW48) = NVNV-N088.

.8 2" NPT 1-1/2" conduit (NW48) = NVNV-N098.

.9 Accessory, enlarger, reducer and imperial-to-metric thread converter as required.

## 2.4 EXPANSION JOINTS FOR RIGID CONDUITS

.1 Weatherproof expansion fittings, capable of withstanding 200 mm linear expansion, and ensuring continuity of grounding network.

.2 Watertight expansion fittings, capable of withstanding linear expansion and deformation of 19 mm, and ensuring continuity of grounding network.

.3 Weatherproof expansion fittings allowing linear expansion of conduits at box entry.

.4 Expansion fitting acceptable for rigid conduit: Thomas & Betts "XJG", O-Z/Gedney "EX", Green-Guard "EXG", or approved equal, complete with jumper.

.5 PVC Expansion Fitting for PVC Conduit.

### 2.5 PULL WIRES

.1 Made of polypropylene.

## 3 EXECUTION

### 3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: Comply with the manufacturer's requirements, recommendations and written specifications, including any available technical bulletins, instructions for handling, storage and installation of products, and data sheets.

### 3.2 INSTALLATION

.1 Conduit routing to be determined on site and approved by the Engineer.

.2 No conduit shall be attached to suspended ceiling, plumbing piping, ventilation and/or air conditioning ducts or any other apparatus provided by another discipline. Steel wire and metal strips with holes will not be tolerated.

.3 Install exposed conduits so as not to diminish the clear height of the room and using as little space as possible.

.4 Conceal conduits except those installed in mechanical and electrical rooms.

.5 Install shims for vertical and horizontal runs of conduit so that there is a minimum space of 1/4" between conduit and wall.

.6 Unless otherwise specified, use rigid galvanized steel screw-in conduit except where specified.

.7 Use epoxy coated conduit for underground installations in wet locations.

.8 Use electrical metal tubing (EMT) inside buildings.

.9 Use rigid PVC conduit for underground installations or in concrete mass.

.10 Use flexible, liquid-tight metal conduit up to one (1) meter in length from junction box or disconnect device to equipment when connecting motor, vibrating equipment or transformer. Use Ty-Rap type fasteners conforming to section 26 05 21 if it is impossible to secure flexible conduit to equipment with fasteners.

.11 Attach flexible conduit to unit or unit structure with Ty-Rap type fasteners conforming to section 26 05 21, only when other fastening systems cannot be used.

.12 Use explosion-proof flexible connections for explosion-proof motor connections.

.13 Install sealing fittings on ducts installed in hazardous locations. Fill with sealing compound.

.14 Use minimum 19 mm conduit.

.15 Cold bend conduit. Replace conduits which have shrunk by more than 1/10 of their original diameter as a result of crushing or deformation.

.16 Mechanically bend steel conduits over 21 mm in diameter.

.17 Threading of rigid conduits, carried out on site, must be of sufficient length to make tight, watertight joints.

.18 Install pull wire in empty ducts.

.19 From each panel installed flush, run two spare 25 mm conduits to ceiling void. Conduits are to terminate in 152 mm x 152 mm x 102 mm junction boxes in ceiling.

.20 Remove and replace clogged duct sections.

.21 Do not use liquids to unclog ducts.

.22 Dry ducts before running wiring.

.23 Install ducts parallel or perpendicular to building lines.

.24 Behind infrared or gas radiators, install ducts with 1.5 m clearance.

.25 Route ducts through flange of steel framing members.

.26 Wherever possible, group conduits in surface-mounted "U" profiles.

.27 Unless otherwise specified, ducts are not to pass through framing or structural members.

.28 For ducts running parallel to steam or hot water pipes, allow a minimum lateral clearance of 150 mm; also allow a minimum clearance of 75 mm for crossings.

.29 Install cable ties as manufactured by OZ Gedney, or equivalent in pull boxes according to spacing specified in Table 21 of Quebec Construction Code, Chapter V - Electricity when installing vertical conduit.

