

**PUBLIC WORKS AND GOVERNMENT
SERVICES CANADA**

**Rehabilitation and Retrofit of the
Generator Room**

Client Ref.: R.098079.001

**TECHNICAL SPECIFICATIONS
Issued for Tender**

**Architectural/Environmental/
Mechanical/Electrical**



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PWGSC

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Rehabilitation and Retrofit of the Generator Room
TECHNICAL SPECIFICATIONS
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SIGN-OFF SHEET

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RECORD OF REVISIONS AND ISSUES

Revision No.	Date	Description of the modification and/or of the issue
00	2020-01-31	Issued for Tender "This document shall not be used for Construction"

LIST OF SECTIONS

NOTE: FOR THE STRUCTURE DISCIPLINE, PLEASE REFER TO THE DRAWINGS.**DIVISION 01 - GENERAL REQUIREMENTS**

Section No.	Discipline	Description	Numbers of Pages	Rev.
01 11 01	AR	Summary of Works	2	00
01 14 00	E	Work Restrictions	4	00
01 31 19	AR	Project Meetings	2	00
01 32 16.19	AR	Construction Progress Schedule - Bar (GANTT) Chart	3	00
01 33 00	AR	Submittal Procedures	5	00
01 35 29.06	AR	Health and Safety Requirements	3	00
01 35 43	AR	Environmental Procedures	1	00
01 45 00	AR	Quality Control	3	00
01 56 00	AR	Temporary Barriers and Enclosures	4	00
01 61 00	AR	Common Product Requirements	6	00
01 73 00	AR	Execution	2	00
01 74 00	AR	Cleaning	2	00
01 74 19	AR	Waste Management and Disposal	2	00
01 77 00	AR	Closeout Procedures	2	00
01 78 00	AR	Closeout Submittals	5	00
01 79 00	AR	Demonstration and Training	1	00
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DIVISION 02 - EXISTING CONDITIONS

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02 65 00	Pb	Underground Storage Tank Removal	3	00
02 82 00.01	ENV	Asbestos Removal Work - Minimum Precautions	10	00
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DIVISION 07 - THERMAL AND MOISTURE PROTECTION

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07 84 00	MB	Fire Stopping	7	00

DIVISION 21 - FIRE SUPPRESSION

Section No.	Discipline	Description	Numbers of Pages	Rev.
21 05 00	FP	Common Work Results for Fire Suppression	4	00
21 22 00	FP	Clean Agent Fire Extinguishing Systems	8	00

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22 05 00	Pb	Common Work Results for Plumbing	3	00
22 05 05	Pb	Selective Demolition for Plumbing	3	00
22 13 16.13	Pb	Sanitary Waste and vent Piping - Cast Iron and Copper	4	00

DIVISION 23 - HEATING, VENTILATION AND AIR-CONDITIONING (HVAC)

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23 05 00	V	Common Work Results for HVAC	5	00
23 05 05	MB	Selective Demolition for Heating, Ventilating, and Air Conditioning (HVAC)	3	00
23 05 15	Pb	Common Installation Requirements for HVAC Pipework	5	00
23 05 29	FP, Pb, V	Hangers and Supports for HVAC Piping and Equipment	10	00
23 05 48	Pb, V	Vibration and Seismic Controls for HVAC	9	00
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23 05 53	MB	Identification for HVAC Piping and Equipment	5	00
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23 31 13.01	V	Metal Ducts - Low Pressure to 500 PA	6	00
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23 51 00	Pb	Breechings, Chimneys and Stacks	3	00
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23 83 13.19	EL	Radian Heating Electric Cables - Snow Melting	3	00

DIVISION 25 - INTEGRATED AUTOMATION

Section No.	Discipline	Description	Numbers of Pages	Rev.
25 05 01	R	EMCS - General Requirements	6	00
25 05 60	R	EMCS - Field Installation	8	00
25 30 02	R	EMCS - Fields Control Devices	6	00
25 90 01	R	EMCS - Site Requirements, Applications and Systems Sequences of Operation	1	00

