

Correctional Service Canada

**Regional Technical Services
250 Montée St-François
Laval (Québec)**

**Project : Modernizing and adding UPS
Regional Reception Centre
246 Montée Gagnon
Sainte-Anne-des-Plaines (Québec)**

**General and technical specifications
Mechanical / Electrical**

Prepared by :

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Date : October 2nd, 2018 – ISSUED FOR TENDER

File : 17-2346-L

CORRECTIONAL SERVICE CANADA

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250 Montée St-François
Laval (Québec)

MODERNIZING AND ADDING UPS

Regional Reception Centre
246 Montée Gagnon
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GENERAL AND TECHNICAL SPECIFICATIONS
Mechanical / Electrical

MLC ASSOCIÉS inc.

Prepared by :



Riccardo Biral – Mechanical Engineer

François Brunet – Electrical Engineer

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Note : The plans and specifications are complementary and should be used together for understanding and execution of the work. The word "provide" in the plans and specifications means "provide, install, connect and test" unless otherwise noted.

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550-2-343-3550_M-01_PN	Work zone and legend
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550-2-343-3550_E-01_PN	Electrical – Legend, list of work and notes
550-2-343-3550_E-02_PN	Electrical – Local B-003A, R-002 and R-003 existing to be modified
550-2-343-3550_E-03_PN	Electrical – Local USD-005 and USD-216 existing to be modified
550-2-343-3550_E-04_PN	Electrical – Local B-003A, R-002 and R-003 existing modified
550-2-343-3550_E-05_PN	Electrical – Local USD-005 and USD-216 existing modified

PART 1 - GENERAL

1.1 References

- .1 National of the building code of Canada (NBC) edition 2010 modified Quebec, including all amendments up to the date of bid closing.

1.2 DESCRIPTION of the work

- .1 the project includes the following works. The listing below is not necessarily complete and does not take on the obligation of the contractor to complete the entire project according to the rule of art, the intentions and general principles, as described later in this quote and drawings.

1. provide and install the plan illustrates apparatus;
2. maintain the UPS
3. connect the mechanical equipment

1.3 SECURITY CONTROL

- .1 all workers will be forced to submit to a security check in order to be accredited to a level of security as required by the Canada Correctional Service and Public services & supply Canada.
- .2 the 01 35 13 describes the procedures detailed in the security check
- .3 at the beginning of the work, a special meeting of site will be held in the presence of representatives of the establishment to set safety and instructions site in prison labour.

1.4 CODES

- .1 perform work in accordance with the national Building Code of Canada (NBC) and any provincial or local codes that apply. In case of discrepancy or contradiction, the more stringent requirements shall prevail.
- .2 the work so as to satisfy all the requirements:
 - .1 contractual documents;
 - .2 specified codes and standards as well as other documents referenced.

1.5 Required DOCUMENTS

- .1 keep on site a copy of each of the following documents:
 - .1 contractual drawings;
 - .2 quote;
 - .3 addendum;

- .4 shop drawings revised;
- .5 change orders;
- .6 other amendments to contracts;
- .7 reports of tests conducted on the spot;
- .8 approved schedule of work;
- .9 implementation and installation instructions provided by the manufacturers;
- .10 licence of occupation of public spaces.

1.6 SCHEDULE OF WORK

- .1 undertake the planning of work immediately after receiving the notice of acceptance of your offer. The work covered by this document, including corrections to construction defects, must be completed within the timeframe specified in this document. In the case of non-respect of the schedule measures will be taken in accordance with the clauses and standard conditions of purchase of Public Services and supply Canada (SPAC).
- .2 within five (5) working days following the award of the contract, submit the work schedule indicating the various stages of the project and the date of completion of the work, which must be completed on a scheduled basis in the 6 weeks following the awarding of the contract.
- .3 within five (5) working days following the award of the contract, submit all the forms of security for approval.
- .4 the sequence of work is defined as follows;
 - .1 kick-off meeting and submission of the calendar, drawings of workshops, technical data sheets, samples and forms of security for approval;
 - .2 approving documents submitted;
 - .3 beginning of the work;
 - .4 . submit the manuals of operation and maintenance for approval;
 - .5 . provisional acceptance;
 - .6 . correction of deficiencies
 - .7 . final acceptance.
- .5 within five (5) working days following the award of the contract, the contractor shall provide, in a form deemed acceptable by the project, a schedule indicating:
 - .1 the dates of submission of shop drawings, data sheets, lists of materials and samples;
 - .2 the dates of delivery of the equipment and the following materials:
 - UPS
 - Air conditioning units
 - .3 the dates of the beginning and the end of work described in each section of the quote;
 - .4 the final date of completion of the work compared to the time of completion stated in the contract documents.

.6 interim revision of the status of the work, according to the submitted timetable, will be made at the option of the designated official of the CSC. The calendar will be updated by the contractor with the cooperation and approval of the designated officer of the CSC.

.7 all work and break's service must be coordinated with the designated officer of the CSC.

.8 take note that building will continue in operation for the duration of the work. Indeed, residents are permanent 24/24.

1.7 Acceptance of the EQUIVALENTS

.1 the firm suggesting substitutes or equivalents next to the products mentioned in the quote, plans or other contractual clauses, must include in its proposal sheets for approval by the Evaluation Committee. These products must be of equal or superior quality so that the proposal, if not, it will be refused. The financial proposal must reflect these substitutes.

.2 it is up to the contractor to provide proof of equivalence. The application of equivalence must be presented clearly and understand all of the details that will make the analysis.

.3 the main criteria for acceptance of the equivalents are: construction, performance, capacity, size, arrangement of fittings, spare parts availability, ease of maintenance, delivery times, existence of similar devices service for some time.

.4 If the use of a device accepted as equivalent changes to the facilities shown on the plans or specifications, these changes will be the responsibility of the general contractor who will, take charge changes that can be required in the work of contractors specialized because of these changes.

1.8 BREAKDOWN OF COSTS

.1 with its bid, the contractor must submit a detailed breakdown of the costs associated with this market, also indicating the overall price of the market on the receipt of bids provides in annex. Once approved, the breakdown of costs will serve as a baseline for the purpose of calculation of payments.

1.9 PAYMENTS

.1 payment will be made on a monthly basis, in proportion to the progress of the work. Before you send an invoice, the contractor shall transmit a request for split payment, according to tender form, with the percentage of completion for each item as well as a statutory declaration for approval. A deduction of 10% shall be applied to the total amount of the request for payment before tax. The deduction will be payable at the final acceptance of the works.

1.10 MEASUREMENT FOR THE PURPOSE OF PAYMENT

- .1 advising the project manager and/or the consultant enough in advance before the beginning of the work for him to perform the measurement necessary for the purpose of payment.

1.11 USE OF THE PREMISES BY THE CONTRACTOR

- .1 during construction, the facility must be maintained in full activity; for this purpose, the designated officer of the CSC or the person in charge of the security of the institution may ask the contractor to temporarily stop the field, running a book, so as not to jeopardize the activities of the establishment.
- .2 using places; limited access to a construction site inside. Those works and identified to be executed outside the construction site, must be carried out by a team accompanied by an escort provided by CSC, see section 01 35 13.
- .3 the contractor will have to provide within five (5) working days following the award of the contract a site plan of the construction site will be located outside the building.
- .4 obtaining of the licence of occupation of public spaces is the responsibility of the contractor.
- .5 the work by disturbing the least possible occupants and ensuring, to the extent possible, normal use of the premises. Agree with the person in charge designated CSC to facilitate the execution of the work. Interior work will be allowed only in one place at a time or in a sequence previously planned and authorized by the designated officer of the CSC.
- .6 maintain existing services in the building

1.12 ATMOSPHERE NOISY AND CELL PHONE

- .1 no radio or "thundering" device is allowed inside the building.
- .2 usage or port of a cell phone is not permitted inside the boundaries of the property, unless a derogation permitted in advance by the Director.

1.13 SITE MEETINGS

- .1 hold site meetings at times and places approved by the designated officer of the CSC.
- .2 the project authority will arrange site meetings, will set the date and time, and will prepare and distribute the minutes.

1.14 LOCATION OF DEVICES AND VARIOUS EQUIPMENT

- .1 the location of various equipment and devices shown in the drawings or the specifications should be considered approximate.
- .2 install appliances and equipment so as to limit congestion and maintain the most useful surface possible, as recommended by the manufacturer for the security, access and maintenance.

1.15 WORKS HIDE

- .1 except otherwise indicated, conceal pipes, ducts and wiring in the floors, walls and ceilings finished areas.

1.16 DRILLING AND SEALING

- .1 approval of the project authority before cutting or drilling a basic element, or insert a sleeve.
- .2 unning the necessary drilling and sealing work for works that must be connected or related to others are accurately and without play.
- .3 make openings in such a way that the banks are clean, straight and smooth.
- .4 where the addition of a new book leads to alterations to an existing building, run the tunnelling work, sealing and other repairs necessary to return the book in its previous state.

1.17 EXISTING NETWORKS

- .1 the services provided by buried utility lines must be maintained operational at all times. The approval of the designated representative of the CSC before any power failure.
- .2 If happened that not identified facilities are discovered during the work, immediately notify the project manager and send a report written on the findings.

1.18 MODIFICATIONS, ADDITIONS OR REPAIRS OF EXISTING BUILDINGS

- .1 the work by disturbing the least possible occupants and the public and ensuring, to the extent possible, normal use of the premises. Agree with the person in charge designated CSC to facilitate the execution of the work.
- .2 in no time, security measures must be reduced because of the work covered by the market, take the necessary steps to ensure all the required security.

.3 when there is in the building of the elevators, conveyors, the lifts or escalators, don't use, to move personnel and equipment within a building, that those who have been reserved for use by the contractor. Before using the elevators, to protect the walls of the booths as directed by the engineer. Assume responsibility for damage, to use the equipment safely and the overloading of existing material.

.4 where the work takes place in a busy place, supply and install all necessary furniture, finishes and equipment protection, ask screens dust, partitions and temporary warning signs and clean at the end of each day of work.

1.19 ADDITIONAL DRAWINGS

.1 the project authority may provide the contractor to additional drawings for the purpose of clarification. These additional designs will have the same meaning and the same scope if they were part of the contract documents.

1.20 RELICS AND ANTIQUITIES

.1 Protect the relics, antiques and other items of historical or scientific interest, such as cornerstones and their contents, commemorative plates and other objects bearing inscriptions found during the work.

.2 Immediately notify the designated CSC lead and wait for written direction before proceeding with work at this location.

.3 The relics, antiques and other objects of historical or scientific interest become the property of the Crown.

1.21 RESTRICTIONS RELATING TO THE USE OF TOBACCO

.1 conform to the restrictions that apply to the use of tobacco on the property of the Crown. It is strictly forbidden to smoke inside the building.

1.22 ASBESTOS

.1 the removal of fibre of asbestos applied by projection or the trowel can be dangerous for health. If, during the execution of the work, the contractor discovers materials that are similar to asbestos applied by projection or the trowel, it must stop its work and immediately inform the designated officer of the CSC. Do not resume work until you have received written instructions to project in this regard.

1.23 OPERATING MANUAL

.1 the contractor shall provide, for approval, one (1) copy of an operations manual including the following items:

- a table of contents;
- the list of providers and their coordinated;

- letters of guarantee;
- shop drawings approved;
- operation and maintenance manuals;
- the drawings 'as built '.

PART 2 - PRODUCTS

Without object

PART 3 - EXECUTION

Without object

END OF SECTION

PART 1 General

1.1 WORK COVERED BY CONTRACT DOCUMENTS

- .1 Work of this Contract comprises modernizing and adding UPS at the Regional Reception Centre, located at Sainte-Anne-des-Plaines.

1.2 CONTRACT METHOD

- .1 Construct Work under single contract.

1.3 WORK SEQUENCE

- .1 Construct Work in stages to accommodate Owner's continued use of premises during construction.
- .2 Co-ordinate Progress Schedule and co-ordinate with Owner Occupancy during construction.

1.4 CONTRACTOR USE OF PREMISES

- .1 Limit use of premises for Work, for storage and for access, to allow:
 - .1 Owner occupancy.
 - .2 Partial owner occupancy.
 - .3 Work by other contractors.
 - .4 Public usage.
- .2 Co-ordinate use of premises under direction of Engineer and Owner.
- .3 Obtain and pay for use of additional storage or work areas needed for operations under this Contract.
- .4 Remove or alter existing work to prevent injury or damage to portions of existing work which remain.
- .5 Repair or replace portions of existing work which have been altered during construction operations to match existing or adjoining work, as directed by Engineer.
- .6 At completion of operations condition of existing work: equal to or better than that which existed before new work started.

1.5 OWNER OCCUPANCY

- .1 Owner will occupy premises during entire construction period for execution of normal operations.

- .2 Co-operate with Owner in scheduling operations to minimize conflict and to facilitate Owner usage.

1.6 PARTIAL OWNER OCCUPANCY

- .1 Schedule and substantially complete designated portions of Work for Owner's occupancy prior to Substantial Performance of entire Work.
- .2 Owner will occupy designated areas for purpose of storage of furnishings and equipment] [installation of equipment].
- .3 Execute Certificate of Substantial Performance for each designated portion of Work prior to Owner occupancy. Contractor shall allow:
 - .1 Access for Owner personnel.
 - .2 Use of parking facilities.
 - .3 Operation of HVAC and electrical systems.
- .4 On occupancy, Owner will provide for occupied areas:
 - .1 Operation of HVAC and electrical systems.
 - .2 Maintenance.
 - .3 Security.
- .5 Execute Partial Interim Certificate of Completion for each designated portion of Work prior to Owner occupancy. Contractor shall allow:
 - .1 Access for Owner personnel.
 - .2 Use of parking facilities.
 - .3 Operation of HVAC and electrical systems.

1.7 OWNER FURNISHED ITEMS

- .1 Owner Responsibilities:
 - .1 Arrange for delivery of shop drawings, product data, samples, manufacturer's instructions, and certificates to Contractor.
 - .2 Deliver supplier's bill of materials to Contractor.
 - .3 Arrange and pay for delivery to site in accordance with Progress Schedule.
 - .4 Inspect deliveries jointly with Contractor.
 - .5 Submit claims for transportation damage.
 - .6 Arrange for replacement of damaged, defective or missing items.
 - .7 Arrange for manufacturer's field services; arrange for and deliver manufacturer's warranties and bonds to Contractor.
- .2 Contractor Responsibilities:
 - .1 Designate submittals and delivery date for each product in progress schedule.
 - .2 Review shop drawings, product data, samples, and other submittals. Submit to Consultant notification of observed discrepancies or problems anticipated due to non-conformance with Contract Documents.

- .3 Receive and unload products at site.
- .4 Inspect deliveries jointly with Owner; record shortages, and damaged or defective items.
- .5 Handle products at site, including uncrating and storage.
- .6 Protect products from damage, and from exposure to elements.
- .7 Assemble, install, connect, adjust, and finish products.
- .8 Provide installation inspections required by public authorities.
- .9 Repair or replace items damaged by [Contractor] [Design-Builder] or subcontractor on site (under his control).

1.8 ALTERATIONS, ADDITIONS OR REPAIRS TO EXISTING BUILDING

- .1 Execute work with least possible interference or disturbance to building operations and normal use of premises. Arrange with Engineer to facilitate execution of work.
- .2 Use only elevators, conveyors or escalators existing in building for moving workers and material.
 - .1 Protect walls of passenger elevators, to approval of Engineer prior to use.
 - .2 Accept liability for damage, safety of equipment and overloading of existing equipment.

1.9 EXISTING SERVICES

- .1 Notify Engineer and utility companies of intended interruption of services and obtain required permission.
- .2 Where Work involves breaking into or connecting to existing services, give Engineer (48) hours notice for necessary interruption of mechanical or electrical service throughout course of work. Minimize duration of interruptions. Carry out work at times as directed by governing authorities with minimum disturbance to [pedestrian] [vehicular traffic] [and] [tenant operations].
- .3 Establish location and extent of service lines in area of work before starting Work. Notify Engineer of findings.
- .4 Submit schedule to and obtain approval from Engineer for any shut-down or closure of active service or facility including power and communications services. Adhere to approved schedule and provide notice to affected parties.
- .5 Provide temporary services when directed by Engineer to maintain critical building and tenant systems.
- .6 Where unknown services are encountered, immediately advise Engineer and confirm findings in writing.

- .7 Protect, relocate or maintain existing active services. When inactive services are encountered, cap off in manner approved by authorities having jurisdiction.
- .8 Record locations of maintained, re-routed and abandoned service lines.
- .9 Construct barriers in accordance with Section 01 56 00 - Temporary Barriers and Enclosures.

1.10 DOCUMENTS REQUIRED

- .1 Maintain at job site, one copy each document as follows:
 - .1 Contract Drawings.
 - .2 Specifications.
 - .3 Addenda.
 - .4 Reviewed Shop Drawings.
 - .5 List of Outstanding Shop Drawings.
 - .6 Change Orders.
 - .7 Other Modifications to Contract.
 - .8 Field Test Reports.
 - .9 Copy of Approved Work Schedule.
 - .10 Health and Safety Plan and Other Safety Related Documents.
 - .11 Other documents as specified.

PART 2 Products

2.1 NOT USED

- .1 Not used.

PART 3 Execution

3.1 NOT USED

- .1 Not used.

END OF SECTION

PART 1 General

1.1 ADMINISTRATIVE

- .1 Submit to Engineer submittals listed for review. Submit promptly and in orderly sequence to not cause delay in Work. Failure to submit in ample time is not considered sufficient reason for extension of Contract Time and no claim for extension by reason of such default will be allowed.
- .2 Do not proceed with Work affected by submittal until review is complete.
- .3 Present shop drawings, product data, samples and mock-ups in SI Metric units.
- .4 Where items or information is not produced in SI Metric units converted values are acceptable.
- .5 Review submittals prior to submission to Engineer. This review represents that necessary requirements have been determined and verified, or will be, and that each submittal has been checked and co-ordinated with requirements of Work and Contract Documents. Submittals not stamped, signed, dated and identified as to specific project will be returned without being examined and considered rejected.
- .6 Notify Engineer, in writing at time of submission, identifying deviations from requirements of Contract Documents stating reasons for deviations.
- .7 Verify field measurements and affected adjacent Work are co-ordinated.
- .8 Contractor's responsibility for errors and omissions in submission is not relieved by Engineer's review of submittals.
- .9 Contractor's responsibility for deviations in submission from requirements of Contract Documents is not relieved by Engineer review.
- .10 Keep one reviewed copy of each submission on site.

1.2 SHOP DRAWINGS AND PRODUCT DATA

- .1 The term "shop drawings" means drawings, diagrams, illustrations, schedules, performance charts, brochures and other data which are to be provided by Contractor to illustrate details of a portion of Work.
- .2 Submit shop drawings bearing stamp and signature of qualified professional engineer registered or licensed in Province of Quebec.

- .3 Indicate materials, methods of construction and attachment or anchorage, erection diagrams, connections, explanatory notes and other information necessary for completion of Work. Where articles or equipment attach or connect to other articles or equipment, indicate that such items have been co-ordinated, regardless of Section under which adjacent items will be supplied and installed. Indicate cross references to design drawings and specifications.
- .4 Allow five (5) days for Engineer's review of each submission.
- .5 Adjustments made on shop drawings by Engineer are not intended to change Contract Price. If adjustments affect value of Work, state such in writing to Engineer prior to proceeding with Work.
- .6 Make changes in shop drawings as Engineer may require, consistent with Contract Documents. When resubmitting, notify Engineer in writing of revisions other than those requested.
- .7 Accompany submissions with transmittal letter, containing:
 - .1 Date.
 - .2 Project title and number.
 - .3 Contractor's name and address.
 - .4 Identification and quantity of each shop drawing, product data and sample.
 - .5 Other pertinent data.
- .8 Submissions include:
 - .1 Date and revision dates.
 - .2 Project title and number.
 - .3 Name and address of:
 - .1 Subcontractor.
 - .2 Supplier.
 - .3 Manufacturer.
 - .4 Contractor's stamp, signed by Contractor's authorized representative certifying approval of submissions, verification of field measurements and compliance with Contract Documents.
 - .5 Details of appropriate portions of Work as applicable:
 - .1 Fabrication.
 - .2 Layout, showing dimensions, including identified field dimensions, and clearances.
 - .3 Setting or erection details.
 - .4 Capacities.
 - .5 Performance characteristics.
 - .6 Standards.
 - .7 Operating weight.