.30 Install a pull box for all conduit runs with more than three (3) 90° elbows or a length of 30 meters.

.31 Install end caps at ends of each duct run.

.32 Install ducts so as not to reduce headroom and using as little space as possible.

.33 Ensure a minimum clearance of 38 mm between metal roof decking and conduits.

.34 Install expansion joints at all building expansion joints.

.35 Install watertight "Bullet Hub" type fittings for all conduits connected to the top of a cabinet or to a box.

.36 Install sealing washers for all conduits connected to a cabinet or box from below or from the sides. Preferably connect conduits from below. If this is not possible, use the sides.

.37 Guns with bullets for anchor insertion are not permitted on site.

.38 Seal conduits passing through fire separations with two-hour fire-resistant sealant.

.39 Seal all ducts with plugs to prevent foreign object penetration during construction.

.40 Horizontal ducts must not be installed in walls.

.41 It is forbidden to embed conduits in terrazzo or concrete screeds.

## 3.3 EXPOSED CONDUITS

.1 Install ducts parallel or perpendicular to building lines.

.2 Behind infrared or gas radiators, install ducts with 1.5 m clearance.

.3 Route ducts through flange of steel framing members where applicable.

.4 Unless otherwise specified, conduits are not to pass through framing members.

.5 For ducts running parallel to steam or hot water pipes, provide at least 75 mm side clearance; also provide at least 25 mm clearance for crossings.

## 3.4 CONCEALED CONDUITS

.1 Install ducts parallel or perpendicular to building site lines.

.2 Do not install horizontal ducts in masonry walls.

.3 Conduits shall not be embedded in terrazzo or concrete screed.

**END OF SECTION**

# 1 GENRAL

## 1.1 SHOP DRAWINGS AND PRODUCT DESCRIPTION

.1 Submit shop drawings and product specifications in accordance with section 26 05 00 - "Electrical General Requirements"

## 1.2 REFERENCES

.1 CSA C22.2 No.42, Generality Use Receptacles, Attachment Plugs and Similar Devices.

.2 *CAN/CSA numéro 42.1, Plaques-couvercles pour dispositifs de câblage en affleurement (norme binationale avec UL 514D).*

.3 *CSA C22.2 numéro 55, Interrupteurs spéciaux.*

.4 *CSA C22.2 numéro 111, Interrupteurs à rupture brusque tout usage (Norme binationale avec UL 20).*

# 2 PRODUCTS

## 2.1 SOCKET OUTLETS

.1 Corrosion-resistant "WR" receptacles for outdoor installation and underground structures, type CSA 5-15 R or 5-20R, 125 V, 15 and 20 A, 3-wire, grounded, suitable for connection of 10 AWG wires, in a flush-mounted outlet box with the following characteristics.

.1 Industrial grade socket-outlet.

.2 Urea resin molded housing, color according to use.

.3 Corrosion resistant.

.4 Cutting links for conversion to separate sockets.

## 2.2 COVER PLATES

.1 Provide all wiring devices with a cover plate complying with CSA C22.2 number 42.1.

.2 Sheet steel cover plates for surface mounted junction boxes.

.3 1 mm thick stainless-steel cover plates for wiring devices mounted in recessed outlet boxes.

.4 Cover plates: stamped aluminum for wiring devices mounted in surface-mounted FS or FD conduit boxes. Iberville models CIFS-6 and CIFS-9 or equivalent.

.5 Molded, aluminum, weatherproof, two (2) leaf, spring-loaded cover plates with gaskets for double receptacles, as specified.

.6 Use only cover plates from the same manufacturer for the entire installation.

### 2.3 SPLASH GUARDS (AE)

.1 Polycarbonate duplex receptacle covers for maximum splash protection when plugs are connected; Pass & Seymour model WIUC10-C (single box) or WIUC20-C (double box) for vertical mounting or equivalent accepted.

.2 Cast aluminum switch covers, type CFSTF d'Iberville.