DIVISION 26 - ÉLECTRICAL

Section No.	Discipline	Description	Numbers of Pages	Rev.
26 05 00	EL	Common Work Results for Electrical	10	00
26 05 05	EL	Selective Demolition for Electrical	4	00
26 05 20	EL	Wire and Box Connectors (0-1000 V)	3	00
26 05 21	EL	Wire and Cables (0-1000 V)	4	00
26 05 28	EL	Grounding - Secondary	4	00
26 05 29	EL	Hangers and Supports for Electrical Systems	3	00
26 05 30	EL	Seismic Restraint System (SRS)	5	00
26 05 31	EL	Splitters, Junction, Pull Boxes and Cabinets	2	00
26 05 32	EL	Outlet Boxes, Conduit Boxes and Fittings	2	00
26 05 34	EL	Conduits, Conduit Fastenings and Conduit Fittings	4	00
26 05 37	EL	Wireways and Auxiliary Gutters	2	00
26 05 43.01	EL	Installation of Cables in Trenches and in Ducts	3	00
26 09 23.02	EL	Lighting Control Devices - Photoelectric	3	00
26 12 16.01	EL	Dry Type Transformers Up to 600 V Primary	4	00
26 24 16.01	EL	Panelboards Breakers type	4	00
26 27 26	EL	Wiring Devices	4	00
26 28 13.01	EL	Fuses - Low Voltage	2	00
26 28 16.02	EL	Moulded Case Circuit Breakers	4	00
26 28 20	EL	Ground Fault Circuit Interrupters - Class A	3	00
26 28 23	EL	Disconnect Switches - Fused and Non-Fused	3	00
26 29 01	EL	Contactors	3	00
26 29 03	EL	Control Devices	3	00

Section No.	Discipline	Description	Numbers of Pages	Rev.
26 29 10	EL	Motor Starters to 600 V	4	00
26 32 13.03	EL	Installation of Electric Power Generating Equipment	8	00
26 36 23	EL	Automatic Transfer Switches	8	00
26 43 13	EL	Surge Protective Devices	3	00
26 50 00	EL	Lighting	3	00
26 52 13.13	EL	Emergency Lighting	4	00
26 52 13.16	EL	Exit Signs	2	00

DIVISION 28 - ELECTRONIC SAFETY AND SECURITY

Section No.	Discipline	Description	Numbers of Pages	Rev.
28 46 01	EL	Fire Detection and Alarm	9	00

Important Note: **The list of sections is used to enumerate required works, without limitation, and to attribute works to contractors according to the symbols explained here-under, and it is considered an integral part of the present specification.**

All : Applicable section to all works
 ENV : Applicable section to environment works
 AR : Applicable section to architectural works
 MB : Applicable section to mechanical works
 EL : Applicable section to electrical works
 I : Applicable section to insulation works
 Pb : Applicable section to plumbing/heating works
 FP : Applicable section to fire protection works
 V : Applicable section to ventilation/air conditioning works
 R : Applicable section to automatic regulation works

END OF SECTION

LIST OF DRAWINGS

ARCHITECTURAL

Drawing No.	Title	Rev.
A101	Notes and Legend - Plans - Elevations - Demolition / New Condition	---
A102	Detail in plan and section	---

STRUCTURAL

Drawing No.	Title	Rev.
S01	General Notes	00
S02	Plans, Sections and Details	00
S03	Sections and Details	00

MECHANICAL

Drawing No.	Title	Rev.
M01	Mechanical Legend and Drawings List	00
M02	Mechanical Plumbing / Ventilation Demolition	00
M03	Mechanical Plumbing / Ventilation New Layout	00
M04	Mechanical Sections and Tables	00
M05	Mechanical Integrated Automation	00
M06	Mechanical Integrated Automation	00
M07	Mechanical Integrated Automation	00

ELECTRICAL

Drawing No.	Title	Rev.
E01	Electrical Legend and Drawings List	00
E02	Electrical Existing Installation	00
E03	Electrical Existing Schematic and Panels	00
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E05	Electrical Proposed Schematic and Panels	00