- .8 Wiring diagrams.
 - .9 Single line and schematic diagrams.
 - .10 Relationship to adjacent work.
- .9 After Engineer's review, distribute copies.
- .10 Submit one (1) electronic copy on CD and one (1) print of shop drawings for each requirement requested in specification Sections and as Engineer may reasonably request.
- .11 Submit one (1) electronic copy on CD and one (1) print of product data sheets or brochures for requirements requested in specification Sections and as requested by Engineer where shop drawings will not be prepared due to standardized manufacture of product.
- .12 Submit one (1) electronic copy on CD and one (1) print of test reports for requirements requested in specification Sections and as requested by Engineer.
- .1 Report signed by authorized official of testing laboratory that material, product or system identical to material, product or system to be provided has been tested in accord with specified requirements.
- .13 Submit one (1) electronic copy on CD and one (1) print of certificates for requirements requested in specification Sections and as requested by Engineer.
- .1 Statements printed on manufacturer's letterhead and signed by responsible officials of manufacturer of product, system or material attesting that product, system or material meets specification requirements.
 - .2 Certificates must be dated after award of project contract complete with project name.
- .14 Submit one (1) electronic copy on CD and one (1) print of manufacturer's instructions for requirements requested in specification Sections and as requested by Engineer.
- .1 Pre-printed material describing installation of product, system or material, including special notices and Material Safety Data Sheets concerning impedances, hazards and safety precautions.
- .15 Submit one (1) electronic copy on CD and one (1) print of Manufacturer's Field Reports for requirements requested in specification Sections and as requested by Engineer.
- .1 Documentation of the testing and verification actions taken by manufacturer's representative to confirm compliance with manufacturer's standards or instructions.
- .16 Submit one (1) electronic copy on CD and one (1) print of Operation and Maintenance Data for requirements requested in specification Sections and as requested by Engineer.
- .17 Delete information not applicable to project.
- .18 Supplement standard information to provide details applicable to project.

- .19 If upon review by Engineer, no errors or omissions are discovered or if only minor corrections are made, fabrication and installation of Work may proceed. If shop drawings are rejected, noted copy will be returned and resubmission of corrected shop drawings, through same procedure indicated above, must be performed before fabrication and installation of Work may proceed.
- .20 The review of shop drawings by Public Works and Government Services Canada (PWGSC) is for sole purpose of ascertaining conformance with general concept.
- .1 This review shall not mean that PWGSC approves detail design inherent in shop drawings, responsibility for which shall remain with Contractor submitting same, and such review shall not relieve Contractor of responsibility for errors or omissions in shop drawings or of responsibility for meeting requirements of construction and Contract Documents.
- .2 Without restricting generality of foregoing, Contractor is responsible for dimensions to be confirmed and correlated at job site, for information that pertains solely to fabrication processes or to techniques of construction and installation and for co-ordination of Work of sub-trades.

1.3 CERTIFICATES AND TRANSCRIPTS

- .1 Immediately after award of Contract, submit Workers' Compensation Board status.
- .2 Submit transcription of insurance immediately after award of Contract.

PART 2 Products

2.1 NOT USED

- .1 Not Used.

PART 3 Execution

3.1 NOT USED

- .1 Not Used.

END OF SECTION

PART 1 - GENERAL

1.1 Object

.1 see to that the construction project and the activities of the institution are conducted without interruption and undue obstacles and that the security of the institution is maintained at all times.

1.2 Definitions

.1 "prohibited items" means:

- a) Intoxicants, including alcohol, drugs or narcotics;
- b) Weapons or parts of weapons, ammunition and any object designed to kill, injure or disable a person or any changed object or Assembly for those purposes which possession has not been authorized in advance;
- c) The explosives or bombs or their components;
- d) The amounts of money, exceeding the ceilings of \$ 50.00;
- e) Any article not described in paragraphs) to d), possessed without prior authorization and that could endanger the safety of persons or the penitentiary.

.2 ' Unauthorized smoking items' means the tobacco products including, but not limited to, cigarettes, cigars, tobacco, tobacco chewing and snuff, rolling machines for cigarettes, matches and lighters which are considered objects not allowed.

.3 ' commercial vehicle' means any motor vehicle intended for the transport of material, equipment or tools to the construction project.

.4 "CSC" means Correctional Service Canada.

.5 "Director" means the Director of the institution, as the case may be, or their authorized representative.

.6 "employees of construction" means the employees of the main contractor, of one of its subcontractors, equipment operators, suppliers of material, laboratory expertise and inspection and agencies of Regulation.

.7 "departmental representative" means the project manager of Public services & supply Canada (SPAC) or Service corrections Canada (CSC) according to the project.

.8 "perimeter" means school playground belted safe fences or walls limiting the movement of inmates.

.9 "construction zone" means the area where, as indicated in the contract documents, the contractor will be allowed to work. It can be or not be isolated from the confines of security of the institution.

1.3 Preliminary measures

- .1 before starting the work, the contractor must meet with the Director to:
 - (a) To discuss the nature and scope of all activities related to the project;
 - b) To establish acceptable security measures on part and another, in accordance with this directive and the specific needs of the institution.
- .2 the contractor must:
 - (a) Ensure that all construction employees know the requirements of the CSC security;
 - b) Ensure that the requirements of the CSC security are always displayed prominently on the site;
 - c) Work with the staff to see that the construction employees comply with all safety requirements.

1.4 CONSTRUCTION employees

- .1 the contractor shall deliver to the Director a list of names with dates of birth for all employees required to work on the construction site as well as a form of security check completed for every employee accompanied by a photocopy of driver's license or an equivalent photo ID card.
- .2 allow two (2) weeks for the processing of security clearance. No employee will be admitted to the facility approved security clearance without an identity card with photo such as driver's license of a province. Security permissions are specific to each CSC facility and any authorization obtained from another institution is invalid for the property where the project will take place.
- .3 the Director may require that the faces of construction workers are photographed and photographs are displayed in some places appropriate school or transferred to a database for the purpose of identification. The Director was able to require photo ID cards are produced for all employees of the construction. These cards will have to be left at the designated entrance where they will be handed over to the holder upon arrival at the hotel. They must be worn prominently on their clothes at all times when they are at school.
- .4 access to ownership of the property is prohibited to anyone that there are grounds to believe that it could present a security risk.
- .5 any person employed on the building site will be immediately expelled from the ownership of the property if:
 - (a) She seems to be under the influence of alcohol, drugs or narcotics;
 - b) She conducted an abnormal or disorderly;
 - c) She is in possession of a prohibited object.

1.5 Vehicles

- .1 the delivery of equipment for the project will not be held to be the subject of a security clearance, but they can't get away from their vehicle for the duration of their stay in the hotel. The Director may require that they be accompanied by an employee of the institution or an agent.
- .2 any person leaving a vehicle unattended on the property of CSC must close the windows, lock the doors and chests and remove the keys. The owner of the vehicle or the owner of the vehicle company employee should keep keys safe on his person.
- .3 no trailer will be allowed to remain on the perimeter of the establishment outside of construction site.
- .4 at any time, the Director may limit the number and type of vehicles allowed inside the establishment.

1.6 Parking

- .1 the Director will identify parking areas authorized for employees of construction vehicles. Parking in other places will be prohibited and the offending vehicles may be towed.

1.7 Deliveries

- .1 any delivery of material, equipment or tools for the project must be sent to the contractor for well distinguish it from shipments intended for the establishment. The contractor must ensure that its employees are onsite to receive remittances, as the CSC staff will accept no delivery of material, equipment and tools for the entrepreneur.

1.8 Hours of work

- .1 the period to access the property runs from Monday to Friday from 7: 30 to 16:00. Check with the Director of the property before the start of the work.
- .2 the work is not permitted on weekends or days of holidays without the express permission of the designated representative of the CSC. This authorisation must be requested at least three (3) days in advance. In the event of an emergency or in any other circumstances, this period may be cancelled by the designated representative of the CSC.

1.9 Work outside normal working

- .1 the Director's permission is required for all work performed outside normal working hours. The contractor shall give notice at least quarante-huit (48) hours when it is necessary to perform work approved outside of normal working hours. Need to work overtime to complete an urgent task, for example, to pour concrete or to ensure the

safety of the construction, the contractor must notify the Director as soon as he is made aware of such a need, then follow the directions given by the Director. The costs incurred by the Canada of the fact of this situation could be attributed to the contractor.

- .2 when to perform work outside normal hours or work the weekend or one day of holiday and that this extra work is authorized by the Director, it or the person he designates may assign additional staff to the Security. The costs associated with this assignment may be charged to the contractor.

1.10 Tools and equipment

- .1 maintain site a complete list of tools and equipment that will be used during the construction project. Make this list available for inspection when required.
- .2 keep up-to-date the list of tools and equipment specified above throughout the construction project.
- .3 never leave unattended, particularly motorized tools, tools tools cartridge, cartridges, the limes, saw blades, saws with carbide, wires and ropes, ladders and any type of lifting device.
- .4 store tools and equipment in approved safe places.
- .5 lock all tool boxes after use. The contractor's employees must keep the keys with them at all times.
- .6 fix and lock the scaffolding unincorporated; When erected, the scaffolding to be fixed in a safe manner to the satisfaction of the Director.
- .7 immediately notify the Director of any loss or disappearance of equipment or tool.
- .8 the Director will ensure that security personnel carries out controls of tools and equipment the contractor, according to the list provided by the:
 - (a) At the beginning and at the end of each construction project; or
 - b) According to the frequency that will be required by the Director of the facility.
- .9 when propane or natural gas is used for heating, the property will require that an employee of the contractor supervises the construction site outside working hours.

1.11 Prescription drugs

- .1 the contractor employees who need medication to order during the working day are required to obtain the approval of the Director to be allowed to bring with them to school the dosage of a day.

1.12 RESTRICTIONS on the use of tobacco

- .1 contractors and construction workers are not allowed to smoke inside correctional facilities. Inside the building, they cannot be in possession of unauthorized tobacco products.
- .2 the contractors and construction employees who violate this policy will be asked to quit immediately or throw any unauthorized tobacco product. If they refuse to comply, they will be ordered to leave the property.
- .3 it will be allowed to smoke outside the correctional facility to a place designated by the Director.

1.13 Objects prohibited

- .1 the weapons, ammunition, explosives, liquor, drugs and narcotics are prohibited on the site.
- .2 the discovery of object (s) ban (s) on the construction site and identification of the person or person (s) responsible (s) of the presence of these objects must be immediately reported to the Director.
- .3 the entrepreneurs must be vigilant as to their employees and the employees of their subcontractors since the discovery of contraband may result in the cancellation of the security clearance of the employee involved. A serious offence could lead to expulsion from the site of the establishment of the company in question, for the duration of the construction project.
- .4 if weapons or ammunition are found in the vehicle of a contractor, a subcontractor, supplier or an employee thereof, the security clearance of the driver of the vehicle will be revoked immediately.

1.14 Electronic devices

- .1 except approval of the Director, electronic devices such as mobile phones, laptops, USB keys are not allowed in the establishment. If this type of device is eventually allowed, their user should not allow their use by inmates.

1.15 EXCAVATIONS

- .1 every person and vehicle access to ownership of the property can be the subject of a search.
- .2 when the Director has reasonable grounds to believe that an employee of the contractor is in possession of contraband or prohibited object, he may require that person to be searched.

.3 personal belongings of any employee arriving at the facility may be subject to checks for the presence of residues of prohibited drugs.

1.16 Access to the property

.1 except approval of the Director, the construction employees and commercial vehicles will not be allowed to establish outside normal working hours.

1.17 Vehicular traffic

.1 the contractor shall notify the Director of twenty-four (24) hours in advance of the arrival of heavy equipment such as cement mixers, cranes, etc.

.2 loaded vehicles litter or soil or any vehicle found it impossible to search must be subject to constant supervision by employees of CSC or agents reporting to the Director.

.3 the property of CSC access will be denied to any vehicle whose content, in the opinion of the Director, represents a risk to the security of the institution.

.4 private employees of the construction vehicles are not allowed inside the security perimeter of medium or maximum security without the express permission of the Director.

1.18 Movement of employees of CONSTRUCTION on the property of the institution

.1 subject to the need to maintain adequate security, the Director will leave to the contractor and its employees as much freedom of action and movement as possible.

.2 However, and notwithstanding the preceding paragraph, the Director may:
(a) Ban or restrict access to any part of the property;
b) Require that, throughout the construction project or at certain times, employees of the construction are accompanied by a security officer or an agent of the CSC in some areas of the facility.

.3 the construction employees are not allowed to eat in the dining room of the hotel.

1.19 Monitoring and INSPECTION

.1 construction activities and movements of personnel and vehicles will be monitoring and inspection by the CSC security personnel to ensure that security standards are met.

.2 the CSC staff will ensure that the construction workers understand the need for monitoring and inspections, and that this understanding be maintained throughout the project.

1.20 Work stoppage

- .1 at all times, the Director may order the contractor, its employees, subcontractors or their employees not to go to the site or to leave immediately due to a security incident ongoing in the establishment. The contractor responsible for the construction site foreman should then note the name of the CSC employee transmitting the order, the time of the statement, and to comply with the order received as soon as possible.
- .2 The contractor shall notify the departmental representative of the situation in the twenty-four (24) hours after the work stoppage.

1.21 CONTACT with INMATES

- .1 it is forbidden, without specific authorization, to enter in contact with the detainees, talk to them, to give them items or receive them. Any breach of the present policy will result in expulsion from the construction site of the employee responsible and the revocation of his security clearance.
- .2 it is worth noting that cameras are not permitted on the property of CSC.
- .3 Notwithstanding the foregoing, if the Director allows the use of cameras, it will continue to be strictly prohibited to photograph inmates or CSC employees or any part of the establishment whose photography is not necessary execution of this contract.

1.22 Completion of the CONSTRUCTION project

- .1 to the completion of the construction project or, if necessary, to the care of the facilities, the contractor shall remove all materials, tools and equipment that are not identified to the contract of construction as before be left to the establishment.

PART 2 - PRODUCTS

Without object

PART 3 - EXECUTION

Without object

END OF SECTION

PART 1 - GENERAL

1.1 SECTION content

- .1 The contractor shall manage its activities so that the health and safety of the public and employees on the site so that the protection of the environment has always precedence on issues related to cost and schedule of work.

1.2 References

- .1 Canadian labour code, part II, Canadian regulations on safety and health in the workplace.
- .2 Canadian standards association (CSA).
- .3 Information system on dangerous substances used at work (WHMIS) Health Canada.
 - .1 Material safety data sheet (MSDS).
- .4 Law on health and safety at work, R.S.Q. chapter S - 2.1 [2002].
- .5 Safety code for construction work, S - 2.1, r.6 [2001].

1.3 To submit DOCUMENTS/samples

- .1 Transmit to the departmental representative the prevention program specific to the construction site, as described in article 1.8, at least 10 days before the start of the work. The contractor must then update its prevention program if the course of the work differs from its initial forecasts. Following receipt of the program and at any time during the work, the departmental representative may require either modified or full program to better reflect the reality of the construction site. The contractor must then make the corrections required before the start of the work.
- .2 To the departmental representative, within 24 hours, a copy of any inspection report, notice of correction, or recommendations issued by the provincial or federal inspectors.
- .3 Pass to the departmental representative, within 24 hours, a report of investigation for any accident resulting in injury and on any incident that highlights a potential risk.
- .4 Pass to the departmental representative all MSDS of controlled products used in the construction site, and this, at least three days prior to their use on the site.
- .5 Pass to the departmental representative copies of training certificates that are required for the application of the prevention program, including:
 - .1 Health and safety courses General for construction sites
 - .2 Security guard certificate
 - .3 First aid in the workplace and CPR

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- .4 May issue of asbestos dust
- .5 Work in confined spaces
- .6 Locking Procedure
- .7 Port and adjustment of individual protection equipment
- .8 Safe Forklift driving
- .9 Elevating work platforms
- .10 And any other training required by regulation or by the prevention program
- .6 Medical examinations: when medical examinations are required, under an Act, a regulation, a directive, a quote or a prevention program, the contractor must:
 - .1 Prior to mobilization, transmit to the departmental representative certificates of medical examinations of its supervisory staff and of all employees covered by the first paragraph of this article who will be present at the opening of the construction site.
 - .2 Pass thereafter as and as, and without delay certificates of medical examinations of all newcomers to the site referred to in the first paragraph of this article.
- .7 Emergency plan: the emergency plan, as described in section 1.8.3 must be forwarded to the departmental representative at the same time as prevention program.
- .8 Notice of commencement of construction: the notice of commencement of construction must be transmitted to the Commission the health and safety of work before the beginning of the work, with a copy to the departmental representative. A copy of this notice must also be displayed prominently at the site. During the demobilization, the closure notice must be sent to the CSST, with a copy to the departmental representative.
- .9 Plans and certificates of conformity of Engineering: the contractor must send to the CSST and the departmental representative a copy signed and sealed by an engineer of all plans and certificates of compliance which are required under the Security Code for the construction (S - 2.1, r. 6), other legislation, a regulation or another clause of the quote or contract. A copy of these documents must be available at all times on site.
- .10 Certificate of compliance issued by the CSST: Attestation of conformity is a document issued by the CSST confirming that the contractor is in good standing with the CSST, that he has paid all amounts due relatively to a given contract. This document must be provided to the departmental representative at the end of the work.

1.4 Risk assessment

- .1 The contractor shall conduct a hazard identification for each of the tasks on the site.
- .2 The contractor shall plan and organize the work so as to encourage the elimination at source of hazards or collective protection and thus minimize the use personal protection equipment. When an individual fall protection is required, workers will need to use a safety harness in accordance with standard CAN/CSA-Z - 259.10 - M90. The seat belt should not be used as fall protection.

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- .3 Equipment, a tool or a means of protection that cannot be installed or used without compromising the health and safety of workers or the public is deemed to be inadequate for the job.
- .4 All mechanical equipment must be inspected before their delivery on the site. Before the use of mechanical equipment the contractor shall transmit to the departmental representative a certificate of compliance signed by a competent mechanic. The departmental representative may at any time, if he suspects a defect or a risk of accident, ordered an immediate halt to the equipment and require a second inspection by a specialist of their choice.

1.5 Meetings

- .1 A decision the contractor's representative must attend all meetings where it is question of health and safety on the site.

1.6 Requirements of regulatory agencies

- .1 Comply with all laws, regulations and all the standards that are applicable to the execution of the works.
- .2 Observe the standards and regulations prescribed to ensure a normal course of work on the lands contaminated by toxic and hazardous materials.
- .3 Notwithstanding the date of publication of the standards indicated in the safety code for the construction work, one must always use the version in force at the time where it applies.

1.7 Health and safety management

- .1 Accept and assume all tasks and obligations normally assigned to the contractor under the law on health and safety (R.S.Q., chapter S - 2.1) work and Safety Code for the construction industry (S - 2.1, r.6).
- .2 Develop a prevention program specific to the site based on the identification of risks and implement this program at the beginning of the project up to the final stage of demobilization. The prevention program must take into account the information that appears in article 1.7. It must be sent to all concerned, in accordance with the provisions of article 1(2). The prevention program must include at least:
 - .1 The policy of the company health and safety;
 - .2 The description of the work, the total cost of the work, the schedule and scheduled workforce; curve
 - .3 The organizational structure of responsibilities for health and safety;
 - .4 Organizing physical and material of the site;
 - .5 Standards for first aid and first aid;

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- .6 The identification of risk compared to the site;
 - .7 The identification of risks in relation to the tasks performed, including measures of prevention and the modalities of implementation;
 - .8 The training required;
 - .9 The procedure in the event of accident/injury;
 - .10 Written everyone to respect this undertaking prevention program;
 - .11 A grid for the inspection of the site based on preventive measures.
- .3 The contractor must develop an effective emergency plan in relation to the characteristics and constraints of the site and its environment. The emergency plan must be sent to all concerned, in accordance with the provisions of article 1(2). The emergency plan must contain:
- .1 The procedure of evacuation;
 - .2 The identification of resources (police, firefighters, ambulances, etc.);
 - .3 The identification of those responsible for the site;
 - .4 The identification of the rescuers;
 - .5 Required training for the people responsible for its application;
 - .6 And any other information that would be required, taking into account the characteristics of the site.

1.8 Responsibilities

- .1 Regardless of the size of the site or the number of workers, appoint a competent person as a supervisor and responsible for health and safety. Take all necessary measures to ensure the health and safety of persons and property to walk to work and in the immediate vicinity of the construction site, which could be affected by the work.
- .2 Take all necessary measures to ensure the application and compliance with health and safety requirements contained in the contract documents, the Federal and provincial regulations, standards that are applicable and the site-specific prevention program and comply promptly with any order where notice of correction issued by the health and safety of work Commission.
- .3 Take all necessary measures to keep the site clean and tidy, throughout the work.