### 2.4 WEATHER PROTECTION COVER (WP)

.1 Cast aluminum cover with two (2) spring-loaded leaves for duplex receptacle providing splash protection when no plug is connected, model 4510 for horizontal mounting from Pass & Seymour or equivalent accepted.

.2 Cast aluminum switch covers, type CFSTF d'Iberville.

## 3 EXECUTION

### 3.1 INSTALLATION

.1 General information :

.1 Installer tous les dispositifs de filerie en affleurement, sauf dans la salle mécanique.

.2 Power outlets:

.1 Install outlets in grouped outlet boxes, when more than one outlet is required in the same location.

.2 Install electrical outlets at the height specified in section 26 05 00 - "Electricity - General requirements" or as indicated in the table below.

.3 It is forbidden to install outlets back to back in a wall; a minimum horizontal clearance of 150 mm between boxes is required.

.4 Where there are block walls, provide for box embedding.

.3 Cover plates :

.1 Protect finish of stainless-steel cover plates with paper or plastic film, to be removed only after all painting and other work is completed.

.2 When devices are grouped, use an appropriate common cover plate.

.3 It is forbidden to install cover plates designed for flush-mounted boxes on surface-mounted boxes.

**END OF SECTION**

# 1 GENERAL

## 1.1 TECHNICAL DATASHEETS

.1 Submit data sheets in accordance with the requirements of section 26 05 00 - "Electricity - General Requirements".

.2 Include characteristic curves based on time-current constants.

## 1.2 SECTION CONTENTS

.1 Materials and equipment for molded case circuit breakers.

## 1.3 RELATED SECTION

.1 Section 26 05 00 – Common Work Results for Electrical.

## 1.4 REFERENCES

.1 *Association canadienne de normalisation (CSA)/CSA International.*

*.1 CSA-C22.2 numéro 5-09, Disjoncteurs à boîtier moulé et enveloppe de disjoncteur (norme trinationale avec UL 489, dixième édition, et NMX-J-266-ANCE, deuxième édition).*

## 1.5 DOCUMENTS/SAMPLES TO BE SUBMITTED FOR APPROVAL/INFORMATION

.1 Include time-current characteristic curves for circuit breakers with breaking capacity of 22,000 A rms symmetrical and more, at mains voltage with a current-carrying capacity of 400 A and more.

.2 Certificates :

.1 Prior to installation of circuit breakers in a new or existing installation, the Contractor shall submit a certificate in French of the manufacturer's production origin. This certificate must be duly signed by a representative of the factory and of the local manufacturer, attesting that the circuit breakers come from this manufacturer and that they are new and in conformity with standards and regulations.

.2 Late submission of the certificate of origin will not justify any extension of the contract period or additional compensation.

.3 Manufacturing, assembly and installation shall commence only after the Engineer has accepted the certificate of origin of production. If this requirement is not met, the Engineer reserves the right to mandate the manufacturer indicated on the breakers to authenticate the new breakers under the contract, at the Contractor's expense.

.4 The certificate of origin must contain the following information:

.1 The name and address of the manufacturer, and the name of the person responsible for authentication. This person must sign and date the certificate.

.2 The name and address of the authorized distributor, and the name of the person responsible, at the distributor, for the Contractor's account.

.3 Name and address of Contractor, and name of person in charge of project.

.4 Name and address of building where circuit breakers are to be installed:

.1 Project title: Project name on tender documents.

.2 End-user reference number: tender number.

.3 Circuit breaker list: in table form.

### 1.6 SERIES PROTECTION

.1 The use of circuit breakers in series protection is not accepted.

## 2 PRODUCTS

### 2.1 CIRCUIT-BREAKERS - GENERAL

.1 Molded case circuit breakers, earth leakage protection devices: to CSA C22.2 number 5 standard.

.2 Moulded case circuit breakers, bolted to busbars: of the quick-closing and snap-action type, manual and automatic operation, with ambient temperature compensation of 40 degrees Celsius.

.3 Circuit breakers shall have a breaking capacity of at least 22,000 A rms symmetrical at 600 volts and 14,000 A rms symmetrical at 347 volts or as specified.