Drawing No.	Title	Rev.
E06	Electrical Existing and Proposed Lighting Ground Floor and Radar Tower	00
E07	Electrical Details	00

END OF SECTION

DIVISION 01

General Requirements

PARTIE 1 - GENERALITY**1.1. RELATED SECTIONS**

1. Conditions Standard Conditions Public Works and Government Services Canada

1.2. WORK COVERED BY CONTRACTUAL DOCUMENTS

1. The Work covered by this Contract includes the replacement and upgrading of the Generator and includes but is not limited to:

1. Concrete works:

All partial slab demolition and concrete slab grounding work required including excavation, off-site transportation and disposal of materials in an authorized location are included at the asking price.

2. Architectural works :

All the work of the building envelope including:

- All the preparatory and demolition work required to complete the structure both inside and outside the building
- Roofing work to allow installation of new roof equipment;
- Insulation, metal studs, sealer, insulation, metalwork, frames, carpentry, painting, interior finishes,
- are included at the asking price

3. Mechanical ventilation works, plumbing:

All the works of supply and installation of all mechanical equipment, controls, distributions, balancing, are included at the asking price.

4. Electrical work:

All the works of supply, installation and connection of all equipment, lighting devices, etc. and electricity distribution network are included at the asking price on a flat rate basis as shown in the plans of the professionals.

1.3. WORK EXECUTED BY THIRD PARTIES

1. Work in collaboration with other contractors and execute the instructions of the professionals.
2. Coordinate work with other contractors. If the performance or result of any part of the Work covered by this contract depends on the work of another Contractor, promptly report, in writing, to the Contractor, any deficiencies or deficiencies that may affect the Contractor's work to the good execution of the works

1.4. USE OF SITE BY THE CONTRACTOR

1. The site may be used in designated locations until substantial completion of the work.

2. Find and pay for additional work or storage areas required to perform the Work under this Contract.

1.5. PARTIAL OCCUPANCY OF PLACES BY THE MASTER OF THE WORK

1. Establish a schedule for substantial completion of the work to permit occupation of the premises (operational equipment and access) throughout the period of the contract work.

1.6. EXISTING UTILITIES SERVICES

1. Before interrupting utility services, inform the professionals and the owner as well as the utilities concerned, and obtain the necessary authorizations.
2. If tapping or connecting to existing utility lines is required, 72 hours notice must be given prior to the scheduled outage of the corresponding electrical or mechanical services. Ensure that the duration of interruptions is as short as possible. Carry out work at the times determined by the competent local authorities, with the least possible interference with pedestrian traffic and / or vehicular traffic.
3. Prior to the start of work, define the extent and location of the utility lines in the work area and inform the professionals.
4. Submit to the project authority for approval a schedule for the shutdown or closure of active facilities or works, including the interruption of communications services or power supply. Respect the approved schedule and inform the parties affected by these inconveniences.
5. Provide temporary utility services to maintain critical building and tenant systems.
6. When unlisted utility lines are discovered, immediately inform the professionals and record them in writing.
7. Protect, move or maintain functional utility pipelines. If non-functional pipelines are discovered during the works, seal them in a manner authorized by the competent authorities.
8. Record the location of utility pipelines that are maintained, relocated or abandoned.
9. Construct barriers in accordance with Section 01 56 00 O Temporary access and protection works

PARTIE 2 - PRODUCTS

1. Not applicable.

PARTIE 3 - EXÉCUTION

1. Not applicable.

END OF SECTION

Part 1 General**1.1 RELATED REQUIREMENTS**

- .1 Section 26 05 00 - Common Work Results for Electrical.

1.2 USE OF SITE AND FACILITIES

- .1 Execute work with least possible interference or disturbance to normal use of premises. Make arrangements with Departmental Representative to facilitate work as stated.
- .2 Maintain existing services to building and provide for personnel and vehicle access.
- .3 Where security is reduced by work provide temporary means to maintain security.
- .4 Use existing stairway in building for moving workers and material.
 - .1 Accept liability for damage, safety of equipment and overloading of existing equipment.
- .5 Closures: Protect work temporarily until permanent enclosures are completed.