1.9 COMMUNICATION and display

- .1 Take steps necessary to ensure effective communication of information on health and safety on the site. Upon arrival at the site, all workers must be informed of the peculiarities of the prevention program, their obligations and their rights. The contractor must insist on the right of workers to refuse work if they believe that this work can jeopardize their health, their safety, their physical integrity or those of the other people on the site. He must keep on site and update a register with information and signature of all workers who received this information.

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- .2 Information and the following documents must be posted in an easily accessible place for workers:
 - .1 Notice of initiation of the site;
 - .2 Identification of the contractor;
 - .3 Policy of the company OHS;
 - .4 Program specific to the site;
 - .5 Emergency;
 - .6 MSDSS for all controlled products used in the project;
 - .7 Minutes of the meetings of the Committee of construction;
 - .8 Name of the rescuers;
 - .9 Intervention and correction issued by the CSST reports.

1.10 UNEXPECTED

- .1 When a specified in the quote and no identifiable source of danger during the preliminary inspection of the site appears by the fact or during the execution of the work, the contractor must immediately stop work, implement the temporary protection measures for workers and the public and prevent the departmental representative orally and in writing.
- .2 Subsequently, the contractor shall make the necessary changes to the prevention program so that the work can resume safely.

1.11 BLASTING

- .1 Blasting, and all other use of explosives is prohibited, unless you have been authorized in writing by the departmental representative.
- .2 Any operation involving explosives must be performed under the immediate supervision of a qualified shotfirer.
- .3 The purchase, transportation, storage and use of explosives must comply with federal and provincial laws apply:
 - .1 Canada: Explosives Act (E-17), explosives regulations (C.R.C. c. 599), deposits of blasting detonators explosives standard, Act and the transportation of dangerous goods regulations.
 - .2 Québec: Explosives Act (E-22), regulations on explosives (E-22, r.1), Safety Code for the construction (S - 2.1, r.6), regulations on the transport of dangerous goods.
- .4 The contractor shall obtain all permits required under the laws and regulations mentioned above and keep an easily accessible site copy.
- .5 The contractor shall facilitate the visit of the site and the deposits of explosives as well as inspection of the vehicles used for their transport to all government officials and police officers who have jurisdiction explosives.

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1.12 Nail guns and other devices cartridges

- .1 Sealing or other devices to cartridge guns are not allowed on the property of CSC. Referred to section 01 35 13.

END OF SECTION

PART 1 General

1.1 RELATED SECTIONS

- .1 Section 01 33 00 – Submittal Procedures.

1.2 SUBMITTALS

- .1 Prepare instructions and data using personnel experienced in maintenance and operation of described products.
- .2 Copy will be returned after final inspection, with Engineer's comments.
- .3 Revise content of documents as required prior to final submittal.
- .4 Two weeks prior to Substantial Performance of the Work, submit to the Engineer four final copies of operating and maintenance manuals in English and French.
- .5 Ensure spare parts, maintenance materials and special tools provided are new, undamaged or defective, and of same quality and manufacture as products provided in Work.
- .6 Furnish evidence, if requested, for type, source and quality of products provided.
- .7 Defective products will be rejected, regardless of previous inspections. Replace products at own expense.
- .8 Pay costs of transportation.

1.3 FORMAT

- .1 Organize data as instructional manual.
- .2 Binders: vinyl, hard covered, 3 'D' ring, loose leaf 219 x 279 mm with spine and face pockets.
- .3 When multiple binders are used correlate data into related consistent groupings. Identify contents of each binder on spine.
- .4 Cover: identify each binder with type or printed title 'Project Record Documents'; list title of project and identify subject matter of contents.
- .5 Arrange content by systems, under Section numbers and sequence of Table of Contents.
- .6 Provide tabbed fly leaf for each separate product and system, with typed description of product and major component parts of equipment.

- .7 Text: manufacturer's printed data, or typewritten data.
- .8 Drawings: provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.
- .9 Provide 1:1 scaled CAD files in dwg format on CD.

1.4 CONTENTS - EACH VOLUME

- .1 Table of Contents: provide title of project;
 - .1 Date of submission; names.
 - .2 Addresses, and telephone numbers of Consultant and [Contractor] [Design-Builder] with name of responsible parties.
 - .3 Schedule of products and systems, indexed to content of volume.
- .2 For each product or system:
 - .1 List names, addresses and telephone numbers of subcontractors and suppliers, including local source of supplies and replacement parts.
- .3 Product Data: mark each sheet to identify specific products and component parts, and data applicable to installation; delete inapplicable information.
- .4 Drawings: supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams.
- .5 Typewritten Text: as required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions.

1.5 AS-BUILTS AND SAMPLES

- .1 Maintain at site for Engineer one record copy of:
 - .1 Contract Drawings.
 - .2 Specifications.
 - .3 Addenda.
 - .4 Change Orders and other modifications to Contract.
 - .5 Reviewed shop drawings, product data, and samples.
 - .6 Field test records.
 - .7 Inspection certificates.
 - .8 Manufacturer's certificates.
- .2 Store record documents and samples in field office apart from documents used for construction. Provide files, racks, and secure storage.
- .3 Label record documents and file in accordance with Section number listings in List of Contents of this Project Manual. Label each document "PROJECT RECORD" in neat, large, printed letters.

- .4 Maintain record documents in clean, dry and legible condition. Do not use record documents for construction purposes.
- .5 Keep record documents and samples available for inspection by Engineer.

1.6 EQUIPMENT AND SYSTEMS

- .1 Each Item of Equipment and Each System: include description of unit or system, and component parts. Give function, normal operation characteristics, and limiting conditions. Include performance curves, with engineering data and tests, and complete nomenclature and commercial number of replaceable parts.
- .2 Panel board circuit directories: provide electrical service characteristics, controls, and communications.
- .3 Include installed colour coded wiring diagrams.
- .4 Operating Procedures: include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shut-down, and emergency instructions. Include summer, winter, and any special operating instructions.
- .5 Maintenance Requirements: include routine procedures and guide for trouble-shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.
- .6 Provide servicing and lubrication schedule, and list of lubricants required.
- .7 Include manufacturer's printed operation and maintenance instructions.
- .8 Include sequence of operation by controls manufacturer.
- .9 Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.
- .10 Provide installed control diagrams by controls manufacturer.
- .11 Provide [Contractor's] [Design-Builder's] co-ordination drawings, with installed colour coded piping diagrams.
- .12 Provide charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.
- .13 Provide list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.
- .14 Include test and balancing reports as specified in Section 01 45 00 - Quality Control and 01 91 13 - General Commissioning (Cx) Requirements.

- .15 Additional requirements: as specified in individual specification sections.

1.7 MATERIALS AND FINISHES

- .1 Building Products, Applied Materials, and Finishes: include product data, with catalogue number, size, composition, and colour and texture designations.
- .2 Instructions for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.
- .3 Additional Requirements: as specified in individual specifications sections.

1.8 SPARE PARTS

- .1 Provide spare parts, in quantities specified in individual specification sections.
- .2 Provide items of same manufacture and quality as items in Work.
- .3 Deliver to location as directed; place and store.
- .4 Receive and catalogue items. Submit inventory listing to Engineer. Include approved listings in Maintenance Manual.
- .5 Obtain receipt for delivered products and submit prior to final payment.

1.9 MAINTENANCE MATERIALS

- .1 Provide maintenance and extra materials, in quantities specified in individual specification sections.
- .2 Provide items of same manufacture and quality as items in Work.
- .3 Deliver to location as directed; place and store.
- .4 Receive and catalogue items. Submit inventory listing to Engineer. Include approved listings in Maintenance Manual.
- .5 Obtain receipt for delivered products and submit prior to final payment.

1.10 SPECIAL TOOLS

- .1 Provide special tools, in quantities specified in individual specification section.
- .2 Provide items with tags identifying their associated function and equipment.
- .3 Deliver to location as directed; place and store.

- .4 Receive and catalogue items. Submit inventory listing to Engineer. Include approved listings in Maintenance Manual.

1.11 STORAGE, HANDLING AND PROTECTION

- .1 Store spare parts, maintenance materials, and special tools in manner to prevent damage or deterioration.
- .2 Store in original and undamaged condition with manufacturer's seal and labels intact.
- .3 Store components subject to damage from weather in weatherproof enclosures.
- .4 Remove and replace damaged products at own expense and to satisfaction of Engineer.

1.12 WARRANTIES AND BONDS

- .1 Separate each warranty or bond with index tab sheets keyed to Table of Contents listing.
- .2 List subcontractor, supplier, and manufacturer, with name, address, and telephone number of responsible principal.
- .3 Obtain warranties and bonds, executed in duplicate by subcontractors, suppliers, and manufacturers, within ten days after completion of applicable item of work.
- .4 Except for items put into use with Owner's permission, leave date of beginning of time of warranty until Date of Substantial Performance is determined.

PART 2 Products

2.1 NOT USED

- .1 Not Used.
- .2

PART 3 Execution

3.1 NOT USED

- .1 Not Used.

END OF SECTION

PART 1 General

1.1 REFERENCES

- .1 Canadian Environmental Protection Act, 1999 (CEPA 1999).
 - .1 Export and Import of Hazardous Waste Regulations (SOR/2002-300).
- .2 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).
- .3 National Fire Code of Canada.
- .4 Transportation of Dangerous Goods Act (TDG Act), (c. 34).
- .5 Transportation of Dangerous Goods Regulations (T-19.01-SOR/2003-400).

1.2 DEFINITIONS

- .1 Dangerous Goods: product, substance, or organism that is specifically listed or meets hazard criteria established in Transportation of Dangerous Goods Regulations.
- .2 Hazardous Material: product, substance, or organism that is used for its original purpose; and that is either dangerous goods or a material that may cause adverse impact to environment or adversely affect health of persons, animals, or plant life when released into the environment.
- .3 Hazardous Waste: any hazardous material that is no longer used for its original purpose and that is intended for recycling, treatment or disposal.
- .4 Workplace Hazardous Materials Information System (WHMIS): Canada-wide system designed to give employers and workers information about hazardous materials used in workplace. Under WHMIS, information on hazardous materials is provided on container labels, material safety data sheets (MSDS), and worker education programs. WHMIS is put into effect by combination of federal and provincial laws.

1.3 SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit product data in accordance with Section 01 33 00 - Submittal Procedures.
 - .1 Submit to Engineer current Material Safety Data Sheet (MSDS) for each hazardous material required prior to bringing hazardous material on site.

1.4 DELIVERY, STORAGE, AND HANDLING

- .1 Co-ordinate storage of hazardous materials with Engineer and abide by internal requirements for labeling and storage of materials and wastes.
- .2 Store and handle hazardous materials and wastes in accordance with applicable federal and provincial laws, regulations, codes, and guidelines.
- .3 Store and handle flammable and combustible materials in accordance with current National Fire Code of Canada requirements.
- .4 Keep no more than 45 litres of flammable and combustible liquids such as gasoline, kerosene and naphtha for ready use.
 - .1 Store flammable and combustible liquids in approved safety cans bearing the Underwriters' Laboratory of Canada or Factory Mutual seal of approval.
- .5 Transfer of flammable and combustible liquids is prohibited within buildings.
- .6 Do not transfer of flammable and combustible liquids in vicinity of open flames or heat-producing devices.
- .7 Do not use flammable liquids having flash point below 38 degrees C, such as naphtha or gasoline as solvents or cleaning agents.
- .8 Store flammable and combustible waste liquids for disposal in approved containers located in safe, ventilated area. Keep quantities to minimum.
- .9 Observe smoking regulations, smoking is prohibited in areas where hazardous materials are stored, used, or handled.
- .10 Storage requirements for quantities of hazardous materials and wastes in excess of 5 kg for solids, and 5 liters for liquids:
 - .1 Store hazardous materials and wastes in closed and sealed containers.
 - .2 Label containers of hazardous materials and wastes in accordance with WHMIS.
 - .3 Store hazardous materials and wastes in containers compatible with that material or waste.
 - .4 Segregate incompatible materials and wastes.
 - .5 Ensure that different hazardous materials or hazardous wastes are not mixed.
 - .6 Store hazardous materials and wastes in secure storage area with controlled access.
 - .7 Maintain clear egress from storage area.
 - .8 Store hazardous materials and wastes in location that will prevent them from spilling into environment.
 - .9 Have appropriate emergency spill response equipment available near storage area, including personal protective equipment.

- .10 Maintain inventory of hazardous materials and wastes, including product name, quantity, and date when storage began.
- .11 Ensure personnel have been trained in accordance with Workplace Hazardous Materials Information System (WHMIS) requirements.
- .12 Report spills or accidents immediately to Engineer. Submit a written spill report to Engineer within 24 hours of incident.

1.5 TRANSPORTATION

- .1 Transport hazardous materials and wastes in accordance with federal Transportation of Dangerous Goods Act, Transportation of Dangerous Goods Regulations, and applicable provincial regulations.
- .2 If exporting hazardous waste to another country, ensure compliance with federal Export and Import of Hazardous Waste Regulations.
- .3 If hazardous waste is generated on site:
 - .1 Co-ordinate transportation and disposal with Engineer.
 - .2 Ensure compliance with applicable federal, provincial and municipal laws and regulations for generators of hazardous waste.
 - .3 Use licensed carrier authorized by provincial authorities to accept subject material.
 - .4 Prior to shipping material obtain written notice from intended hazardous waste treatment or disposal facility that it will accept material and that it is licensed to accept this material.
 - .5 Label containers with legible, visible safety marks as prescribed by federal and provincial regulations.
 - .6 Ensure that trained personnel handle, offer for transport, or transport dangerous goods.
 - .7 Provide photocopy of shipping documents and waste manifests to Engineer.
 - .8 Track receipt of completed manifest from consignee after shipping dangerous goods. Provide a photocopy of completed manifest to Engineer.
 - .9 Report discharge, emission, or escape of hazardous materials immediately to Engineer and appropriate provincial authority. Take reasonable measures to control release.

PART 2 Products

2.1 MATERIALS

- .1 Only bring on site quantity of hazardous materials required to perform work.

- .2 Maintain MSDS in proximity to where materials are being used. Communicate this location to personnel who may have contact with hazardous materials.

PART 3 Execution

3.1 DISPOSAL

- .1 Dispose of hazardous waste materials in accordance with applicable federal and provincial acts, regulations, and guidelines.
- .2 Recycle hazardous wastes for which there is approved, cost effective recycling process available.
- .3 Send hazardous wastes to authorized hazardous waste disposal or treatment facilities.
- .4 Burning, diluting, or mixing hazardous wastes for purpose of disposal is prohibited.
- .5 Disposal of hazardous materials in waterways, storm or sanitary sewers, or in municipal solid waste landfills is prohibited.
- .6 Dispose of hazardous wastes in timely fashion in accordance with applicable provincial regulations.
- .7 Minimize generation of hazardous waste to maximum extent practicable. Take necessary precautions to avoid mixing clean and contaminated wastes.
- .8 Identify and evaluate recycling and reclamation options as alternatives to land disposal, such as:
 - .1 Hazardous wastes recycled in manner constituting disposal.
 - .2 Hazardous waste burned for energy recovery.
 - .3 Lead-acid battery recycling.
 - .4 Hazardous wastes with economically recoverable precious metals.

END OF SECTION

PART 1 General

1.1 GENERAL

- .1 Thermal insulation is under the responsibility of plumbing contractor.

1.2 SUBMITTALS

- .1 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Shop drawings; submit drawings stamped and signed by professional engineer registered or licensed in Province of Quebec, Canada.
- .3 Shop drawings to show:
 - .1 Mounting arrangements.
 - .2 Operating and maintenance clearances.
- .4 Shop drawings and product data accompanied by:
 - .1 Detailed drawings of bases, supports, and anchor bolts.
 - .2 Acoustical sound power data, where applicable.
 - .3 Points of operation on performance curves.
 - .4 Manufacturer to certify current model production.
 - .5 Certification of compliance to applicable codes.
- .5 In addition to transmittal letter referred to in Section 01 33 00 - Submittal Procedures: use MCAC "Shop Drawing Submittal Title Sheet". Identify section and paragraph number.
- .6 Closeout Submittals:
 - .1 Provide operation and maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.
 - .2 Operation and maintenance manual approved by, and final copies deposited with Engineer before final inspection.
 - .3 Operation data to include:
 - .1 Control schematics for systems including environmental controls.
 - .2 Description of systems and their controls.
 - .3 Description of operation of systems at various loads together with reset schedules and seasonal variances.
 - .4 Operation instruction for systems and component.
 - .5 Description of actions to be taken in event of equipment failure.
 - .6 Valves schedule and flow diagram.
 - .7 Colour coding chart.
 - .4 Maintenance data to include:
 - .1 Servicing, maintenance, operation and trouble-shooting instructions for each item of equipment.

- .2 Data to include schedules of tasks, frequency, tools required and task time.
- .5 Performance data to include:
 - .1 Equipment manufacturer's performance datasheets with point of operation as left after commissioning is complete.
 - .2 Equipment performance verification test results.
 - .3 Special performance data as specified.
 - .4 Testing, adjusting and balancing reports as specified in Section 23 05 93 - Testing, Adjusting and Balancing for HVAC.
- .6 Approvals:
 - .1 Submit 2 copies of draft Operation and Maintenance Manual to Engineer for approval. Submission of individual data will not be accepted unless directed by Engineer.
 - .2 Make changes as required and re-submit as directed by Engineer.
- .7 Additional data:
 - .1 Prepare and insert into operation and maintenance manual additional data when need for it becomes apparent during specified demonstrations and instructions.
- .8 Site records:
 - .1 Engineer will provide 1 set of reproducible mechanical drawings. Provide sets of white prints as required for each phase of work. Mark changes as work progresses and as changes occur. Include changes to existing mechanical systems, control systems and low voltage control wiring.
 - .2 Transfer information [weekly] [] to reproductibles, revising reproductibles to show work as actually installed.
 - .3 Use different colour waterproof ink for each service.
 - .4 Make available for reference purposes and inspection.
- .9 As-built drawings:
 - .1 Prior to start of Testing, Adjusting and Balancing for HVAC, finalize production of as-built drawings.
 - .2 Identify each drawing in lower right hand corner in letters at least 12 mm high as follows: - "AS BUILT DRAWINGS: THIS DRAWING HAS BEEN REVISED TO SHOW MECHANICAL SYSTEMS AS INSTALLED" (Signature of Contractor) (Date).
 - .3 Submit to Engineer for approval and make corrections as directed.
 - .4 Perform testing, adjusting and balancing for HVAC using as-built drawings.
 - .5 Submit completed reproducible as-built drawings with Operating and Maintenance Manuals.
- .10 Submit copies of as-built drawings for inclusion in final TAB report.

PART 2 Products

2.1 N/A

PART 3 Execution

3.1 PAINTING REPAIRS AND RESTORATION

- .1 Prime and touch up marred finished paintwork to match original.
- .2 Restore to new condition, finishes which have been damaged.

3.2 CLEANING

- .1 Clean interior and exterior of all systems including strainers. Vacuum interior of ductwork and air handling units.

3.3 FIELD QUALITY CONTROL

- .1 Manufacturer's Field Services:
 - .1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in PART 1 - SUBMITTALS.
 - .2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.
 - .3 Schedule site visits, to review Work, as directed in PART 1 - QUALITY ASSURANCE.

3.4 DEMONSTRATION

- .1 Supply tools, equipment and personnel to demonstrate and instruct operating and maintenance personnel in operating, controlling, adjusting, trouble-shooting and servicing of all systems and equipment during regular work hours, prior to acceptance.
- .2 Use operation and maintenance manual, as-built drawings, and audio visual aids as part of instruction materials.

3.5 PROTECTION

- .1 Protect equipment and systems openings from dirt, dust, and other foreign materials with materials appropriate to system.

END OF SECTION

PART 1 General

1.1 REFERENCES

- .1 American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)
 - .1 ASHRAE Standard 90.1, Energy Standard for Buildings Except Low-Rise Residential Buildings (IESNA co-sponsored; ANSI approved; Continuous Maintenance Standard).

- .2 American Society for Testing and Materials International (ASTM)
 - .1 ASTM B 209M, Standard Specification for Aluminum and Aluminum Alloy Sheet and Plate [Metric].
 - .2 ASTM C 335, Standard Test Method for Steady State Heat Transfer Properties of Horizontal Pipe Insulation.
 - .3 ASTM C 411, Standard Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation.
 - .4 ASTM C 449/C 449M, Standard Specification for Mineral Fiber-Hydraulic-Setting Thermal Insulating and Finishing Cement.
 - .5 ASTM C 533, Calcium Silicate Block and Pipe Thermal Insulation.
 - .6 ASTM C 547, Mineral Fiber Pipe Insulation.
 - .7 ASTM C 795, Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel.
 - .8 ASTM C 921, Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.