.4 Circuit breakers shall have a breaking capacity of at least 10,000 A symmetrical rms at 120/208 volts or as specified.

.5 All 600V 3-pole circuit breakers shall be equipped with a permanent locking device. Each circuit breaker shall be equipped with a handle locking device, enabling the circuit breaker handle to be locked in the ON or OFF position. The device must be semi-permanently mounted on the face of the circuit breaker and protected by the insulating panel cover.

.6 Common trip circuit breakers: equipped with a single handle on multipole circuits.

.7 Circuit-breakers equipped with instantaneous magnetic releases, which operate only when the current reaches the set value. The trip unit can be set between 3 and 10 times the rated current.

.8 Circuit breakers with interchangeable trip units as indicated.

.9 Factory-adjusted to 5 mA ground leakage detection, when required.

### 2.2 THERMOMAGNETIC CIRCUIT BREAKERS

.1 Moulded case circuit breakers, automatic, actuated by thermal and magnetic releases providing reverse time-current tripping and instantaneous tripping for short circuit protection.

.2 Minimum short-circuit current resistance coordinated with switchboard characteristics.

### 2.3 MAGNETIC CIRCUIT BREAKERS

.1 Moulded case circuit breakers, automatic, operated by instantaneous magnetic releases providing short-circuit protection.

### 2.4 THERMOMAGNETIC CURRENT-LIMITING CIRCUIT-BREAKERS

.1 Thermomagnetic circuit breakers with current limiters.

.1 Time-current characteristics coordinated with those of triggers.

.2 Coordination shall be such that the circuit breaker can interrupt fault currents up to the maximum value of its breaking capacity.

### 2.5 ACCEPTABLE PRODUCTS

.1 Schneider, Eaton, Siemens or approved equivalent.

## 3 EXECUTION

### 3.1 INSTALLATION

.1 Install circuit breakers as indicated.

**END OF SECTION**

# 1 GENERAL

## 1.1 TECHNICAL DATASHEETS

.1 Submit data sheets in accordance with section 26 05 00.

## 1.2 REFERENCES STANDARDS

.1 *Association canadienne de normalisation (CSA)/CSA International.*

*.1 CAN/CSA C22.2 numéro 4-04 (R2009), Interrupteurs sous boîtier.*

*.2 CSA C22.2 numéro 39-M1987 (C2007), Porte-fusible.*

# 2 PRODUCTS

## 2.1 SWITCHES

.1 Fuseless switches, in CSA enclosures suitable for location, Nema 3R enclosure.

.2 All switches used shall be heavy duty industrial type and shall be fitted with viewing windows.

.3 Approved for connection of 100% continuous loads.

.4 Locked in "open" position by three (3) padlocks.

.5 Door with mechanical interlock preventing opening when lever is in "closed" position.

.6 Quick-release mechanism.

.7 Indication of "OPEN" and "CLOSED" positions on enclosure cover.

.8 Connection terminals for copper cables.

.9 Fuses: rating and type as specified.

.10 Viewing window for switch knives.

.11 Solid neutral for 120/208V switches, 3-pole, 4-wire.

## 2.2 EQUIPMENT IDENTIFICATION

.1 Identify equipment in accordance with the requirements of section 26 05 00.

## 2.3 ACCEPTABLE PRODUCTS

.1 Schneider, Eaton, Siemens or approved equivalent.

# 3 EXECUTION

## 3.1 INSTALLATION

.1 Install switches.

.2 All switches are to be secured to floor and ceiling with U-channel brackets. No switches are to be mounted directly on building partitions.

.3 Install switches so that 600 mm clearance is available on operating handle side for safe maneuvering.

.4 Install main switch on distributor so that 1000 mm clearance is available on operating handle side for safe maneuvering.

.5 Switches connected to mechanical equipment such as ventilation units, pumps, etc. must be installed on an independent support or on the wall. Installation of switches on ventilation ducts or ventilation unit is prohibited.

**END OF SECTION**