1.3 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 Departmental Representative to facilitate execution of work.

1.4 EXISTING SERVICES

- .1 Notify, Departmental Representative and utility companies of intended interruption of services and obtain required permission.
- .2 Where Work involves breaking into or connecting to existing services, give Departmental Representative 72 hours of notice for necessary interruption of mechanical or electrical service throughout course of work. Keep duration of interruptions minimum. Carry out interruptions after normal working hours of occupants, preferably on weekends.
- .3 Provide for personnel and vehicular traffic.

1.5 SPECIAL REQUIREMENTS

- .1 Ensure Contractor's personnel employed on site become familiar with and obey regulations including safety, fire, traffic and security regulations.
- .2 Keep within limits of work and avenues of ingress and egress.
- .3 Ingress and egress of Contractor vehicles at site is limited.

1.6 SECURITY

- .1 Where security has been reduced by Work of Contract, provide temporary means to maintain security.

- .2 Security Clearances:
 - .1 Personnel employed on this project will be subject to security check. Obtain clearance, as instructed, for everyone who will require to enter premises.
 - .2 Obtain requisite clearance, as instructed, for everyone required to enter premises.
 - .3 Personnel will be checked daily at start of work shift and provided with pass which must always be worn. Pass must be returned at end of work shift and personnel checked out.

1.7 BUILDING SMOKING ENVIRONMENT

- .1 Comply with smoking restrictions. Smoking is not permitted.

1.8 CONTINUITY OF ELECTRICAL SERVICES

- .1 Ensure the full continuity of electrical services for the maintenance of operations during and after work.

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

1.9 INTERRUPTIONS TO THE POWER SUPPLY

- .1 Interruptions to the power supply must be minimized and must be carried out in close coordination with the Departmental Representative who must be notified at least 15 working days to the advance and recalled 48 hours before the start of the work.
- .2 Interruptions to the power supply must be planned and documented. The Contractor must submit, for approval, a detailed description explaining the interventions and work in each of the stages. The duration of each operation must be adequately established to enable the Ministry's representative to decide to proceed with the work.
- .3 In the event of a counter-order by the Departmental Representative, the Contractor must provide for the possibility of putting the power supply into operation in less than 20 minutes.
- .4 All power interruptions must be made outside of regular working hours.

1.10 MAINTAINING OF ELECTRICAL SERVICES

- .1 Existing electrical services must always be maintained.
- .2 The Contractor must relocate the existing electrical distribution of the main electrical room to free the space required for the installation of the new electrical distribution and the new generator as well as allow the work of painting and membrane. To this end, the Contractor must provide for temporary external structures, such as buildings, walls, brackets, electrical distribution panels, circuit breakers, transformers, switches, conduits, boxes, wiring, drilling and other devices, and intercept the existing electrical distribution in steel boxes with identified terminal blocks. At no time must the Contractor's work interfere with the operations of the Departmental Representative.

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- .3 All service cuts must be made outside of regular working hours and with the consent of the Departmental Representative.

1.11 MAINTAINING OF THE EMERGENCY ELECTRICAL DISTRIBUTION SYSTEM

- .1 Existing emergency electrical services must always be maintained during regular working hours and other periods specified by the Departmental Representative.
- .2 The Contractor must relocate the existing emergency electrical distribution of the main electrical room to free the space required for the installation of the new electrical distribution and the new generator, and allow the work of other disciplines. To this end, the Contractor must provide for temporary external structures, such as buildings, walls, brackets, electrical distribution panels, circuit breakers, transformers, switches, conduits, boxes, wiring, drilling and other devices, and intercept the existing electrical distribution in steel boxes with identified terminal blocks.
- .3 The Contractor must also remove and dispose of the existing generator, and provide and install a temporary generator set under a soundproof shelter outside with a reservoir under base and connect the emergency electrical distribution of the Building. The location of the temporary generator will be determined at the site with the Departmental Representative. At no time must the Contractor's work interfere with the operations of the Departmental Representative.
- .4 All service cuts must be made outside of regular working hours and with the consent of the Departmental Representative.