- .3 Canadian General Standards Board (CGSB)
 - .1 CGSB 51-GP-52Ma, Vapour Barrier, Jacket and Facing Material for Pipe, Duct and Equipment Thermal Insulation.
 - .2 CAN/CGSB-51.53, Poly (Vinyl Chloride) Jacketing Sheet, for Insulated Pipes, Vessels and Round Ducts

- .4 Department of Justice Canada (Jus)
 - .1 Canadian Environmental Assessment Act (CEAA), c. 37.
 - .2 Canadian Environmental Protection Act (CEPA), c. 33.
 - .3 Transportation of Dangerous Goods Act (TDGA), c. 34.

- .5 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).

- .6 Manufacturer's Trade Associations
 - .1 Thermal Insulation Association of Canada (TIAC): National Insulation Standards.

- .7 Underwriters' Laboratories of Canada (ULC)
 - .1 CAN/ULC-S102, Surface Burning Characteristics of Building Materials and Assemblies.

- .2 CAN/ULC-S701, Thermal Insulation, Polystyrene, Boards and Pipe Covering.
- .3 CAN/ULC-S702, Thermal Insulation, Mineral Fibre, for Buildings
- .4 CAN/ULC-S702.2, Thermal Insulation, Mineral Fibre, for Buildings, Part 2: Application Guidelines.

1.2 DEFINITIONS

- .1 For purposes of this section:
 - .1 "CONCEALED" - insulated mechanical services in suspended ceilings and non-accessible chases and furred-in spaces.
 - .2 "EXPOSED" - will mean "not concealed" as specified.
- .2 TIAC ss:
 - .1 CRF: Code Rectangular Finish.
 - .2 CPF: Code Piping Finish.

1.3 SUBMITTALS

- .1 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00 - Submittal Procedures. Include product characteristics, performance criteria, and limitations.
 - .1 Submit two (2_ copies of Workplace Hazardous Materials Information System (WHMIS) Material Safety Data Sheets (MSDS) in accordance with Section 01 33 00 - Submittal Procedures.
- .3 Shop Drawings:
 - .1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.
 - .1 Shop drawings: submit drawings stamped and signed by professional engineer registered or licensed in Province of Quebec, Canada.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Packing, shipping, handling and unloading:
 - .1 Deliver, store and handle in accordance with manufacturer's written instruction.
 - .2 Deliver, store and handle materials in accordance with manufacturer's written instructions.
 - .3 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

PART 2 Products

2.1 FIRE AND SMOKE RATING

- .1 In accordance with CAN/ULC-S102.
 - .1 Maximum flame spread rating: 25.
 - .2 Maximum smoke developed rating: 50.

2.2 INSULATION

- .1 Mineral fibre specified includes glass fibre, rock wool, slag wool.
- .2 Thermal conductivity ("k" factor) not to exceed specified values at 24 degrees C mean temperature when tested in accordance with ASTM C 335.
- .3 TIAC Code A-1: rigid moulded mineral fibre without factory applied vapour retarder jacket.
 - .1 Mineral fibre: to CAN/ULC-S702 and ASTM C 547.
 - .2 Maximum "k" factor: to CAN/ULC-S702.
- .4 TIAC Code A-3: rigid moulded mineral fibre with factory applied vapour retarder jacket.
 - .1 Mineral fibre: to CAN/ULC-S702 and ASTM C 547.
 - .2 Jacket: to CGSB 51-GP-52Ma.
 - .3 Maximum "k" factor: to CAN/ULC-S702 and ASTM C 547.
- .5 TIAC Code C-2: mineral fibre blanket faced [with] [without] factory applied vapour retarder jacket (as scheduled in PART 3 of this section).
 - .1 Mineral fibre: to CAN/ULC-S702 and ASTM C 547.
 - .2 Jacket: to CGSB 51-GP-52Ma.
 - .3 Maximum "k" factor: to CAN/ULC-S702 and ASTM C 547.
- .6 TIAC Code A-6: flexible unicellular tubular elastomer.

2.3 INSULATION SECUREMENT

- .1 Tape: self-adhesive, aluminum, reinforced, 50 mm wide minimum.
- .2 Contact adhesive: quick setting.
- .3 Canvas adhesive: washable.
- .4 Tie wire: 1.5 mm diameter stainless steel.
- .5 Bands: stainless steel, 19 mm wide, 0.5 mm thick.

2.4 CEMENT

- .1 Thermal insulating and finishing cement:
 - .1 Hydraulic setting or air drying on mineral wool, to ASTM C 449/C 449M.

2.5 VAPOUR RETARDER LAP ADHESIVE

- .1 Water based, fire retardant type, compatible with insulation.

2.6 INDOOR VAPOUR RETARDER FINISH

- .1 Vinyl emulsion type acrylic, compatible with insulation.

2.7 OUTDOOR VAPOUR RETARDER FINISH

- .1 Vinyl emulsion type acrylic, compatible with insulation.
- .2 Reinforcing fabric: fibrous glass, untreated 305 g/m².

PART 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

- .1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.2 PRE-INSTALLATION REQUIREMENT

- .1 Pressure testing of piping systems and adjacent equipment to be complete, witnessed and certified.
- .2 Surfaces clean, dry, free from foreign material.

3.3 INSTALLATION

- .1 Install in accordance with TIAC National Standards.
- .2 Apply materials in accordance with manufacturer's instructions and this specification.
- .3 Use two layers with staggered joints when required nominal wall thickness exceeds 75 mm.
- .4 Maintain uninterrupted continuity and integrity of vapour retarder jacket and finishes.
 - .1 Install hangers, supports outside vapour retarder jacket.

- .5 Supports, Hangers:
 - .1 Apply high compressive strength insulation, suitable for service, at oversized saddles and shoes where insulation saddles have not been provided.

3.4 INSTALLATION OF ELASTOMERIC INSULATION

- .1 Insulation to remain dry. Overlaps to manufacturer’s instructions. Ensure tight joints.
- .2 Provide vapour retarder as recommended by manufacturer.

3.5 PIPING INSULATION SCHEDULES

- .1 Includes valves, valve bonnets, strainers, flanges and fittings unless otherwise specified.
- .2 Thickness of insulation as listed in following table.
 - .1 Run-outs to individual units and equipment not exceeding 4000 mm long.
 - .2 Do not insulate exposed runouts to plumbing fixtures, chrome plated piping, valves, fittings.

Application	Temp. °C		Pipe sizes (NPS) and insulation thickness (mm)					
	Run out	TIAC Code	To 1	1¼ to 2	2½ to 4	5	6	8 & over
Refrigerant (hot gas) (liquid) (suction)	4 – 13	(A-6)	25	25	25	25	25	25
Refrigerant (hot gas) (liquid) (suction)	Below 4	(A-6)	25	25	38	38	38	38
Cooling coil cond. drain		(C-2)	25	25	25	25	25	25

END OF SECTION

PART 1 General

1.1 SUMMARY

- .1 Section Includes:
 - .1 The installation of drainage waste and vent piping.

1.2 REFERENCES

- .1 American Society for Testing and Materials International, (ASTM).
 - .1 ASTM B 32, Specification for Solder Metal.
 - .2 ASTM B 306, Specification for Copper Drainage Tube (DWV).
 - .3 ASTM C 564, Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings.
- .2 Canadian Standards Association (CSA International).
 - .1 CSA B67, Lead Service Pipe, Waste Pipe, Traps, Bends and Accessories.
 - .2 CAN/CSA-B70, Cast Iron Soil Pipe, Fittings and Means of Joining.
 - .3 CAN/CSA-B125, Plumbing Fittings.

PART 2 Products

2.1 COPPER TUBE AND FITTINGS

- .1 Above ground vent Type DWV to: ASTM B 306.
 - .1 Fittings.
 - .1 Cast brass: to CAN/CSA-B125.
 - .2 Wrought copper: to CAN/CSA-B125.
 - .2 Solder: lead free, tin- 95:5, type TA, to ASTM B 32.

2.2 CAST IRON PIPING AND FITTINGS

- .1 Buried sanitary minimum NPS 3, to: CAN/CSA-B70, with one layer of protective coating.
 - .1 Joints.
 - .1 Mechanical joints.
 - .1 Neoprene or butyl rubber compression gaskets: to ASTM C 564 or CAN/CSA-B70.
 - .2 Stainless steel clamps.
 - .2 Hub and spigot.
 - .1 Caulking lead: to CSA B67.
 - .2 Cold caulking compounds.

- .2 Above ground sanitary: to CAN/CSA-B70.
 - .1 Joints.
 - .1 Hub and spigot.
 - .1 Caulking lead: to CSA B67.
 - .2 Mechanical joints.
 - .1 Neoprene or butyl rubber compression gaskets with stainless steel clamps.

PART 3 Execution

3.1 INSTALLATION

- .1 In accordance with Section 23 05 01 - Installation of Pipework.

3.2 TESTING

- .1 Pressure test buried systems before backfilling.
- .2 Hydraulically test to verify grades and freedom from obstructions.

3.3 PERFORMANCE VERIFICATION

- .1 Cleanouts:
 - .1 Ensure accessible and that access doors are correctly located.
 - .2 Open, cover with linseed oil and re-seal.
 - .3 Verify that cleanout rods can probe as far as the next cleanout, at least.
- .2 Test to ensure traps are fully and permanently primed.
- .3 Storm water drainage:
 - .1 Verify domes are secure.
 - .2 Ensure weirs are correctly sized and installed correctly.
 - .3 Verify provisions for movement of roof system.
- .4 Ensure that fixtures are properly anchored, connected to system and effectively vented.
- .5 Affix applicable label (storm, sanitary, vent, pump discharge etc.) c/w directional arrows every floor or 4.5 m (whichever is less).
 - .1 Resource reuse.
 - .2 Local/regional materials.
 - .3 Low-emitting materials.

END OF SECTION

PART 1 General

1.1 SUBMITTALS

- .1 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Shop drawings; submit drawings stamped and signed by professional engineer registered or licensed in Province of Quebec, Canada.
- .3 Shop drawings to show:
 - .1 Mounting arrangements.
 - .2 Operating and maintenance clearances.
- .4 Shop drawings and product data accompanied by:
 - .1 Detailed drawings of bases, supports, and anchor bolts.
 - .2 Acoustical sound power data, where applicable.
 - .3 Points of operation on performance curves.
 - .4 Manufacturer to certify current model production.
 - .5 Certification of compliance to applicable codes.
- .5 In addition to transmittal letter referred to in Section 01 33 00 - Submittal Procedures: use MCAC "Shop Drawing Submittal Title Sheet". Identify section and paragraph number.
- .6 Closeout Submittals:
 - .1 Provide operation and maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.
 - .2 Operation and maintenance manual approved by, and final copies deposited with Engineer before final inspection.
 - .3 Operation data to include:
 - .1 Control schematics for systems including environmental controls.
 - .2 Description of systems and their controls.
 - .3 Description of operation of systems at various loads together with reset schedules and seasonal variances.
 - .4 Operation instruction for systems and component.
 - .5 Description of actions to be taken in event of equipment failure.
 - .6 Valves schedule and flow diagram.
 - .7 Colour coding chart.
 - .4 Maintenance data to include:
 - .1 Servicing, maintenance, operation and trouble-shooting instructions for each item of equipment.
 - .2 Data to include schedules of tasks, frequency, tools required and task time.

- .5 Performance data to include:
 - .1 Equipment manufacturer's performance datasheets with point of operation as left after commissioning is complete.
 - .2 Equipment performance verification test results.
 - .3 Special performance data as specified.
 - .4 Testing, adjusting and balancing reports as specified in Section 23 05 93 - Testing, Adjusting and Balancing for HVAC.
- .6 Approvals:
 - .1 Submit 2 copies of draft Operation and Maintenance Manual to Engineer for approval. Submission of individual data will not be accepted unless directed by Engineer.
 - .2 Make changes as required and re-submit as directed by Engineer.
- .7 Additional data:
 - .1 Prepare and insert into operation and maintenance manual additional data when need for it becomes apparent during specified demonstrations and instructions.
- .8 Site records:
 - .1 Engineer will provide 1 set of reproducible mechanical drawings. Provide sets of white prints as required for each phase of work. Mark changes as work progresses and as changes occur. Include changes to existing mechanical systems, control systems and low voltage control wiring.
 - .2 Transfer information weekly to reproducibles, revising reproducibles to show work as actually installed.
 - .3 Use different colour waterproof ink for each service.
 - .4 Make available for reference purposes and inspection.
- .9 As-built drawings:
 - .1 Prior to start of Testing, Adjusting and Balancing for HVAC, finalize production of as-built drawings.
 - .2 Identify each drawing in lower right hand corner in letters at least 12 mm high as follows: - "AS BUILT DRAWINGS: THIS DRAWING HAS BEEN REVISED TO SHOW MECHANICAL SYSTEMS AS INSTALLED" (Signature of Contractor) (Date).
 - .3 Engineer for approval and make corrections as directed.
 - .4 Perform testing, adjusting and balancing for HVAC using as-built drawings.
 - .5 Submit completed reproducible as-built drawings with Operating and Maintenance Manuals.
- .10 Submit copies of as-built drawings for inclusion in final TAB report.

1.2 QUALITY ASSURANCE

- .1 Quality Assurance: in accordance with Section 01 45 00 - Quality Control.
- .2 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 35 13 – SCC Security.

1.3 MAINTENANCE

- .1 Furnish spare parts in accordance with Section 01 78 00 - as follows:
 - .1 One filter cartridge or set of filter media for each filter or filter bank in addition to final operating set.
- .2 Provide one set of special tools required to service equipment as recommended by manufacturers and in accordance with Section 01 78 00 - Closeout Submittals.
- .3 Furnish one commercial quality grease gun, grease and adapters to suit different types of grease and grease fittings.

PART 2 Products

2.1 N.A.

PART 3 Execution

3.1 PAINTING REPAIRS AND RESTORATION

- .1 Do painting in accordance with Section 09 91 23 - Interior Painting.
- .2 Low VOC paints are preferable.
- .3 Prime and touch up marred finished paintwork to match original.
- .4 Restore to new condition, finishes which have been damaged.

3.2 CLEANING

- .1 Clean interior and exterior of all systems including strainers. Vacuum interior of ductwork and air handling units.

3.3 FIELD QUALITY CONTROL

- .1 Manufacturer's Field Services:
 - .1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in PART 1 - SUBMITTALS.
 - .2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.

.3 Schedule site visits, to review Work, as directed in PART 1 - QUALITY ASSURANCE.

3.4 PROTECTION

.1 Protect equipment and systems openings from dirt, dust, and other foreign materials with materials appropriate to system.

END OF SECTION

PART 1 General

1.1 REFERENCES

- .1 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-1.181, Ready-Mixed Organic Zinc-Rich Coating.

PART 2 Products

2.1 NOT USED

- .1 Not Used.

PART 3 Execution

3.1 CONNECTIONS TO EQUIPMENT

- .1 In accordance with manufacturer's instructions unless otherwise indicated.
- .2 Use valves and either unions or flanges for isolation and ease of maintenance and assembly.
- .3 Use double swing joints when equipment mounted on vibration isolation and when piping subject to movement.

3.2 CLEARANCES

- .1 Provide clearance around systems, equipment and components for observation of operation, inspection, servicing, maintenance and as recommended by manufacturer.
- .2 Provide space for disassembly, removal of equipment and components as recommended by manufacturer or as indicated (whichever is greater) without interrupting operation of other system, equipment, and components.

3.3 DRAINS

- .1 Install piping with grade in direction of flow except as indicated.
- .2 Install drain valve at low points in piping systems, at equipment and at section isolating valves.
- .3 Pipe each drain valve discharge separately to above floor drain. Discharge to be visible.

- .4 Drain valves: NPS 3/4 gate or globe valves unless indicated otherwise, with hose end male thread, cap and chain.

3.4 DIELECTRIC COUPLINGS

- .1 General: Compatible with system, to suit pressure rating of system.
- .2 Locations: Where dissimilar metals are joined.
- .3 NPS 2 and under: isolating unions or bronze valves.
- .4 Over NPS 2: Isolating flanges.

3.5 PIPEWORK INSTALLATION

- .1 Screwed fittings jointed with Teflon tape.
- .2 Protect openings against entry of foreign material.
- .3 Install to isolate equipment and allow removal without interrupting operation of other equipment or systems.
- .4 Assemble piping using fittings manufactured to ANSI standards.
- .5 Saddle type branch fittings may be used on mains if branch line is no larger than half the size of main.
 - .1 Hole saw (or drill) and ream main to maintain full inside diameter of branch line prior to welding saddle.
- .6 Install exposed piping, equipment, rectangular cleanouts and similar items parallel or perpendicular to building lines.
- .7 Install concealed pipework to minimize furring space, maximize headroom, conserve space.
- .8 Slope piping, except where indicated, in direction of flow for positive drainage and venting.
- .9 Install, except where indicated, to permit separate thermal insulation of each pipe.
- .10 Group piping wherever possible [and as indicated].
- .11 Ream pipes, remove scale and other foreign material before assembly.
- .12 Use eccentric reducers at pipe size changes to ensure positive drainage and venting.

- .13 Provide for thermal expansion as indicated.
- .14 Valves:
 - .1 Install in accessible locations.
 - .2 Remove interior parts before soldering.
 - .3 Install with stems above horizontal position unless otherwise indicated.
 - .4 Valves accessible for maintenance without removing adjacent piping.
 - .5 Install globe valves in bypass around control valves.
 - .6 Use gate valves at branch take-offs for isolating purposes except where otherwise specified.
 - .7 Install butterfly valves on chilled water and related condenser water systems only.
 - .8 Install butterfly valves between weld neck flanges to ensure full compression of liner.
 - .9 Use chain operators on valves NPS 2-1/2 and larger where installed more than 2400 mm above floor in Mechanical Rooms.
- .15 Check Valves:
 - .1 Install silent check valves in vertical pipes with downward flow and elsewhere as indicated.
 - .2 Install swing check valves in horizontal lines

3.6 SLEEVES

- .1 General: Install where pipes pass through masonry, concrete structures, fire rated assemblies, and elsewhere as indicated.
- .2 Material: Schedule 40 black steel pipe.
- .3 Construction: Foundation walls and where sleeves extend above finished floors to have annular fins continuously welded on at mid-point.
- .4 Sizes: 6 mm minimum clearance between sleeve and uninsulated pipe or between sleeve and insulation.
- .5 Installation:
 - .1 Concrete, masonry walls, concrete floors on grade: Terminate flush with finished surface.
 - .2 Other floors: Terminate 25 mm above finished floor.
 - .3 Before installation, paint exposed exterior surfaces with heavy application of zinc-rich paint to CAN/CGSB-1.181.
- .6 Sealing:
 - .1 Foundation walls and below grade floors: Fire retardant, waterproof non-hardening mastic.

- .2 Elsewhere: Provide space for firestopping. Maintain fire rating integrity.
- .3 Sleeves installed for future use: Fill with lime plaster or other easily removable filler.
- .4 Ensure no contact between copper pipe or tube and sleeve.

3.7 ESCUTCHEONS

- .1 Install on pipes passing through walls, partitions, floors, and ceilings in finished areas.
- .2 Construction: One piece type with set screws. Chrome or nickel plated brass or type 302 stainless steel.
- .3 Sizes: Outside diameter to cover opening or sleeve. Inside diameter to fit around pipe or outside of insulation if so provided.

3.8 PREPARATION FOR FIRESTOPPING

- .1 Material and installation within annular space between pipes, ducts, insulation and adjacent fire separation to Section 07 84 00 - Firestopping.
- .2 Uninsulated unheated pipes not subject to movement: No special preparation.
- .3 Uninsulated heated pipes subject to movement: Wrap with non-combustible smooth material to permit pipe movement without damaging firestopping material or installation.
- .4 Insulated pipes and ducts: Ensure integrity of insulation and vapour barriers.

3.9 PRESSURE TESTING OF EQUIPMENT AND PIPEWORK

- .1 Advise Engineer 48 hours minimum prior to performance of pressure tests.
- .2 Pework: Test as specified in relevant sections of Division 22.
- .3 Maintain specified test pressure without loss for 4 hours minimum unless specified for longer period of time in relevant sections of Division 22.
- .4 Prior to tests, isolate equipment and other parts which are not designed to withstand test pressure or media.
- .5 Pay costs for repairs or replacement, retesting, and making good. Engineer to determine whether repair or replacement is appropriate.
- .6 Insulate or conceal work only after approval and certification of tests by Engineer.