1.12 MAINTENANCE OF THE UNINTERRUPTIBLE POWER SUPPLY SYSTEM (UPS)

- .1 Uninterruptible power supply services must always be maintained.
- .2 To this end, the Contractor shall provide a temporary UPS system as well as all conduits, conductors, hardware, and accessories to maintain the uninterruptible power supply services.
- .3 All power interruptions must be made outside the regular working hours and with the consent of the Departmental Representative.

Part 2 Products

2.1 NOT USED

- .1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

PARTIE 1 - GENERALITY**1.1. SECTIONS CONNEXES**

1. Standard Conditions of PWGSC;

1.2. ADMINISTRATIVE TERMS

1. Arrange for project meetings to be held throughout the course of the work, at the request of the Ministerial representatives and to manage them.
2. Prepare the meeting agenda.
3. Notify in writing of a meeting seven (7) days prior to the scheduled date.
4. Provide a room or other space for meetings and make the necessary arrangements.
5. Direct project meetings.
6. Write the minutes of the meetings. Include all important questions and decisions. Specify the actions taken by the different parties.
7. Make copies of the minutes and distribute them to participants 3 days after the meeting.
8. Representatives of the Contractor, subcontractors and suppliers attending project meetings are entitled and authorized to act on behalf of the parties they represent.

1.3. PRE-WORK MEETING

- .1 Within 15 days of contract award, arrange a meeting of the parties to the contract to discuss administrative procedures and define the responsibilities of each.
- .2 Must be present at this meeting the Ministerial representatives and the Contractor
 1. Points devant figurer à l'ordre du jour
 - .1 Designation of the official representatives of the participants in the works.
 - .2 Schedule of Work, in accordance with Section 01 32 16.07 Schedule and Scheduling of Work - Bar Graphs (GANTT).
 - .3 Submission schedule for shop drawings, product samples and color samples in accordance with Section 01 33 00 - Submittal Procedures.
 - .4 Requirements for temporary installations, site signage, offices, sheds and storage facilities, utilities and fences, in accordance with Section 01 52 00 - Construction Site Facilities.
 - .5 Site Safety, in accordance with Section 01 56 00 - Temporary Access and Protective Work.
 - . 6 Drawings to be included in the project file, according to section 01 33 00 - Submittal Procedures.
 - .7 Service Manuals, in accordance with Section 01 78 00 - Documents and Materials to be

Delivered upon Completion.

.8 Work Delivery and Acceptance Procedures, and Guarantees, in accordance with Section 01 78 00 - Documents and Materials to be Delivered upon Completion.

.9 Monthly installment claims, administrative procedures, photos, holdbacks.

.10 Designation of agencies and inspection and testing firms.

.11 Insurance.

2. MEETING ON THE PROGRESS OF WORK

- .1 Establish a schedule of meetings to be held weekly during the course of the work and one week before the completion of the work.
- .2 The main subcontractors involved in the work and the Ministerial representatives must be present at these meetings.
- .3 Write the minutes of these meetings and send them to the participants as well as to the concerned parties absent from them, within 3 days of each holding.
- .4 Items to be included on the agenda
 - .1 Reading and approval of the minutes of the previous meeting.
 - .2 Review of progress since the previous meeting.
 - .3 Observations on the spot; problems and conflicts.
 - .4 Problems affecting schedule of work.
 - .5 Review of delivery schedules for off-site products.
 - .6 Procedures and corrective actions to make up for delays in order to meet schedule.
 - .7 Revision of the schedule of work.
 - .8 Review progress schedule during successive stages of work.
 - .9 Revised schedule of submission of required documents and samples; speed up the process as needed.
 - .10 Maintenance of quality standards.
 - .11 Review of proposed changes and their potential impact on work schedule and completion date.
 - .12 Miscellaneous.

PARTIE 2 - PRODUCTS

1. Not applicable

PARTIE 3 - EXECUTION

1. Not applicable

END OF THE SECTION

PART 1 - GENERALITY

1.1. RELATED SECTIONS

1. Not applicable.

1.2. DEFINITIONS

1. Activity: Determined work performed as part of a project. An activity normally has a planned duration, expected cost and expected resource requirements. Activities can be subdivided into tasks.
2. Bar chart (GANTT chart): Graphical representation of data related to the project schedule. In the usual bar chart, the activities or other elements of the project are shown from top to bottom, to the left of the graph while the dates are presented at the top, from left to right; the duration of each activity is indicated by horizontal segments placed between dates. In general, the bar chart is generated from a commercially available computerized project management system.
3. Baseline: Approved initial plan (for a project, a work package, or an activity), taking into account approved changes to the scope of the project.
4. Work Week: A five (5) day week, Monday to Friday, defining the business days for the submission of the bar chart (GANTT chart).
5. Duration: Required number of work periods (except holidays and other nonworking periods) for the performance of an activity or other project element. The duration is usually expressed in working days or working weeks.
6. Overall Plan: Summary program showing key activities and milestones.
7. Milestone: An important event in the execution of the project, most often corresponding to the completion of a major (deliverable) product.
8. Implementation Schedule: Dates set for the execution of activities and achievement of milestones. Dynamic and detailed program of the tasks or activities necessary to reach the milestones of a project. The monitoring and control process is based on the implementation schedule for carrying out and monitoring activities; it is he who defines the decisions that will be made throughout the project.
9. Scheduling - Project Planning, Tracking and Control: A global system managed by the Contractor to track the execution of work against specified milestones or milestones.

1.3. REQUIREMENTS

1. Ensure that the overall plan and schedule are workable and that they meet the prescribed duration of the contract.
2. The overall plan must provide for the completion of the work in accordance with the prescribed

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milestones within the agreed time period.

3. The award of the contract or the start date of the works, the progress of the works, the issue of the provisional certificate of completion and the final certificate of completion constitute defined stages of the project and are essential requirements of the contract.

1.4. DOCUMENTS TO SUBMIT

1. Submit to the Ministerial representatives, no later than seven (7) business days after contract award, a bar chart (GANTT chart) that will serve as a blueprint and will be used for planning and monitoring works, and for the production of progress reports.
2. Submit the schedule to the Consultant no later than five (5) business days after acceptance of the master plan.
3. Submit two (2) copies, one of which will be retained by the consultant.
4. The Consultant will verify the proposed schedule and return a revised copy within four (4) days of receipt.
5. Submit a final version of the schedule within three (3) days of receipt of the revised copy.
6. Each down payment request must be accompanied by a revised implementation schedule.
7. Send a copy of the revised schedule of execution
 1. at the site office;
 2. to subcontractors;
 3. other interested parties.
8. Ask the consignees to report to the Contractor, within seven (7) days, any problems that might be caused by the proposed execution program in the schedule.

1.5. MILESTONES OF THE PROJECT

1. The milestones of the project are the intermediate objectives stated in the implementation schedule (expressed in calendar days from the date of the grant including the period of the construction holidays).
 1. Site preparation and demolition work must be completed no later than 84 days after the date of contract award.
 2. The Interim Certificate of Completion must be issued no later than 21 days after completion of the preparation and demolition work (84 days).

1.6. REDUCTION OF WORKS SCHEDULE

1. The Contractor will not be able to submit a schedule of completion of less than 10% of the time stipulated in the contract.
2. No modification or request for complaint may be presented to the Employer in connection with the reduction or increase of the construction time provided for in the scope of work.

1.7. EXECUTION CALENDER

1. Develop a detailed implementation schedule from the project milestones
2. The detailed construction schedule must include at least the steps corresponding to the following activities
 1. Award of the contract.
 2. Shop drawings, samples.
 3. Permit.
 4. Mobilization.
 5. Demolition
 6. Slab on ground.
 7. Patching and work on the cover.
 8. Interior architectural elements (walls, floors, ceilings).
 9. Plumbing.
 10. Electricity.
 11. Piping.
 12. Control / regulation.
 13. Heating, ventilation and air conditioning.
 14. Testing and commissioning.
 15. Materials supplied with a long delivery time

1.8. REPORT ON THE PROGRESSION OF WORKS

1. Update the construction schedule weekly to reflect changes to activities, completion of activities, and ongoing activities.
2. Attach a narrative report to the construction schedule that indicates the status of the work, compare progress against the baseline, and present current forecasts, expected delays, impacts, and metrics. possible mitigation.