3.10 EXISTING SYSTEMS

- .1 Connect into existing piping systems at times approved by the Owner.
- .2 Request written approval 10 days minimum, prior to commencement of work.
- .3 Be responsible for damage to existing plant by this work.
- .4 Ensure daily clean-up of existing areas.

END OF SECTION

PART 1 General

1.1 REFERENCES

- .1 American National Standards Institute/American Society of Mechanical Engineers (ANSI/ASME)
 - .1 ANSI/ASME B31.1, Power Piping.
 - .2 ANSI/ASME B31.3, Process Piping Addenda A.
 - .3 ANSI/ASME B31.3, Process Piping Addenda B.
 - .4 ANSI/ASME Boiler and Pressure Vessel Code:
 - .1 Section I: Power Boilers.
 - .2 Section V: Nondestructive Examination.
 - .3 Section IX: Welding and Brazing Qualifications.
- .2 American National Standards Institute/American Water Works Association (ANSI/AWWA)
 - .1 ANSI/AWWA C206, Field Welding of Steel Water Pipe.
- .3 American Welding Society (AWS)
 - .1 AWS C1.1, Recommended Practices for Resistance Welding.
 - .2 AWS Z49.1, Safety Welding, Cutting and Allied Process.
 - .3 AWS W1, Welding Inspection Handbook..
- .4 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-48.2, Spot Radiography of Welded Butt Joints in Ferrous Materials.
- .5 Canadian Standards Association (CSA International)
 - .1 CSA W47.2, Certification of Companies for Fusion Welding of Aluminum.
 - .2 CSA W48 series, Filler Metals and Allied Materials for Metal Arc Welding.
 - .3 CSA B51, Boiler, Pressure Vessel and Pressure Piping Code.
 - .4 CSA-W117.2, Safety in Welding, Cutting and Allied Processes.
 - .5 CSA W178.1, Certification of Welding Inspection Organizations.
 - .6 CSA W178.2, Certification of Welding Inspectors.

1.2 QUALIFICATIONS

- .1 Welders
 - .1 Welding qualifications in accordance with CSA B51.
 - .2 Use qualified and licensed welders possessing certificate for each procedure performed from authority having jurisdiction.
 - .3 Furnish welder's qualifications to Engineer.
 - .4 Each welder to possess identification symbol issued by authority having jurisdiction.
 - .5 Certification of companies for fusion welding of aluminum in accordance with CSA W47.2.

- .2 Inspectors
 - .1 Inspectors qualified to CSA W178.2.

1.3 QUALITY ASSURANCE

- .1 Registration of welding procedures in accordance with CSA B51.
- .2 Copy of welding procedures available for inspection.
- .3 Safety in welding, cutting and allied processes in accordance with CSA-W117.2.

1.4 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal, and with the Waste Reduction Workplan.
- .2 Remove from site and dispose of all packaging materials at appropriate recycling facilities.
- .3 Collect and separate for disposal packaging material for recycling in accordance with Waste Management Plan.

PART 2 Products

2.1 ELECTRODES

- .1 Electrodes: in accordance with CSA W48 Series.

PART 3 Execution

3.1 WORKMANSHIP

- .1 Welding: in accordance with ANSI/ASME B31.1, ANSI/ASME Boiler and Pressure Vessel Code, Sections I and IX and ANSI/AWWA C206, using procedures conforming to AWS B3.0, AWS C1.1, and special procedures specified elsewhere in Division 22 applicable requirements of provincial authority having jurisdiction.

3.2 INSTALLATION REQUIREMENTS

- .1 Identify each weld with welder's identification symbol.
- .2 Backing rings:
 - .1 Where used, fit to minimize gaps between ring and pipe bore.
 - .2 Do not install at orifice flanges.

- .3 Fittings:
 - .1 NPS 2 and smaller: install welding type sockets.
 - .2 Branch connections: install welding tees or forged branch outlet fittings.

3.3 INSPECTION AND TESTS - GENERAL REQUIREMENTS

- .1 Review weld quality requirements and defect limits of applicable codes and standards with Engineer before work is started.
- .2 Formulate "Inspection and Test Plan" in co-operation with Engineer.
- .3 Do not conceal welds until they have been inspected, tested and approved by inspector.
- .4 Provide for inspector to visually inspect welds during early stages of welding procedures in accordance with Welding Inspection Handbook. Repair or replace defects as required by codes and as specified.

3.4 SPECIALIST EXAMINATIONS AND TESTS

- .1 General
 - .1 Perform examinations and tests by specialist qualified in accordance with CSA W178.1 and CSA W178.2 and approved by Engineer.
 - .2 To ANSI/ASME Boiler and Pressure Vessels Code, Section V, CSA B51 and requirements of authority having jurisdiction.
 - .3 Inspect and test 5% of welds in accordance with "Inspection and Test Plan" by non-destructive visual examination and magnetic particle (hereinafter referred to as "particle") tests and spot full gamma ray radiographic (hereinafter referred to as "radiography") tests.
- .2 Hydrostatically test welds to requirements of ANSI/ASME B31.1.
- .3 Visual examinations: include entire circumference of weld externally and wherever possible internally.
- .4 Failure of visual examinations:
 - .1 Upon failure of welds by visual examination, perform additional testing as directed by Engineer of total of up to 10% of welds, selected at random by Engineer particle tests.

END OF SECTION

PART 1 General

1.1 REFERENCES

- .1 American National Standards Institute/American Society of Mechanical Engineers (ANSI/ASME)
 - .1 ANSI/ASME B31.1, Power Piping.
- .2 American Society for Testing and Materials International (ASTM)
 - .1 ASTM A 125, Specification for Steel Springs, Helical, Heat-Treated.
 - .2 ASTM A 307, Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
 - .3 ASTM A 563, Specification for Carbon and Alloy Steel Nuts.
- .3 Factory Mutual (FM)
- .4 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).
- .5 Manufacturer's Standardization Society of the Valves and Fittings Industry (MSS)
 - .1 MSS SP 58, Pipe Hangers and Supports - Materials, Design and Manufacture.
 - .2 ANSI/MSS SP69, Pipe Hangers and Supports - Selection and Application.
 - .3 MSS SP 89, Pipe Hangers and Supports - Fabrication and Installation Practices.
- .6 Underwriter's Laboratories of Canada (ULC)

1.2 SYSTEM DESCRIPTION

- .1 Design Requirements:
 - .1 Construct pipe hanger and support to manufacturer's recommendations utilizing manufacturer's regular production components, parts and assemblies.
 - .2 Base maximum load ratings on allowable stresses prescribed by MSS SP 58. ASME B31.1 or
 - .3 Ensure that supports, guides, anchors do not transmit excessive quantities of heat to building structure.
 - .4 Design hangers and supports to support systems under conditions of operation, allow free expansion and contraction, prevent excessive stresses from being introduced into pipework or connected equipment.
 - .5 Provide for vertical adjustments after erection and during commissioning. Amount of adjustment in accordance with MSS SP 58.
- .2 Performance Requirements:
 - .1 Design supports, platforms, catwalks, hangers to withstand seismic events.

1.3 SUBMITTALS

- .1 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Shop drawings: submit drawings stamped and signed by professional engineer registered or licensed in Province of Quebec, Canada.
- .3 Submit shop drawings and product data for following items:
 - .1 Bases, hangers and supports.
 - .2 Connections to equipment and structure.
 - .3 Structural assemblies.
- .4 Quality assurance submittals: submit following in accordance with Section 01 33 00 - Submittal Procedures.
 - .1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
 - .2 Instructions: submit manufacturer's installation instructions.
 - .1 Engineer will make available 1 copy of systems supplier's installation instructions.
- .5 Closeout Submittals:
 - .1 Provide maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

PART 2 Products

2.1 GENERAL

- .1 Fabricate hangers, supports and sway braces in accordance with ANSI B31.1 and MSS SP 58.
- .2 Use components for intended design purpose only. Do not use for rigging or erection purposes.

2.2 PIPE HANGERS

- .1 Finishes:
 - .1 Pipe hangers and supports: galvanized after manufacture.
 - .2 Use electro-plating galvanizing process.
 - .3 Ensure steel hangers in contact with copper piping are copper plated.
- .2 Upper attachment structural: suspension from lower flange of I-Beam:
 - .1 Cold piping NPS 2 maximum: malleable iron C-clamp with hardened steel cup point setscrew, locknut and carbon steel retaining clip.
 - .1 Rod: 13 mm FM approved.

- .2 Cold piping NPS 2 1/2 or greater, hot piping: malleable iron beam clamp, eye rod, jaws and extension with carbon steel retaining clip, tie rod, nuts and washers, FM approved to MSS-SP 58 and MSS-SP 69.
- .3 Upper attachment structural: suspension from upper flange of I-Beam:
 - .1 Cold piping NPS 2 maximum: ductile iron top-of-beam C-clamp with hardened steel cup point setscrew, locknut and carbon steel retaining clip, FM approved to MSS SP 69.
 - .2 Cold piping NPS 2 1/2 or greater, hot piping: malleable iron top-of-beam jaw-clamp with hooked rod, spring washer, plain washer and nut FM approved.
- .4 Upper attachment to concrete:
 - .1 Ceiling: carbon steel welded eye rod, clevis plate, clevis pin and cotters with weldless forged steel eye nut. Ensure eye 6 mm minimum greater than rod diameter.
 - .2 Concrete inserts: wedge shaped body with knockout protector plate FM approved to MSS SP 69.
- .5 Shop and field-fabricated assemblies:
 - .1 Sway braces for seismic restraint systems: to Section 23 05 48 – Vibration and seismic controls for HVAC piping and equipment.
- .6 Hanger rods: threaded rod material to MSS SP 58:
 - .1 Ensure that hanger rods are subject to tensile loading only.
 - .2 Provide linkages where lateral or axial movement of pipework is anticipated.
 - .3 Do not use 22 mm or 28 mm rod.
- .7 Pipe attachments: material to MSS SP 58:
 - .1 Attachments for steel piping: carbon steel [black][galvanized].
 - .2 Attachments for copper piping: copper plated black steel.
 - .3 Use insulation shields for hot pipework.
 - .4 Oversize pipe hangers and supports.
- .8 Adjustable clevis: material to MSS SP 69 [UL listed] [FM approved], clevis bolt with nipple spacer and vertical adjustment nuts above and below clevis.
 - .1 Ensure "U" has hole in bottom for rivetting to insulation shields.
- .9 Yoke style pipe roll: carbon steel yoke, rod and nuts with cast iron roll, to MSS SP 69.
- .10 U-bolts: carbon steel to MSS SP 69 with 2 nuts at each end to ASTM A 563.
 - .1 Finishes for steel pipework: black.
 - .2 Finishes for copper, glass, brass or aluminum pipework: black, with formed portion plastic coated.

- .11 Pipe rollers: cast iron roll and roll stand with carbon steel rod to MSS SP 69.

2.3 RISER CLAMPS

- .1 Steel or cast iron pipe: black carbon steel to MSS SP 58, type 42, FM approved.
- .2 Copper pipe: carbon steel copper plated to MSS SP 58, type 42.
- .3 Bolts: to ASTM A 307.
- .4 Nuts: to ASTM A 563.

2.4 INSULATION PROTECTION SHIELDS

- .1 Insulated cold piping:
 - .1 64 kg/m³ density insulation plus insulation protection shield to: MSS SP 69, galvanized sheet carbon steel. Length designed for maximum 3 m span.
- .2 Insulated hot piping:
 - .1 Curved plate 300 mm long, with edges turned up, welded-in centre plate for pipe sizes NPS 12 and over, carbon steel to comply with MSS SP 69.

2.5 EQUIPMENT SUPPORTS

- .1 Fabricate equipment supports not provided by equipment manufacturer from structural grade steel meeting requirements of Section 05 12 23 - Structural Steel for Buildings. Submit calculations with shop drawings.

2.6 EQUIPMENT ANCHOR BOLTS AND TEMPLATES

- .1 Provide templates to ensure accurate location of anchor bolts.

2.7 OTHER EQUIPMENT SUPPORTS

- .1 Fabricate equipment supports from structural grade steel meeting requirements of Section 05 12 23 - Structural Steel for Buildings.
- .2 Submit structural calculations with shop drawings.

PART 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

- .1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.2 INSTALLATION

- .1 Install in accordance with:
 - .1 manufacturer's instructions and recommendations.
- .2 Vibration Control Devices:
 - .1 Install on piping systems at pumps, boilers, chillers, cooling towers, and as indicated.
- .3 Clamps on riser piping:
 - .1 Support independent of connected horizontal pipework using riser clamps and riser clamp lugs welded to riser.
 - .2 Bolt-tightening torques to industry standards.
 - .3 Steel pipes: install below coupling or shear lugs welded to pipe.
 - .4 Cast iron pipes: install below joint.
- .4 Clevis plates:
 - .1 Attach to concrete with 4 minimum concrete inserts, one at each corner.
- .5 Provide supplementary structural steelwork where structural bearings do not exist or where concrete inserts are not in correct locations.
- .6 Use approved constant support type hangers where:
 - .1 vertical movement of pipework is 13 mm or more,
 - .2 transfer of load to adjacent hangers or connected equipment is not permitted.
- .7 Use variable support spring hangers where:
 - .1 transfer of load to adjacent piping or to connected equipment is not critical.
 - .2 variation in supporting effect does not exceed 25 % of total load.

3.3 HANGER SPACING

- .1 Plumbing piping: to Provincial Code.
- .2 Fire protection: to applicable fire code.
- .3 Gas and fuel oil piping: up to NPS 1/2: every 1.8 m.
- .4 Copper piping: up to NPS 1/2: every 1.5 m.
- .5 Flexible joint roll groove pipe: in accordance with table below, but not less than one hanger at joints.

- .6 Within 300 mm of each elbow.

Maximum Pipe Size : NPS	Maximum Spacing Steel	Maximum Spacing Copper
Up to 1¼	2,1 m	1,8 m
1½	2,7 m	2,4 m
2	3,0 m	2,7 m
2½	3,6 m	3,0 m
3	3,6 m	3,0 m
3½	3,9 m	3,3 m
4	4,2 m	3,6 m
5	4,8 m	
6	5,1 m	
8	5,7 m	
10	6,6 m	
12	6,9 m	

- .7 Pipework greater than NPS 12: to MSS SP 69.

3.4 HANGER INSTALLATION

- .1 Install hanger so that rod is vertical under operating conditions.
- .2 Adjust hangers to equalize load.
- .3 Support from structural members. Where structural bearing does not exist or inserts are not in suitable locations, provide supplementary structural steel members.

3.5 HORIZONTAL MOVEMENT

- .1 Angularity of rod hanger resulting from horizontal movement of pipework from cold to hot position not to exceed 4 degrees from vertical.
- .2 Where horizontal pipe movement is less than 13 mm, offset pipe hanger and support so that rod hanger is vertical in the hot position.

3.6 FINAL ADJUSTMENT

- .1 Adjust hangers and supports:
- .1 Ensure that rod is vertical under operating conditions.
 - .2 Equalize loads.
- .2 Adjustable clevis:
- .1 Tighten hanger load nut securely to ensure proper hanger performance.
 - .2 Tighten upper nut after adjustment.

- .3 C-clamps:
 - .1 Follow manufacturer's recommended written instructions and torque values when tightening C-clamps to bottom flange of beam.

- .4 Beam clamps:
 - .1 Hammer jaw firmly against underside of beam.

3.7 FIELD QUALITY CONTROL

- .1 Manufacturer's Field Services:
 - .1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in PART 1 - SUBMITTALS.
 - .2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.
 - .3 Schedule site visits, to review Work, as directed in PART 1 - QUALITY ASSURANCE.

END OF SECTION

PART 1 General

1.1 REFERENCES

- .1 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).
- .2 National Building Code of Canada (NBC) – 2010.

1.2 SUBMITTALS

- .1 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.
 - .1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00 - Submittal Procedures. Include product characteristics, performance criteria, and limitations.
 - .1 Submit two (2) copies of Workplace Hazardous Materials Information System (WHMIS) Material Safety Data Sheets (MSDS) in accordance with Section 01 33 00 - Submittal Procedures.
 - .2 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.
 - .1 Shop drawings: submit drawings stamped and signed by professional engineer registered or licensed in Province of Quebec, Canada.
 - .2 Provide system shop drawings complete with performance and product data.
 - .3 Provide detailed drawings of seismic control measures for equipment and piping.
 - .3 Quality assurance submittals: submit following in accordance with Section 01 33 00 - Submittal Procedures.
 - .1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
 - .2 Instructions: submit manufacturer's installation instructions.
 - .1 Engineer will make available 1 copy of systems supplier's installation instructions.
 - .3 Manufacturer's Field Reports: manufacturer's field reports specified.

1.3 DELIVERY, STORAGE, AND HANDLING

- .1 Packing, shipping, handling and unloading:
 - .1 Deliver, store and handle in accordance with Section 01 61 00 - Common Product Requirements.
 - .2 Deliver, store and handle materials in accordance with manufacturer's written instructions.

- .2 Waste Management and Disposal:
 - .1 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse and recycling in accordance with Section [01 74 21 - Construction/Demolition Waste Management and Disposal.

PART 2 Products

2.1 GENERAL

- .1 Size and shape of bases type and performance of vibration isolation as indicated.

2.2 ELASTOMERIC PADS

- .1 Type EP2 - rubber waffle or ribbed; 9 mm minimum thick; 40 durometer natural rubber; maximum loading 415 kPa.
- .2 Type EP3 - neoprene-steel-neoprene; 9 mm minimum thick neoprene bonded to 1.71 mm steel plate; 50 durometer neoprene, waffle or ribbed; holes sleeved with isolation washers; maximum loading 350 kPa.

2.3 ELASTOMERIC MOUNTS

- .1 Type M1 - colour coded; neoprene in shear; maximum durometer of 60; threaded insert and two bolt-down holes; ribbed top and bottom surfaces.

2.4 ROOF CURB ISOLATION RAILS

- .1 General: complete factory assembled.
- .2 Lower member: continuous rectangular steel tube.
- .3 Upper member: continuous rectangular steel tube to provide continuous support for equipment, complete with all-directional neoprene snubber bushings 6 mm thick to resist wind and seismic forces.
- .4 Springs: steel, adjustable, removable, selected for 25 mm maximum static deflection plus 50% additional travel to solid, cadmium plated, sized and positioned to ensure uniform deflection.
- .5 High frequency isolation: 6 mm minimum thick continuous gasket on top and bottom of complete assembly or pads on top and bottom of each spring. Material: closed cell neoprene.
- .6 Weatherproofing: continuous flexible counterflashing to curb and providing access to springs. Material: neoprene.
- .7 Hardware: cadmium plated or galvanized.

2.5 SEISMIC CONTROL MEASURES

- .1 General:
 - .1 Following systems and/or equipment to remain operational during and after earthquakes:
 - .1 HVAC system for UPS room.
 - .2 Seismic control systems to work in every direction.
 - .3 Fasteners and attachment points to resist same maximum load as seismic restraint.
 - .4 Drilled or power driven anchors and fasteners not permitted.
 - .5 No equipment, equipment supports or mounts to fail before failure of structure.
 - .6 Supports of cast iron or threaded pipe not permitted.
 - .7 Seismic control measures not to interfere with integrity of firestopping.
- .2 Static equipment:
 - .1 Anchor equipment to equipment supports. Anchor equipment supports to structure.
 - .2 Suspended equipment:
 - .1 Use one or more of following methods depending upon site conditions and or as indicated:
 - .1 Install tight to structure.
 - .2 Cross brace in every direction.
 - .3 Brace back to structure.
 - .4 Cable restraint system.
 - .3 Seismic restraints:
 - .1 Cushioning action gentle and steady.
 - .2 Never reach metal-like stiffness.
- .3 Piping systems:
 - .1 Fire protection systems: to NFPA 13.
 - .2 Piping systems: hangers longer than 300 mm; brace at each hanger.
 - .3 Compatible with requirements for anchoring and guiding of piping systems.

PART 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

- .1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.2 INSTALLATION

- .1 Seismic control measures to meet requirements of NBC.

- .2 Install vibration isolation equipment in accordance with manufacturers instructions and adjust mountings to level equipment.
- .3 Ensure piping, ducting and electrical connections to isolated equipment do not reduce system flexibility and that piping, conduit and ducting passage through walls and floors do not transmit vibrations.
- .4 Unless indicated otherwise, support piping connected to isolated equipment with spring mounts or spring hangers with 25 mm minimum static deflection as follows:
 - .1 Up to NPS4: first 3 points of support. NPS5 to NPS8: first 4 points of support. NPS10 and over: first 6 points of support.
 - .2 First point of support: static deflection of twice deflection of isolated equipment, but not more than 50 mm.
- .5 Where isolation is bolted to floor use vibration isolation rubber washers.
- .6 Block and shim level bases so that ductwork and piping connections can be made to rigid system at operating level, before isolator adjustment is made. Ensure that there is no physical contact between isolated equipment and building structure.