PART 2 - PRODUCTS

1. Not applicable

PART 3 - EXECUTION

1. Not applicable

END OF THE SECTION

PART 1 - GENERALITIES**1.1 SECTION CONTENT**

- .1 Shop drawings and data sheets;
- .2 Samples of products and work;
- .3 Certificates and minutes;
- .4 Safety Data Sheets for hazardous material.

1.2 SECTIONS CONNEXES

- .1 Section 01 45 00 – Quality control.
- .2 Section 01 78 00 – Closeout submittals

1.3 MANAGEMENT CONSIDERATIONS

- .1 Within a reasonable time and in a predetermined order so as not to delay the execution of the work, submit documents and samples required for the approval of the Ministerial representatives. A delay in this regard cannot constitute a sufficient reason for an extension of the time limit for completion and no such request will be accepted.
- .2 The work for which we require the filing of documents and samples should not be undertaken until the verification of all documents submitted is complete.
- .3 The data shown on the shop drawings, data sheets and samples of products and works must be expressed in metric units.
- .4 When the elements are not produced or manufactured in metric or that the features are not given in SI units, converted values can be accepted.
- .5 Review all documents and samples before returning them to the Ministerial representatives. With this prior check, the Contractor confirms that the requirements applicable to works have been or will be determined and verified, and that each of the documents and submitted samples was examined and found to comply with the requirements of the work and contract documents. The documents and samples that will not be stamped, signed, dated and identified in connection with the particular project will be returned without being reviewed and will be considered rejected.
- .6 Notify the Ministerial representatives in writing at the time of filing of documents and samples, of any differences that they have with the requirements of the contract documents, and state the reasons. It is the sole responsibility of the Contractor to demonstrate the equivalence between his proposal and the Contract Documents.
- .7 Ensure the accuracy of the measures taken on site from adjacent structures affected by the work.

- .8 The fact that the documents and samples submitted are reviewed by the Ministerial representatives does not release the Contractor from his responsibility to provide complete and accurate work and to comply with the requirements of the contract documents.
- .9 Keep on the site a copy of each reviewed document submitted.

1.4 TECHNICAL SPECIFICATIONS AND SHOP DRAWINGS

- .1 The term "shop drawings" means drawings, diagrams, illustrations, tables, graphics, leaflets and other documentation to be provided by the Contractor to show in detail part of the intended work.
- .2 Shop drawings must indicate the materials used and construction methods, ties or anchors to use, and they must contain the assembly diagrams, details of connections, the relevant explanatory notes and any other required information for the execution of works. When structures or elements are connected to other structures or other elements shown in the drawings coordination is required, regardless of the section under which the works or adjacent elements will be provided and installed.
- .3 Allow five (5) business days to Ministerial representatives to examine each batch of documents submitted.
- .4 Changes to shop drawings by the Ministerial representatives are not intended to change the contract price. If this is the case, however, notify the Ministerial representatives in writing before starting work.
- .5 Bring changes to the shop drawings if requested by the Ministerial representatives in accordance with the Contract Documents. When submitting drawings again, notify the Ministerial representatives in writing of changes that were made in addition to those required.
- .6 The documents submitted must indicate the following:
 - .1 The date of preparation and review dates;
 - .2 The name and project number;
 - .3 The names and addresses of: the contractor, supplier and manufacturer;
 - .4 The stamp of the Contractor, signed by the authorized representative, certifying that the documents submitted are approved, that the actions on site were checked and all comply with the requirements of the contract documents;
 - .5 Important details to the relevant portions of the work:
 - .1 Materials and manufacturing details;
 - .2 The layout or configuration, with dimensions, including those taken on site, as well as clearances;
 - .3 Details of mounting or setting;
 - .4 Performance characteristics;