3.3 FIELD QUALITY CONTROL

- .1 Manufacturer's Field Services:
 - .1 Arrange with manufacturer's representative to review work of this Section and submit written reports to verify compliance with Contract Documents.
 - .2 Manufacturer's Field Services: consisting of product use recommendations and periodic site visits to review installation, scheduled as follows:
 - .1 After delivery and storage of Products.
 - .2 After preparatory work is complete but before installation commences.
 - .3 Twice during the installation, at 25% and 60% completion stages.
 - .4 Upon completion of installation.
 - .3 Submit manufacturer's reports to Engineer within [3] days of manufacturer representative's review.
 - .4 Make adjustments and corrections in accordance with written report.
- .2 Inspection and Certification:
 - .1 Experienced and competent sound and vibration testing professional engineer to take vibration measurement for HVAC system[s] after start up and TAB of systems to Section 23 05 93 - Testing, Adjusting and Balancing for HVAC.
 - .2 Take vibration measurements for equipment listed below:
 - .1 Roof equipment.
 - .3 Advise Engineer with notice 24 h in advance of commencement of tests.
 - .4 Establish adequacy of equipment isolation and acceptability of noise levels in occupied areas and where appropriate, remedial recommendations (including sound curves).
 - .5 Submit complete report of test results [including sound curves.

3.4 CLEANING

- .1 Proceed in accordance with Section 01 74 11 – Cleaning.
- .2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

PART 1 General

1.1 REFERENCES

- .1 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-1.60, Interior Alkyd Gloss Enamel.
 - .2 CAN/CGSB-24.3, Identification of Piping Systems.

1.2 SUBMITTALS

- .1 Product Data:
 - .1 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.
 - .2 Product data to include paint colour chips, other products specified in this section.
- .2 Samples:
 - .1 Submit samples in accordance with Section 01 33 00 - Submittal Procedures.
 - .2 Samples to include nameplates, labels, tags, lists of proposed legends.

1.3 QUALITY ASSURANCE

- .1 Quality assurance submittals: submit following in accordance with Section 01 33 00 - Submittal Procedures.

1.4 DELIVERY, STORAGE, AND HANDLING

- .1 Packing, shipping, handling and unloading:
 - .1 Deliver, store and handle in accordance with Section 01 61 00 - Common Product Requirements.
 - .2 Deliver, store and handle materials in accordance with manufacturer's written instructions.

PART 2 Products

2.1 MANUFACTURER'S EQUIPMENT NAMEPLATES

- .1 Metal or plastic laminate nameplate mechanically fastened to each piece of equipment by manufacturer.
- .2 Lettering and numbers raised or recessed.
- .3 Information to include, as appropriate:
 - .1 Equipment: manufacturer's name, model, size, serial number, capacity.
 - .2 Motor: voltage, Hz, phase, power factor, duty, frame size.

2.2 SYSTEM NAMEPLATES

- .1 Colours:
 - .1 Hazardous: red letters, white background.
 - .2 Elsewhere: black letters, white background (except where required otherwise by applicable codes).
- .2 Construction:
 - .1 3 mm thick laminated plastic, matte finish, with square corners, letters accurately aligned and machine engraved into core.
- .3 Sizes:
 - .1 Conform to following table:

Size #	Sizes (mm)	No of lines	Height of letters (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 Use maximum of 25 letters/numbers per line.
- .4 Identification for PWGSC Preventive Maintenance Support System (PMSS):
 - .1 Use arrangement of Main identifier, Source identifier, Destination identifier.
 - .2 Equipment in Mechanical Room:
 - .1 Main identifier: size #9.
 - .2 Source and Destination identifiers: size #6.
 - .3 Terminal cabinets, control panels: size #5.
 - .3 Equipment elsewhere: sizes as appropriate.

2.3 IDENTIFICATION OF PIPING SYSTEMS

- .1 Identify contents by background colour marking, pictogram (as necessary), legend; direction of flow by arrows. To CAN/CGSB 24.3 except where specified otherwise.
- .2 Pictograms:
 - .1 Where required: Workplace Hazardous Materials Information System (WHMIS) regulations.

- .3 Legend:
 - .1 Block capitals to sizes and colours listed in CAN/CGSB 24.3.

- .4 Arrows showing direction of flow:
 - .1 Outside diameter of pipe or insulation less than 75 mm: 100 mm long x 50 mm high.
 - .2 Outside diameter of pipe or insulation 75 mm and greater: 150 mm long x 50 mm high.
 - .3 Use double-headed arrows where flow is reversible.

- .5 Extent of background colour marking:
 - .1 To full circumference of pipe or insulation.
 - .2 Length to accommodate pictogram, full length of legend and arrows.

- .6 Materials for background colour marking, legend, arrows:
 - .1 Pipes and tubing 20 mm and smaller: waterproof and heat-resistant pressure sensitive plastic marker tags.
 - .2 Other pipes: pressure sensitive [plastic-coated cloth] [vinyl] with protective overcoating, waterproof contact adhesive undercoating, suitable for ambient of 100% RH and continuous operating temperature of 150 degrees C and intermittent temperature of 200 degrees C.

- .7 Colours and Legends:
 - .1 Where not listed, obtain direction from Engineer.
 - .2 Colours for legends, arrows: to following table:

Background colour	Legend, arrows
Yellow	BLACK
Green	WHITE
Red	WHITE

2.4 CONTROLS COMPONENTS IDENTIFICATION

- .1 Identify all systems, equipment, components, controls, sensors with system nameplates specified in this section.
- .2 Inscriptions to include function and (where appropriate) fail-safe position.

2.5 LANGUAGE

- .1 Identification in English and French.
- .2 Use one nameplate and label for both languages.

PART 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

- .1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.2 TIMING

- .1 Provide identification only after painting specified Section 09 91 23 - Interior Painting has been completed.

3.3 INSTALLATION

- .1 Perform work in accordance with CAN/CGSB-24.3 except as specified otherwise.
- .2 Provide ULC and/or CSA registration plates as required by respective agency.
- .3 Identify systems, equipment to conform to PWGSC PMSS.

3.4 NAMEPLATES

- .1 Locations:
 - .1 In conspicuous location to facilitate easy reading and identification from operating floor.
- .2 Standoffs:
 - .1 Provide for nameplates on hot and/or insulated surfaces.
- .3 Protection:
 - .1 Do not paint, insulate or cover.

3.5 LOCATION OF IDENTIFICATION ON PIPING AND DUCTWORK SYSTEMS

- .1 On long straight runs in open areas in boiler rooms, equipment rooms, galleries, tunnels: at not more than 17 m intervals and more frequently if required to ensure that at least one is visible from any one viewpoint in operating areas and walking aisles.
- .2 Adjacent to each change in direction.
- .3 At least once in each small room through which piping or ductwork passes.
- .4 On both sides of visual obstruction or where run is difficult to follow.
- .5 On both sides of separations such as walls, floors, partitions.

- .6 Where system is installed in pipe chases, ceiling spaces, galleries, confined spaces, at entry and exit points, and at access openings.
- .7 At beginning and end points of each run and at each piece of equipment in run.
- .8 At point immediately upstream of major manually operated or automatically controlled valves, and dampers. Where this is not possible, place identification as close as possible, preferably on upstream side.
- .9 Identification easily and accurately readable from usual operating areas and from access points.
 - .1 Position of identification approximately at right angles to most convenient line of sight, considering operating positions, lighting conditions, risk of physical damage or injury and reduced visibility over time due to dust and dirt.

3.6 VALVES, CONTROLLERS

- .1 Valves and operating controllers, except at plumbing fixtures, radiation, or where in plain sight of equipment they serve: Secure tags with non-ferrous chains or closed "S" hooks.
- .2 Install one copy of flow diagrams, valve schedules mounted in frame behind non-glare glass where directed by Engineer. Provide one copy (reduced in size if required) in each operating and maintenance manual.
- .3 Number valves in each system consecutively.

END OF SECTION

PART 1 General

1.1 SUMMARY

- .1 TAB is used throughout this Section to describe the process, methods and requirements of testing, adjusting and balancing for HVAC.
- .2 TAB means to test, adjust and balance to perform in accordance with requirements of Contract Documents and to do other work as specified in this section.

1.2 QUALIFICATIONS OF TAB PERSONNEL

- .1 Submit names of personnel to perform TAB to Engineer within 30 days of award of contract.
- .2 Provide documentation confirming qualifications, successful experience.
- .3 TAB: performed in accordance with the requirements of standard under which TAB Firm's qualifications are approved:
 - .1 Associated Air Balance Council, (AABC) National Standards for Total System Balance, MN-1.
 - .2 National Environmental Balancing Bureau (NEBB) TABES, Procedural Standards for Testing, Adjusting, Balancing of Environmental Systems.
 - .3 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA), HVAC TAB HVAC Systems - Testing, Adjusting and Balancing.
- .4 Recommendations and suggested practices contained in the TAB Standard: mandatory.
- .5 Use TAB Standard provisions, including checklists, and report forms to satisfy Contract requirements.
- .6 Use TAB Standard for TAB, including qualifications for TAB Firm and Specialist and calibration of TAB instruments.
- .7 Where instrument manufacturer calibration recommendations are more stringent than those listed in TAB Standard, use manufacturer's recommendations.
- .8 TAB Standard quality assurance provisions such as performance guarantees form part of this contract.
 - .1 For systems or system components not covered in TAB Standard, use TAB procedures developed by TAB Specialist.
 - .2 Where new procedures, and requirements, are applicable to Contract requirements have been published or adopted by body responsible for TAB Standard used (AABC, NEBB, or TABB), requirements and recommendations contained in these procedures and requirements are mandatory.

1.3 PURPOSE OF TAB

- .1 Test to verify proper and safe operation, determine actual point of performance, evaluate qualitative and quantitative performance of equipment, systems and controls at design, average and low loads using actual or simulated loads
- .2 Adjust and regulate equipment and systems to meet specified performance requirements and to achieve specified interaction with other related systems under normal and emergency loads and operating conditions.
- .3 Balance systems and equipment to regulate flow rates to match load requirements over full operating ranges.

1.4 CO-ORDINATION

- .1 Schedule time required for TAB (including repairs, re-testing) into project construction and completion schedule to ensure completion before acceptance of project.
- .2 Do TAB of each system independently and subsequently, where interlocked with other systems, in unison with those systems.

1.5 PRE-TAB REVIEW

- .1 Review contract documents before project construction is started and confirm in writing to Engineer adequacy of provisions for TAB and other aspects of design and installation pertinent to success of TAB.
- .2 Review specified standards and report to Engineer in writing proposed procedures which vary from standard.
- .3 During construction, co-ordinate location and installation of TAB devices, equipment, accessories, measurement ports and fittings.

1.6 START-UP

- .1 Follow start-up procedures as recommended by equipment manufacturer unless specified otherwise.
- .2 Follow special start-up procedures specified elsewhere in Division 23.

1.7 OPERATION OF SYSTEMS DURING TAB

- .1 Operate systems for length of time required for TAB and as required by Engineer for verification of TAB reports.

1.8 START OF TAB

- .1 Notify Engineer [7] days prior to start of TAB.
- .2 Start TAB when building is essentially completed, including:
- .3 Installation of ceilings, doors, windows, other construction affecting TAB.
- .4 Application of weatherstripping, sealing, and caulking.
- .5 Pressure, leakage, other tests specified elsewhere Division 23.
- .6 Provisions for TAB installed and operational.
- .7 Start-up, verification for proper, normal and safe operation of mechanical and associated electrical and control systems affecting TAB including but not limited to:
 - .1 Proper thermal overload protection in place for electrical equipment.
 - .2 Air systems:
 - .1 Filters in place, clean.
 - .2 Coil fins combed, clean.

1.9 INSTRUMENTS

- .1 Prior to TAB, submit to Engineer list of instruments used together with serial numbers.
- .2 Calibrate in accordance with requirements of most stringent of referenced standard for either applicable system or HVAC system.
- .3 Calibrate within [3] months of TAB. Provide certificate of calibration to Engineer.

1.10 SUBMITTALS

- .1 Submit, prior to commencement of TAB:
- .2 Proposed methodology and procedures for performing TAB if different from referenced standard.

1.11 PRELIMINARY TAB REPORT

- .1 Submit for checking and approval of Engineer, prior to submission of formal TAB report, sample of rough TAB sheets. Include:
 - .1 Details of instruments used.
 - .2 Details of TAB procedures employed.
 - .3 Calculations procedures.
 - .4 Summaries.

1.12 TAB REPORT

- .1 Format in accordance with referenced standard.
- .2 TAB report to show results in SI units and to include:
 - .1 Project record drawings.
 - .2 System schematics.
- .3 Submit 1 copy of TAB Report to Engineer for verification and approval, in French language in D-ring binders, complete with index tabs as well as a “pdf” version on compact disc.

1.13 VERIFICATION

- .1 Reported results subject to verification by Engineer.
- .2 Provide personnel and instrumentation to verify up to 30% of reported results.
- .3 Number and location of verified results as directed by Engineer.
- .4 Pay costs to repeat TAB as required to satisfaction of Engineer] [Consultant.

1.14 SETTINGS

- .1 After TAB is completed to satisfaction of Engineer, replace drive guards, close access doors, lock devices in set positions, ensure sensors are at required settings.
- .2 Permanently mark settings to allow restoration at any time during life of facility. Do not eradicate or cover markings.

1.15 COMPLETION OF TAB

- .1 TAB considered complete when final TAB Report received and approved by Engineer.

1.16 AIR SYSTEMS

- .1 Standard: TAB to most stringent of this section or TAB standards of AABC, NEBB SMACNA or ASHRAE
- .2 Do TAB of systems, equipment, components, controls specified Division 23.
- .3 Qualifications: personnel performing TAB current member in good standing of AABC qualified to standards of AABC.
- .4 Quality assurance: perform TAB under direction of supervisor qualified to standards of AABC.

- .5 Measurements: to include as appropriate for systems, equipment, components, controls: air velocity, static pressure, flow rate, pressure drop (or loss), temperatures (dry bulb, wet bulb, dewpoint), duct cross-sectional area, RPM, electrical power, voltage, noise, vibration.
- .6 Locations of equipment measurements: to include as appropriate:
 - .1 Inlet and outlet of dampers, filter, coil, humidifier, fan, other equipment causing changes in conditions.
 - .2 At controllers, controlled device.
- .7 Locations of systems measurements to include as appropriate: main ducts, main branch, sub-branch, run-out (or grille, register or diffuser).

1.17 OTHER TAB REQUIREMENTS

- .1 General requirements applicable to work specified this paragraph:
 - .1 Qualifications of TAB personnel: as for air systems specified this section.
 - .2 Quality assurance: as for air systems specified this section.

1.18 POST-OCCUPANCY TAB

- .1 Participate in systems checks twice during Warranty Period - #1 approximately [3] months after acceptance and #2 within [1] month of termination of Warranty Period.

PART 2 Products

2.1 NOT USED

- .1 Not used.

PART 3 Execution

3.1 NOT USED

- .1 Not used.

END OF SECTION

PART 1 General

1.1 REFERENCES

- .1 American Society of Mechanical Engineers (ASME)
 - .1 ASME B16.22, Wrought Copper and Copper Alloy Solder - Joint Pressure Fittings.
 - .2 ASME B16.24, Cast Copper Pipe Flanges and Flanged Fittings: Class 150, 300, 400, 600, 900, 1500 and 2500.
 - .3 ASME B16.26, Cast Copper Alloy Fittings for Flared Copper Tubes.
 - .4 ASME B31.5, Refrigeration Piping and Heat Transfer Components.

- .2 American Society for Testing and Materials International (ASTM)
 - .1 ASTM A 307, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
 - .2 ASTM B 280, Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service.

- .3 Canadian Standards Association (CSA International)
 - .1 CSA B52, Mechanical Refrigeration Code.

- .4 Environment Canada (EC)
 - .1 EPS 1/RA/1, Environmental Code of Practice for the Elimination of Fluorocarbon Emissions from Refrigeration and Air Conditioning Systems.

- .5 Health Canada / Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).

1.2 SUBMITTALS

- .1 Submittals in accordance with Section 01 33 00 - Submittal Procedures.

1.3 QUALITY ASSURANCE

- .1 Health and Safety:
 - .1 Do construction occupational health and safety in accordance with Section 01 35 13 – Sécurité SCC.

PART 2 Products

2.1 TUBING

- .1 Processed for refrigeration installations, deoxidized, dehydrated and sealed.
 - .1 Annealed copper: to ASTM B 280, with minimum wall thickness as per CSA B52 and ASME B31.5.

2.2 FITTINGS

- .1 Service: design pressure 2070 kPa and temperature 121 degrees C.
- .2 Brazed:
 - .1 Fittings: wrought copper to ASME B16.22.
 - .2 Joints: silver 15% Ag-80% Cu-5%P.
- .3 Flanged:
 - .1 Bronze or brass, to ASME B16.24, Class 150 and Class 300.
 - .2 Gaskets: suitable for service.
 - .3 Bolts, nuts and washers: to ASTM A 307, heavy series.
- .4 Flared:
 - .1 Bronze or brass, for refrigeration, to ASME B16.26.

2.3 PIPE SLEEVES

- .1 Hard copper or steel, sized to provide 6 mm clearance around between sleeve and uninsulated pipe or between sleeve and insulation.

2.4 VALVES

- .1 22 mm and under: Class 500, 3.5 Mpa, globe or angle non-directional type, diaphragm, packless type, with forged brass body and bonnet, moisture proof seal for below freezing applications, brazed connections.
- .2 Over 22 mm: Class 375, 2.5 Mpa, globe or angle type, diaphragm, packless type, back-seating, cap seal, with cast bronze body and bonnet, moisture proof seal for below freezing applications, brazed connections.

PART 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

- .1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.2 GENERAL

- .1 Install in accordance with CSA B52, EPS1/RA/1 and ASME B31.5 Section 23 05 01 - Installation of Pipework.

3.3 BRAZING PROCEDURES

- .1 Bleed inert gas into pipe during brazing.
- .2 Remove valve internal parts, solenoid valve coils, sight glass.
- .3 Do not apply heat near expansion valve and bulb.

3.4 PIPING INSTALLATION

- .1 General:
 - .1 Hard drawn copper tubing: do not bend.
- .2 Hot gas lines:
 - .1 Pitch at least 1:240 down in direction of flow to prevent oil return to compressor during operation.
 - .2 Provide trap at base of risers greater than 2400 mm high and at each 7600 mm thereafter.
 - .3 Provide inverted deep trap at top of risers.
 - .4 Provide double risers for compressors having capacity modulation.
 - .1 Large riser: install traps as specified.
 - .2 Small riser: size for 5.1 m/s at minimum load. Connect upstream of traps on large riser.

3.5 PRESSURE AND LEAK TESTING

- .1 Close valves on factory charged equipment and other equipment not designed for test pressures.
- .2 Leak test to CSA B52 before evacuation to 2MPa and 1MPa on high and low sides respectively.
- .3 Test Procedure: build pressure up to 35 kPa with refrigerant gas on high and low sides. Supplement with nitrogen to required test pressure. Test for leaks with electronic or halide detector. Repair leaks and repeat tests.

3.6 FIELD QUALITY CONTROL

- .1 Site Tests/Inspection:
 - .1 Close service valves on factory charged equipment.
- .2 Ambient temperatures to be at least 13 degrees C for at least 12 hours before and during dehydration.
- .3 Use copper lines of largest practical size to reduce evacuation time.

- .4 Use two-stage vacuum pump with gas ballast on 2nd stage capable of pulling 5Pa absolute and filled with dehydrated oil.
- .5 Measure system pressure with vacuum gauge. Take readings with valve between vacuum pump and system closed.
- .6 Triple evacuate system components containing gases other than correct refrigerant or having lost holding charge as follows:
 - .1 Twice to 14 Pa absolute and hold for 4 h.
 - .2 Break vacuum with refrigerant to 14 kPa.
 - .3 Final to 5 Pa absolute and hold for at least 12 h.
 - .4 Isolate pump from system, record vacuum and time readings until stabilization of vacuum.
 - .5 Submit test results to Engineer.
- .7 Charging:
 - .1 Charge system through filter-drier and charging valve on high side. Low side charging not permitted.
 - .2 With compressors off, charge only amount necessary for proper operation of system. If system pressures equalize before system is fully charged, close charging valve and start up. With unit operating, add remainder of charge to system.
 - .3 Re-purge charging line if refrigerant container is changed during charging process.
- .8 Checks:
 - .1 Make checks and measurements as per manufacturer's operation and maintenance instructions.
 - .2 Record and report measurements to Engineer.

3.7 CLEANING

- .1 Perform cleaning operations in accordance with manufacturer's recommendations.
- .2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

PART 1 General

1.1 REFERENCES

- .1 Canadian Standards Association (CSA International)
 - .1 CSA C22.1, Canadian Electrical Code, Part 1, Safety Standard for Electrical Installations.
- .2 Institute of Electrical and Electronics (IEEE)/National Electrical Safety Code Product Line (NESC)
 - .1 IEEE SP1122, The Authoritative Dictionary of IEEE Standards Terms, 7th Edition.

1.2 DEFINITIONS

- .1 Electrical and electronic terms: unless otherwise specified or indicated, terms used in these specifications, and on drawings, are those defined by IEEE SP1122.

1.3 DESIGN REQUIREMENTS

- .1 Operating voltages: to CAN3-C235.
- .2 Motors, electric heating, control and distribution devices and equipment to operate satisfactorily at 60 Hz within normal operating limits established by above standard.
 - .1 Equipment to operate in extreme operating conditions established in above standard without damage to equipment.
- .3 Language operating requirements: provide identification nameplates and labels for control items in English and French.
- .4 Use one nameplate or label for both languages.

1.4 SUBMITTALS

- .1 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Shop drawings:
 - .1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Quebec, Canada.
 - .2 Submit wiring diagrams and installation details of equipment indicating proposed location, layout and arrangement, control panels, accessories, piping, ductwork, and other items that must be shown to ensure co-ordinated installation.
 - .3 Identify on wiring diagrams circuit terminals and indicate internal wiring for each item of equipment and interconnection between each item of equipment.

- .4 Indicate of drawings clearances for operation, maintenance, and replacement of operating equipment devices.
- .5 Submit one copy (PDF) of drawings and product data to authority having jurisdiction.
- .3 Quality Control:
 - .1 Provide CSA certified equipment and material.
 - .2 Submit test results of installed electrical systems and instrumentation.

1.5 QUALITY ASSURANCE

- .1 Qualifications: electrical Work to be carried out by qualified, licensed electricians who hold valid Master Electrical Contractor license or apprentices in accordance with authorities having jurisdiction as per the conditions of Provincial Act respecting manpower vocational training and qualification.
 - .1 Employees registered in provincial apprentices program: permitted, under direct supervision of qualified licensed electrician, to perform specific tasks.
 - .2 Permitted activities: determined based on training level attained and demonstration of ability to perform specific duties.
- .2 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 35 13 – PWGSC – Safety.

1.6 DELIVERY, STORAGE AND HANDLING

- .1 Material Delivery Schedule: provide Departmental Representative and Engineer with schedule within 2 weeks after award of Contract.
- .2 Construction/Demolition Waste Management and Disposal: separate waste materials for recycling.

1.7 SYSTEM STARTUP

- .1 Instruct operating personnel in operation, care and maintenance of systems, system equipment and components.
- .2 Arrange and pay for services of manufacturer's factory service engineer to supervise start-up of installation, check, adjust, balance and calibrate components and instruct operating personnel.
- .3 Provide these services for such period, and for as many visits as necessary to put equipment in operation, and ensure that operating personnel are conversant will aspects of its care and operation.

1.8 OPERATING INSTRUCTIONS

- .1 Provide for each system and principal item of equipment as specified in technical sections for use by operation and maintenance personnel.
- .2 Operating instructions to include following:
 - .1 Wiring diagrams, control diagrams, and control sequence for each principal system and item of equipment.
 - .2 Start up, proper adjustment, operating, lubrication, and shutdown procedures.
 - .3 Safety precautions.
 - .4 Procedures to be followed in event of equipment failure.
 - .5 Other items of instruction as recommended by manufacturer of each system or item of equipment.
- .3 Print or engrave operating instructions and frame under glass or in approved laminated plastic.
- .4 Post instructions where directed.
- .5 For operating instructions exposed to weather, provide weather-resistant materials or weatherproof enclosures.
- .6 Ensure operating instructions will not fade when exposed to sunlight and are secured to prevent easy removal or peeling.

PART 2 - Products

2.1 MATERIALS AND EQUIPMENT

- .1 Material and equipment to be CSA certified.

2.2 WIRING TERMINATIONS

- .1 Ensure lugs, terminals, screws used for termination of wiring are suitable for either copper or aluminum conductors.

2.3 EQUIPMENT IDENTIFICATION

- .1 Identify electrical equipment with nameplates as follows:
 - .1 Nameplates: plastic lamicaid 3 mm melamine black face, white core, lettering accurately aligned and engraved into core mechanically attached with self tapping screws.

- .2 Sizes as follows:

NAMEPLATE SIZES

Size 1	10 x 50 mm	1 line	3 mm high letters
Size 2	12 x 70 mm	1 line	5 mm high letters
Size 3	12 x 70 mm	2 lines	3 mm high letters
Size 4	20 x 90 mm	1 line	8 mm high letters
Size 5	20 x 90 mm	2 lines	5 mm high letters
Size 6	25 x 100 mm	1 line	12 mm high letters
Size 7	25 x 100 mm	2 lines	6 mm high letters

- .2 Wording on nameplates to be approved by Departmental Representative and Engineer prior to manufacture.
- .3 Allow for minimum of twenty-five (25) letters per nameplate.
- .4 Identify equipment with Size 3 labels engraved "ASSET INVENTORY NO." as directed by Departmental Representative.
- .5 Disconnects, starters and contactors: indicate equipment being controlled and voltage.
- .6 Terminal cabinets and pull boxes: indicate system and voltage.
- .7 Transformers: indicate capacity, primary and secondary voltages.

2.4 WIRING IDENTIFICATION

- .1 Identify wiring with permanent indelible identifying markings with numbered plastic tapes on both ends of phase conductors of feeders and branch circuit wiring.
- .2 Maintain phase sequence and colour coding throughout.
- .3 Colour coding: to CSA C22.1.
- .4 Use colour coded wires in communication cables, matched throughout system.

2.5 CONDUIT AND CABLE IDENTIFICATION

- .1 Colour code conduits, boxes and metallic sheathed cables.
- .2 Code with plastic tape or paint at points where conduit or cable enters wall, ceiling, or floor, and at 15 m intervals.
- .3 Colours: 25 mm wide prime colour and 20 mm wide auxiliary colour.

	Prime	Auxiliary
Up to 250 V	Yellow	
Up to 600V	Yellow	Green
Up to 5 kV	Yellow	Blue
Up to 15 kV	Yellow	Red
Telephone	Green	
Other communication systems	Green	Blue
Fire alarm	Red	
Emergency voice	Red	Blue
Other security systems	Red	Yellow

2.6 FINISHES

- .1 Shop finish metal enclosure surfaces by application of rust resistant primer inside and outside, and at least two coats of finish enamel.
 - .1 Paint indoor switchgear and distribution enclosures light gray to EEMAC 2Y-1.

PART 3 - Execution

3.1 INSTALLATION

- .1 Do complete installation in accordance with CSA C22.1 except where specified otherwise.
- .2 Do overhead and underground systems in accordance with CSA C22.3 No.1 except where specified otherwise.

3.2 NAMEPLATES AND LABELS

- .1 Ensure manufacturer's nameplates, CSA labels and identification nameplates are visible and legible after equipment is installed.

3.3 CO-ORDINATION OF PROTECTIVE DEVICES

- .1 Ensure circuit protective devices such as overcurrent trips, relays and fuses are installed to required values and settings.

3.4 FIELD QUALITY CONTROL

- .1 Conduct tests on the following equipment:
 - .1 Uninterruptible power supply (UPS).

END OF SECTION

PART 1- General

1.1 SECTION INCLUDES

- .1 Materials and installation for wire and box connectors.

1.2 REFERENCES

- .1 Canadian Standards Association (CSA International)
 - .1 CAN/CSA-C22.2 No.18, Outlet Boxes, Conduit Boxes, Fittings and Associated Hardware.
 - .2 CSA C22.2 No.65, Wire Connectors.
- .2 Electrical and Electronic Manufacturers' Association of Canada (EEMAC)
 - .1 EEMAC 1Y-2, 1961 Bushing Stud Connectors and Aluminum Adapters (1200 Ampere Maximum Rating).
- .3 National Electrical Manufacturers Association (NEMA)

1.3 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials.
- .2 Remove from site and dispose of all packaging materials at appropriate recycling facilities.

PART 2 - Products

2.1 MATERIALS

- .1 Pressure type wire connectors to: CSA C22.2 No.65, with current carrying parts of copper sized to fit copper conductors as required.
- .2 Bushing stud connectors: to NEMA to consist of:
 - .1 Connector body and stud clamp for copper aluminum conductors.
 - .2 Clamp for copper conductors.
 - .3 Stud clamp bolts.
 - .4 Bolts for copper conductors.
 - .5 Sized as indicated.

PART 3 - Execution

3.1 INSTALLATION

- .1 Remove insulation carefully from ends of conductors and:
 - .1 Install mechanical pressure type connectors and tighten screws with appropriate compression tool recommended by manufacturer. Installation shall meet secureness tests in accordance with CSA C22.2 No.65.
 - .2 Install fixture type connectors and tighten. Replace insulating cap.

END OF SECTION

PART 1- General

1.1 RELATED SECTION

- .1 Section 26 05 20 - Wire and Box Connectors - 0 - 1000 V.

1.2 REFERENCES

- .1 CSA C22.2 No .0.3, Test Methods for Electrical Wires and Cables.
- .2 CAN/CSA-C22.2 No. 131, Type TECK 90 Cable.

1.3 PRODUCT DATA

- .1 Submit product data in accordance with Section 01 33 00 - Submittal Procedures.

1.4 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials.
- .2 Collect and separate plastic, paper packaging and corrugated cardboard in accordance with Waste Management Plan.
- .3 Fold up metal banding, flatten and place in designated area for recycling.

PART 2- Products

2.1 BUILDING WIRES

- .1 Conductors: stranded for 10 AWG and larger. Minimum size: 12 AWG.
- .2 Copper conductors: size as indicated, with 600 V insulation of chemically cross-linked thermosetting polyethylene material rated RW90.

2.2 TECK CABLE

- .1 Cable: to CAN/CSA-C22.2 No. 131.
- .2 Conductors:
 - .1 Grounding conductor: copper.
 - .2 Circuit conductors: copper, size as indicated.
- .3 Armour: aluminum.
- .4 Overall covering: thermoplastic material.

- .5 Connectors:
 - .1 Approved for TECK cable.

2.3 ARMOURED CABLES

- .1 Conductors: insulated, copper, size as indicated.
- .2 Type: AC90.
- .3 Armour: interlocking type fabricated from aluminum strip.

PART 3- Execution

3.1 INSTALLATION OF TECK CABLE 0 -1000 V

- .1 Install cables.
- .2 Group cables wherever possible on channels.
- .3 Terminate cables in accordance with Section 26 05 20 - Wire and Box Connectors - 0 - 1000 V.

3.2 INSTALLATION OF ARMOURED CABLES

- .1 Group cables wherever possible.
- .2 1000 mm maximum length.

END OF SECTION

PART 1- General

1.1 SECTION INCLUDES

- .1 Materials and installation for connectors and terminations.

1.2 RELATED SECTIONS

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 26 05 32 – Outlet boxes, conduit boxes and fittings.

1.3 REFERENCES

- .1 Canadian Standards Association (CSA International)
 - .1 CSA C22.2 No.41, Grounding and Bonding Equipment.

1.4 PRODUCT DATA

- .1 Submit product data in accordance with Section 01 33 00 - Submittal Procedures.

1.5 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials.

PART 2- Products

2.1 CONNECTORS AND TERMINATIONS

- .1 Copper compression connectors to CSA C22.2 as required sized for conductors.
- .2 Contact aid for aluminum cables where applicable.

PART 3- Execution

3.1 INSTALLATION

- .1 Install stress cones, terminations, and splices in accordance with manufacturer's instructions.
- .2 Bond and ground as required to CSA C22.2 No.41.

END OF SECTION

PART 1- General

1.1 REFERENCES

- .1 CSA C22.1, Canadian Electrical Code, Part 1.

1.2 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials.

PART 2- Products

2.1 OUTLET AND CONDUIT BOXES – GENERAL

- .1 Size boxes in accordance with CSA C22.1.
- .2 102 mm square or larger outlet boxes as required for special devices.
- .3 Gang boxes where wiring devices are grouped.
- .4 Blank cover plates for boxes without wiring devices.
- .5 347 V outlet boxes for 347 V switching devices.
- .6 Combination boxes with barriers where outlets for more than one system are grouped.

2.2 SHEET STEEL OUTLET BOXES

- .1 Electro-galvanized steel utility boxes for outlets connected to surface-mounted EMT conduit, minimum size 102 x 54 x 48 mm.

2.3 CONDUIT BOXES

- .1 Cast FS boxes with factory-threaded hubs and mounting feet for surface wiring of switches and receptacle.

2.4 FITTINGS - GENERAL

- .1 Bushing and connectors with nylon insulated throats.
- .2 Knock-out fillers to prevent entry of debris.
- .3 Conduit outlet bodies for conduit up to 32 mm and pull boxes for larger conduits.
- .4 Double locknuts and insulated bushings on sheet metal boxes.

PART 3- Execution

3.1 INSTALLATION

- .1 Support boxes independently of connecting conduits.
- .2 Fill boxes with paper, sponges or foam or similar approved material to prevent entry of debris during construction. Remove upon completion of work.
- .3 For flush installations mount outlets flush with finished wall using plaster rings to permit wall finish to come within 6 mm of opening.
- .4 Provide correct size of openings in boxes for conduit, mineral insulated and armoured cable connections. Reducing washers are not allowed.

END OF SECTION

PART 1- General

1.1 REFERENCES

- .1 Canadian Standards Association (CSA International)
 - .1 CAN/CSA C22.2 No. 18, Outlet Boxes, Conduit Boxes, Fittings and Associated Hardware, A National Standard of Canada.
 - .2 CSA C22.2 No. 45, Rigid Metal Conduit.
 - .3 CSA C22.2 No. 56, Flexible Metal Conduit and Liquid-Tight Flexible Metal Conduit.
 - .4 CSA C22.2 No. 83, Electrical Metallic Tubing.
 - .5 CSA C22.2 No. 211.2, Rigid PVC (Unplasticized) Conduit.

1.2 SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product data: submit manufacturer's printed product literature, specifications and datasheets.
 - .1 Submit cable manufacturing data.

1.3 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate waste materials for recycling.

PART 2- Products

2.1 CABLES AND REELS

- .1 Provide cables on reels or coils.
 - .1 Mark or tag each cable and outside of each reel or coil, to indicate cable length, voltage rating, conductor size, and manufacturer's lot number and reel number.
- .2 Each coil or reel of cable to contain only one continuous cable without splices.
- .3 Identify cables for exclusively dc applications.

2.2 CONDUITS

- .1 Electrical metallic tubing (EMT): to CSA C22.2 No. 83, with couplings.
- .2 Rigid pvc conduit: to CSA C22.2 No. 211.2.
- .3 Flexible metal conduit: to CSA C22.2 No. 56, aluminum liquid-tight flexible metal.

2.3 CONDUIT FASTENINGS

- .1 One hole steel straps to secure surface conduits 50 mm and smaller.
 - .1 Two hole steel straps for conduits larger than 50 mm.
- .2 Beam clamps to secure conduits to exposed steel work.
- .3 Threaded rods, 6 mm diameter, to support suspended channels.

2.4 CONDUIT FITTINGS

- .1 Fittings: to CAN/CSA C22.2 No. 18.

2.5 FISH CORD

- .1 Polypropylene.

PART 3- Execution

3.1 MANUFACTURER'S INSTRUCTIONS

- .1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 INSTALLATION

- .1 Install conduits to conserve headroom in exposed locations and cause minimum interference in spaces through which they pass.
- .2 Conceal conduits except in mechanical and electrical service rooms.
- .3 Use electrical metallic tubing (EMT).
- .4 Use rigid pvc conduit in corrosive areas.
- .5 Use flexible metal conduit for connection to motors in dry areas.
- .6 Minimum conduit size for lighting and power circuits: NPS 3/4.
- .7 Mechanically bend steel conduit over 19 mm diameter.
- .8 Install fish cord in empty conduits.
- .9 Dry conduits out before installing wire.

3.3 SURFACE CONDUITS

- .1 Run parallel or perpendicular to building lines.
- .2 Locate conduits behind infrared or gas fired heaters with 1.5 m clearance.
- .3 Run conduits in flanged portion of structural steel.
- .4 Group conduits wherever possible on surface channels.
- .5 Do not pass conduits through structural members except as indicated.
- .6 Do not locate conduits less than 75 mm parallel to steam or hot water lines with minimum of 25 mm at crossovers.

3.4 CLEANING

- .1 Proceed to cleaning every day.
- .2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

PART 1- General

1.1 RELATED SECTION

- .1 Section 26 05 01 - Common Work Results - Electrical.

1.2 REFERENCES

- .1 Canadian Standards Association (CSA)
 - .1 CSA C22.2 No.248.12, Low Voltage Fuses Part 12: Class R (Bi-National Standard with, UL 248-12 (1st Edition).

1.3 SHOP DRAWINGS AND PRODUCT DATA

- .1 Submit shop drawings and product data in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit fuse performance data characteristics for each fuse type and size. Performance data to include: average melting time-current characteristics.

1.4 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials.

1.5 DELIVERY AND STORAGE

- .1 Ship fuses in original containers.
- .2 Do not ship fuses installed in switchboard.
- .3 Store fuses in original containers in storage cabinet.

PART 2- Products

2.1 FUSES - GENERAL

- .1 Fuses: as shown on drawings.

PART 3- Execution

3.1 INSTALLATION

- .1 Install fuses in mounting devices immediately before energizing circuit.

- .2 Ensure correct fuses fitted to physically matched mounting devices.
- .3 Ensure correct fuses fitted to assigned electrical circuit.

END OF SECTION

PART 1 General

1.1 SECTION INCLUDES

- .1 Materials and installation for load break switches and enclosures.

1.2 RELATED SECTIONS

- .1 Section 26 05 01 - Common Work Results - Electrical.
- .2 Section 26 28 13.01 - Fuses - Low Voltage.

1.3 REFERENCES

- .1 Canadian Standards Association (CSA International)
 - .1 CAN/CSA-C22.2 No. 4, Enclosed Switches.
 - .2 CAN/CSA-C22.2 No. 31, Switchgear Assemblies.
- .2 Underwriters' Laboratories (UL)
 - .1 UL 977, Fused Power-Circuit Devices.

1.4 PRODUCT DATA

- .1 Submit product data in accordance with Section 01 33 00 - Submittal Procedures.

1.5 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials.

PART 2- Products

2.1 SWITCHES

- .1 With or without fuses as per indication on drawings.
- .2 Load Break Switches: to CAN/CSA-C22.2 No. 4.
- .3 Switches of continuous ampere rating as indicated, load-break bolted contact type with accommodation for fuses to Section 26 28 13.01 - Fuses - Low Voltage.

PART 3- Execution

3.1 INSTALLATION

- .1 Install equipment in accordance with manufacturer's instructions.

END OF SECTION

PART 1- General

1.1 SECTION INCLUDES

- .1 Both single and three phase Uninterruptible Power Systems (UPS).

1.2 RELATED SECTIONS

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 78 00 - Closeout Submittals.
- .3 Section 26 05 01 - Common Work Results - Electrical.
- .4 Section 26 33 16 - Battery Racks.

1.3 REFERENCES

- .1 American National Standards Institute (ANSI)
 - .1 ANSI S1.13, Measurement of Sound Pressure Levels in Air.
 - .2 ANSI S1. 4, Specification for Sound Level Meters.
- .2 Canadian Standards Association (CSA International)
 - .1 CSA C813.1, Performance Test Method for Uninterruptible Power Supplies.

1.4 SYSTEM DESCRIPTION

- .1 System to consist of:
 - .1 Rectifier cubicle;
 - .2 Invertor cubicle;
 - .3 Battery cubicle;
 - .4 Bypass switch cubicle;
 - .5 Controls and meters.
- .2 System to use normal power supply mains and battery to provide continuous, regulated ac power to isolated load.
- .3 Equipment to operate continuously and unattended.
- .4 Ensure that Uninterruptible Power Systems (UPS) is compatible with equipment that it feeds.

1.5 SYSTEM PERFORMANCE

- .1 Normal operation:
 - .1 System operates on mains power when mains voltage is within +/-10% of nominal value and mains frequency is between 59.5 and 60.5 Hz.
- .2 Battery operation:
 - .1 System transfers automatically to battery operation.
 - .1 When manually selected at control panel;
 - .2 When mains power fails;
 - .3 When mains voltage varies more than 10% from nominal or mains frequency varies more than 0.5 Hz from 60 Hz;
 - .4 When mains power is restored and mains voltage is within 10% of nominal and mains frequency is within 0.3 Hz of 60 Hz, system automatically resynchronizes with mains;
 - .5 Slew rate of frequency during transition period of system output automatically synchronizing with mains and return to its internal frequency to be set between 0.5 to 1.0 Hz per second.
- .3 Bypass operation:
 - .1 For maintenance purposes, system can be bypassed automatically by manual selection at control panel to connect load directly to ac mains. Transfer without load interruption and leaving inverter energized.
 - .2 Load transfer from mains back to system automatically by manual selection at control panel when maintenance completed.
 - .3 Automatic transfer of load to mains in not more than 1/4 cycle including sensing with inverter left energized but disconnected from load in case of:
 - .1 Inverter overloaded;
 - .2 Short circuit in load;
 - .4 Automatic retransfer of load to system without load interruption when above conditions disappear.
 - .5 Automatic transfer of load to mains in not more than 1/4 cycle including sensing and shutdown of inverter in case of inverter internal malfunctions.
 - .6 Automatic transfer of load to mains without load interruption and inverter shutdown in case of:
 - .1 Over temperature harmful to system.
 - .2 Loss of forced ventilation.
 - .3 Low voltage of dc supply to inverter.
 - .7 Bypass capable of closing onto and withstanding momentary fault current of 800% of rating for 0.01 s.

1.6 SYSTEM PROTECTION

- .1 Circuit breakers in system used to isolate it from load and from mains for safe working on equipment, and for manual blocking of bypass automatic control to prevent inadvertent operation of bypass during Work on inverter.
- .2 Automatic circuit breakers and protection included in:
 - .1 Ac input to rectifier;
 - .2 Battery input;
 - .3 Bypass circuit input;
 - .4 Inverter output.
- .3 Surge suppressors:
 - .1 To protect system against supply voltage switching transients;
 - .2 To protect internal circuits where necessary against voltage transients.
- .4 Current limiting devices, with panel front indication of device operation, to protect inverter SCR's.
- .5 Suitable devices, with panel front indication of device operation, to protect rectifier diodes.
- .6 Failure of circuit or component not to cause equipment to operate in dangerous or uncontrolled mode.

1.7 SHOP DRAWINGS

- .1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Include:
 - .1 Outline sketch showing arrangement of cubicles, meters, controls, recommended aisle spaces, battery rack, battery arrangement and dimensions.
 - .2 Shipping weight
 - .3 Schematic diagram showing interconnection of rectifier, inverter, battery, bypass switch, meters, controls and indicating lamps.
 - .4 Description of system operation, referenced to schematic diagram, for:
 - .1 Manual control during initial start-up and load transfer to bypass and back to inverter output;
 - .2 Inverter;
 - .3 Bypass;
 - .5 System performance and reliability:
 - .1 Consider any deviation from the required output power waveform as failure in UPS and include estimate, with supporting calculations, of the Mean Time Between Failures (MTBF) expressed in hours.
 - .2 Provide estimate with supporting data for Mean Time to Repair factor (MTTR).

- .6 Full load kVA output at power factor.
- .7 Efficiency of system at 25%, 50%, 75% and 100% rated load.
- .8 Type of ventilation: natural or forced.
- .9 Battery:
 - .1 Number of cells;
 - .2 Maximum and minimum voltages;
 - .3 Type of battery;
 - .4 Type of plates;
 - .5 Catalogue data with cell trade name and type;
 - .6 Size and weight of each cell;
 - .7 Cell charge and discharge curves of voltage, current, time and capacity;
 - .8 Derating factor for specified temperature range;
 - .9 Nominal ampere hour capacity of each cell;
 - .10 Maximum short circuit current;
 - .11 Maximum charging current expected for fully discharged condition;
 - .12 Recommended low voltage limit for fully discharged condition;
 - .13 Expected life.
- .10 Inverter:
 - .1 Type and catalogue number;
 - .2 Dc current at minimum battery voltage to produce full load ac output.
- .11 Rectifier:
 - .1 Type and capacity, with catalogue number;
 - .2 Battery charging sequence;
 - .3 Current-time data for Silicon Controlled Rectifier (SCR) protective devices;
 - .4 Guaranteed noise level;
 - .5 Estimated life;
 - .6 Metering;
 - .7 Alarms.
- .12 Manufacturer's field experience with UPS of similar ratings including engineering expertise, manufacturing facilities and listing of UPS units manufactured and installed during last 5 years including model, customer, location and installation dates.
- .13 Evaluation of Canadian content.
- .14 Heat losses at no load, 25%, 50%, 75% and 100% of rated output, in kW.
- .15 Cooling air required in m³ /s.
- .16 List of recommended spare parts, tools and instruments with catalogue numbers and current prices.
- .17 Typical operation and maintenance manual.
- .18 Description of factory test facilities.
- .19 Manufacturer's maintenance capabilities including:
 - .1 Willingness to undertake maintenance contract;
 - .2 Number of trained personnel available;
 - .3 Location of trained personnel and repair facilities.

1.8 CLOSEOUT SUBMITTALS

- .1 Provide data for incorporation into operation and maintenance manual specified in Section 01 78 00 - Closeout Submittals.
- .2 Submit interim, draft final, and final Operation and Maintenance (OM) Manual. Final manual approved by Engineer. Submit interim copies to Engineer prior to notification of factory test date.
- .3 Operation and Maintenance Manual to include:
 - .1 Operation and maintenance instructions concerning design elements, construction features, component functions and maintenance requirements to permit effective operations maintenance and repair.
 - .2 Technical data:
 - .1 Approved shop drawings;
 - .2 Characteristic curves for automatic circuit breakers and protective devices;
 - .3 Project data;
 - .4 Technical description of components;
 - .5 Part lists with names and addresses of suppliers.

1.9 DELIVERY, STORAGE AND HANDLING

- .1 Crating:
 - .1 Adequately enclosed and protected from weather and shipping damage by use of minimum 12 mm plywood with vapour barrier inside.
 - .2 For tractor train or sea shipment use double layer of vapour barrier and 19 mm plywood covering.
 - .3 Subassemblies may be packed separately.
 - .4 Label crates:
 - .1 Shipping address.
 - .2 Weight and dimensions
 - .3 Serial number of unit and brief description of contents
 - .4 Stenciled with durable paint on at least two sides of each crate.
 - .5 List of contents:
 - .1 In weatherproof envelope stapled on outside of each crate;
 - .2 Copy placed inside each crate.

1.10 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials.

1.11 SYSTEM START-UP

- .1 Advise personnel on:
 - .1 Expected failure rate of equipment;
 - .2 Type of expected failures;
 - .3 Estimated time between major overhauls based on 20 year equipment life;
 - .4 Estimated cost of major overhaul based on current costs and excluding travelling expenses;
 - .5 Type and cost of test equipment needed for fault isolating and performing preventive maintenance.

PART 2- Products

2.1 UNINTERRUPTIBLE POWER SUPPLY

- .1 Input power:
 - .1 Three phase, 208-240V, wire, grounded neutral, 60 Hz.
 - .2 Normal supply from ac mains.
 - .3 Emergency supply from standby automatic diesel-electric unit.
- .2 Output power:
 - .1 Single or three phase, 208-240 V as indicated on drawings, wire, grounded neutral, 60 Hz.
 - .2 Full load output at 0.8 power factor lagging.
 - .3 Overload capability: 125% of rated full load current at 0.8 power factor and rated voltage for 10 min.
 - .4 Frequency - nominal 60 Hz:
 - .1 Adjustable from 58.5 to 61.5 Hz.
 - .2 Maximum variation from set value under load changes, including transients, not to exceed 0.3 Hz.
 - .3 Drift from set value - after two months normal operation within ambient temperature range of 0 degrees to 40 degrees C, not to exceed 0.6 Hz.
 - .5 Duration of full load output after mains failure not less than 15 min.
 - .6 Output voltage control:
 - .1 Continuously adjustable on load at least 5% from rated value.
 - .2 Voltage regulation: voltage not to change by more than 2% as load increases gradually from zero to 100%, or for specified duration of full load after mains failure.
 - .3 Transient voltage change not to exceed +/-10% of rated voltage upon 50% sudden load change, loss or return of ac input voltage to system when fully loaded or transfer of full load from inverter to bypass and vice versa, and return to normal within 3 Hz.

- .4 Harmonics over entire load range:
 - .1 Total rms value not to exceed 5% rms value of total output voltage.
 - .2 Single harmonic not to exceed 3% of total output voltage.
- .5 Proper angular phase relation maintained within 4 electrical degrees at up to 20% load unbalance.
- .7 Interference suppression:
 - .1 If UPS equipment generates electromagnetic rf interference at levels which adversely affects other equipment in vicinity, install suppression circuits or shielding as required to eliminate such interference.
 - .2 If harmonics reflected back to mains from rectifier adversely affect other loads connected to same bus, install suppression circuits to prevent that condition.

2.2 ELECTRICAL REQUIREMENTS

- .1 In accordance with Section 26 05 01 - Common Work Results - Electrical.
- .2 Bring out test points to protected coded pin jacks at convenient locations to permit testing without hazard, including:
 - .1 Inverter output ahead of output switch.
 - .2 Mains power.
- .3 No battery, other than main battery incorporated in design.
- .4 Wires number tagged or colour coded with same designation on drawings. Tags: non deteriorating type.
- .5 Variable resistors: fine adjustment, rheostat type.
- .6 Phasing marked on input and output terminals, viewed from front of equipment:
 - .1 Left to right;
 - .2 Top to bottom;
 - .3 Front to back.
- .7 Indicator lamps: long life incandescent or neon, rated for continuous duty, with sockets having adequate heat dissipation of lamps and dropping resistor if used.
- .8 Solid state circuits used where more reliable than mechanical timers or control relays.
- .9 Standard components available from commercial sources used throughout, with 10 years minimum shelf life.
- .10 Arrangement to permit easy removal of defective components to facilitate servicing, by replacing with stock spares.

- .11 Small components, related to specific function, removable plug-in modular sub-assembly or printed circuit card.
- .12 Heavy sub-assemblies easily accessible, or slide on runners of anti-friction material, and have flexible leads and bolted connections.
- .13 Components and sub-assemblies accurately made for interchangeability.

2.3 DISPLAY

- .1 Back lighted liquid crystal display allowing to configure the system and show trouble.

2.4 FABRICATION

- .1 Shop assemble:
 - .1 Rectifier unit;
 - .2 Inverter unit;
 - .3 Bypass switch unit;
 - .4 Battery rack and battery.

2.5 EQUIPMENT IDENTIFICATION

- .1 Provide equipment identification in accordance with Section 26 05 01 - Common Work Results - Electrical.
- .2 For major components such as ac input breaker, inverter breakers, bypass switch: size 4 nameplates.
- .3 For mode lights, alarms, meters: size 2 nameplates.

PART 3- Execution

3.1 INSTALLATION

- .1 Locate UPS cubicles, battery rack and battery as indicated.
- .2 Locate and install remote mode lights and alarm cabinets as indicated.
- .3 Assemble and interconnect components to provide complete UPS as specified.
- .4 Connect ac mains to main input terminal.
- .5 Connect UPS output to load.
- .6 Start-up UPS and make preliminary tests to ensure satisfactory performance.

3.2 TESTING

- .1 Perform tests in accordance with Section 26 05 01 - Common Work Results - Electrical and CSA-C813.1.
- .2 Provide:
 - .1 Competent field personnel to perform test, adjustments and instruction on UPS equipment.
 - .2 Dummy load adjustable to 150% of system rated output.
- .3 Notify Engineer 10 working days in advance of test date.
- .4 Tests:
 - .1 Inspection of cubicles, battery rack and battery.
 - .2 Inspection of electrical connections.
 - .3 Inspection of installation of remote mode lights and alarms.
 - .4 Demonstration of system start-up and shut-down.
 - .5 Run UPS for minimum period of [4] hours at full rated load to demonstrate proper operation with ac mains input, emergency generator input, no ac input.
 - .6 Discharge battery by operating UPS with ac mains open for specified duration of full load. Record readings of temperature of each cell.
 - .7 Recharge battery automatically with full rated load on UPS for 4 hours and record readings of voltage of each cell.

END OF SECTION

PART 1- GENERAL

1.1 SUMMARY

- .1 Related Section:
 - .1 Section 01 33 00 - Submittal Procedures.

1.2 REFERENCES

- .1 American National Standards Institute (ANSI)/The Instrumentation, Systems and Automation Society (ISA).
 - .1 ANSI/ISA 5.5, Graphic Symbols for Process Displays.
- .2 American National Standards Institute (ANSI)/ Institute of Electrical and Electronics Engineers (IEEE).
 - .1 ANSI/IEEE 260.1, American National Standard Letter Symbols Units of Measurement (SI Units, Customary Inch-Pound Units, and Certain Other Units).
- .3 American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE).
 - .1 ASHRAE STD 135, BACNET - Data Communication Protocol for Building Automation and Control Network.
- .4 Canadian Standards Association (CSA International).
 - .1 CAN/CSA-Z234.1, Canadian Metric Practice Guide.
- .5 Consumer Electronics Association (CEA).
 - .1 CEA-709.1, Control Network Protocol Specification.
- .6 Department of Justice Canada (Jus).
 - .1 Canadian Environmental Assessment Act (CEAA), c. 37.
 - .2 Canadian Environmental Protection Act (CEPA), c. 33.
- .7 Electrical and Electronic Manufacturers Association (EEMAC).
 - .1 EEMAC 2Y-1, Light Gray Colour for Indoor Switch Gear.
- .8 Health Canada/Workplace Hazardous Materials Information System (WHMIS).
 - .1 Material Safety Data Sheets (MSDS).
- .9 Transport Canada (TC).
 - .1 Transportation of Dangerous Goods Act (TDGA), c. 34.

1.3 ACRONYMS AND ABBREVIATIONS

- .1 Acronyms used in EMCS:
 - .1 AEL - Average Effectiveness Level.
 - .2 AI - Analog Input.
 - .3 AIT - Agreement on International Trade.
 - .4 AO - Analog Output.
 - .5 BACnet - Building Automation and Control Network.
 - .6 BC(s) - Building Controller(s).
 - .7 BECC - Building Environmental Control Center.
 - .8 CAD - Computer Aided Design.

- .9 CDL - Control Description Logic.
- .10 CDS - Control Design Schematic.
- .11 COSV - Change of State or Value.
- .12 CPU - Central Processing Unit.
- .13 DI - Digital Input.
- .14 DO - Digital Output.
- .15 DP - Differential Pressure.
- .16 ECU - Equipment Control Unit.
- .17 EMCS - Energy Monitoring and Control System.
- .18 HVAC - Heating, Ventilation, Air Conditioning.
- .19 IDE - Interface Device Equipment.
- .20 I/O - Input/Output.
- .21 ISA - Industry Standard Architecture.
- .22 LAN - Local Area Network.
- .23 LCU - Local Control Unit.
- .24 MCU - Master Control Unit.
- .25 NAFTA - North American Free Trade Agreement.
- .26 NC - Normally Closed.
- .27 NO - Normally Open.
- .28 OS - Operating System.
- .29 O&M - Operation and Maintenance.
- .30 OWS - Operator Work Station.
- .31 PC - Personal Computer.
- .32 PCI - Peripheral Control Interface.
- .33 PCMCIA - Personal Computer Micro-Card Interface Adapter.
- .34 PID - Proportional, Integral and Derivative.
- .35 RAM - Random Access Memory.
- .36 SP - Static Pressure.
- .37 ROM - Read Only Memory.
- .38 TCU - Terminal Control Unit.
- .39 USB - Universal Serial Bus.
- .40 UPS - Uninterruptible Power Supply.
- .41 VAV - Variable Air Volume.

1.4 DEFINITIONS

- .1 Point: may be logical or physical.
 - .1 Logical points: values calculated by system such as setpoints, totals, counts, derived corrections and may include, but not limited to result of and statements in CDL's.
 - .2 Physical points: inputs or outputs which have hardware wired to controllers which are measuring physical properties, or providing status conditions of contacts or relays which provide interaction with related equipment (stop, start) and valve or damper actuators.

- .2 Point Name: composed of two parts, point identifier and point expansion.
 - .1 Point identifier: comprised of three descriptors, "area" descriptor, "system" descriptor and "point" descriptor, for which database to provide 25 character field for each point identifier. "System" is system that point is located on.
 - .1 Area descriptor: building or part of building where point is located.
 - .2 System descriptor: system that point is located on.
 - .3 Point descriptor: physical or logical point description. For point identifier "area", "system" and "point" will be shortforms or acronyms. Database must provide 25 character field for each point identifier.
 - .2 Point expansion : comprised of three fields, one for each descriptor. Expanded form of shortform or acronym used in "area", "system" and "point" descriptors is placed into appropriate point expansion field. Database must provide 32 character field for each point expansion.
 - .3 Bilingual systems to include additional point identifier expansion fields of equal capacity for each point name for second language.
 - .1 System to support use of numbers and readable characters including blanks, periods or underscores to enhance user readability for each of the above strings.
- .3 Point Object Type: points fall into following object types:
 - .1 AI (analog input).
 - .2 AO (analog output).
 - .3 DI (digital input).
 - .4 DO (digital output).
 - .5 Pulse inputs.
- .4 Symbols and engineering unit abbreviations utilized in displays: to ANSI/ISA S5.5.
 - .1 Printouts: to ANSI/IEEE 260.1.

1.5 QUALITY ASSURANCE

- .1 Have local office within 50 km of project staffed by trained personnel capable of providing instruction, routine maintenance and emergency service on systems.
- .2 Provide record of successful previous installations submitting tender showing experience with similar installations utilizing computer-based systems.
- .3 Have access to local supplies of essential parts and provide 7 year guarantee of availability of spare parts after obsolescence.
- .4 Ensure qualified supervisory personnel continuously direct and monitor Work and attend site meetings.

1.6 EXISTING CONDITIONS - CONTROL COMPONENTS

- .1 Utilize existing control wiring and piping as indicated.
- .2 Re-use field control devices that are usable in their original configuration provided that they conform to applicable codes, standards specifications.
 - .1 Do not modify original design of existing devices without written permission from Engineer.

- .2 Provide for new, properly designed device where re-usability of components is uncertain.
- .3 Inspect and test existing devices intended for re-use within 30 days of award of contract, and prior to installation of new devices.
 - .1 Furnish test report within 40 days of award of contract listing each component to be re-used and indicating whether it is in good order or requires repair by Engineer.
 - .2 Failure to produce test report will constitute acceptance of existing devices by contractor.
- .4 Non-functioning items:
 - .1 Provide with report specification sheets or written functional requirements to support findings.
 - .2 Engineer will repair or replace existing items judged defective yet deemed necessary for EMCS.
- .5 Submit written request for permission to disconnect controls and to obtain equipment downtime before proceeding with Work.
- .6 Assume responsibility for controls to be incorporated into EMCS after written receipt of approval from [Engineer].
 - .1 Be responsible for items repaired or replaced by Engineer.
 - .2 Be responsible for repair costs due to negligence or abuse of equipment.
 - .3 Responsibility for existing devices terminates upon final acceptance of applicable portions of EMCS as approved by Engineer.
- .7 Remove existing controls not re-used or not required. Place in approved storage for disposition as directed.

PART 2 - PRODUCTS

2.1 EQUIPMENT

- .1 Control Network Protocol and Data Communication Protocol: to CEA 709.1 and ASHRAE STD 135.
- .2 Complete list of equipment and materials to be used on project and forming part of tender documents by adding manufacturer's name, model number and details of materials, and submit for approval.

2.2 ADAPTORS

- .1 Provide adaptors between metric and imperial components.

PART 3- EXECUTION

3.1 MANUFACTURER'S RECOMMENDATIONS

- .1 Installation: to manufacturer's recommendations.

3.2 PAINTING

- .1 Painting: in accordance with Section 09 91 23- Interior Painting, supplemented as follows:
 - .1 Clean and touch up marred or scratched surfaces of factory finished equipment to match original finish.
 - .2 Restore to new condition, finished surfaces too extensively damaged to be primed and touched up to make good.
 - .3 Clean and prime exposed hangers, racks, fastenings, and other support components.
 - .4 Paint unfinished equipment installed indoors to EEMAC 2Y-1.

END OF SECTION