- .5 Reference standards;
- .6 Connections with adjacent structures.
- .7 The Contractor is responsible for issuing email copies and make the distribution of shop drawings and data sheets once the Ministerial representative has completed the verifications. In addition, the Contractor is responsible to keep copies required for assembly of the project's closeout manuals. Unless otherwise indicated, the review of technical specifications and shop drawings will be distributed by electronic copy.
- .8 Submit by email shop drawings prescribed in the specification sections and all other requirements of the Ministerial representatives.
- .9 If shop drawings are not required due to the use of a standard production product, submit by email datasheets or the manufacturers documentation prescribed in the specification sections and demanded by professionals.
- .10 Remove the information that does not apply to the present works.
- .11 In addition to the current information, provide any additional details that apply to the work.
- .12 When the shop drawings were verified by the Ministerial representatives and no error or omission was detected or they contain only minor corrections, copies are returned by e-mail, and processing work and installation may then be undertaken. If shop drawings are rejected, or the annotated copies are returned and corrected, the shop drawings must be submitted again according to the above indications before the construction and installation work can be undertaken.
- .13 When the requirements of the specification sections require that documents be checked and calculated by an engineer they must bear the seal and signature of an Engineer, who is a member in good standing of the order of Engineers of Quebec and able to validate this type of work.
- .14 Maintain and update a calendar showing the processing of all shop drawings and technical data required by the contract.
- .15 Submit all technical specifications and shop drawings required within two (2) weeks after contract award.

1.5 SAMPLE PRODUCTS

- .1 Submit at least two (2) product samples for verification, as specified by the specification sections. Label samples indicating their origin and intended destination.

- .2 Ship prepaid samples to the Ministerial representatives' business office.
- .3 Notify the Ministerial representatives in writing at the time of submission of product samples, indicate any differences they have with the requirements of the contract documents.
- .4 When the colour, pattern or texture is the subject of a prescription, submit full range of samples required.
- .5 Changes to the samples by the Ministerial representatives are not intended to change the contract price. If this is the case, however, notify the Ministerial representatives in writing before starting work.
- .6 Indicated the changes requested by the Ministerial representatives while respecting the requirements of the contract documents.
- .7 The samples examined and approved become the reference standard from which the quality of materials and finished works and installation will be evaluated.

1.6 JOB SAMPLE

- .1 Carry out work samples required in accordance with Section 01 45 00 – Quality control.

1.7 CERTIFICATES AND MINUTES

- .1 Submit the relevant documents required by the Commission for Health and Safety at Work immediately after the contract is awarded.

1.8 PROGRESS PHOTOGRAPHS

- .1 Submit one (1) copy of the digital photographic record, high resolution, in .jpg or .tif format, presented in electronic format.
- .2 Project identification: project name and number and date of photograph.
- .3 Number of viewpoints:
 - .1 The viewpoints and their location will be determined by the on-site Consultant in coordination with the Contractor and the Parks Canada Agency Representative.
- .4 Frequency of submission of photos:
 - .1 Once before mobilization;
 - .2 At least once at each key milestone following the progress schedule, in particular;
 - .1 Once the work is completed;

- .2 Once before the works are concealed;
- .3 After demobilization.

1.9 DANGEROUS SUBSTANCES

- .1 Submit updated MSDS sheets for each hazardous material required on site before it is brought there.
- .2 Submit a Hazardous Materials Management Plan, indicating the name of all hazardous materials, use, location, personal protective equipment required and the arrangements that were made for their disposal.

PART 2 - PRODUCTS

2.1 NOT APPLICABLE.

PARTIE 3 - EXECUTION

3.1 NOT APPLICABLE

End of section

PART 1 - GENERAL

1.1 REFERENCES

- .1 Canada Labour Code, Part 2, Canada Occupational Safety and Health Regulations and provincial CNESST
- .2 Health Canada/Workplace Hazardous Materials Information System (WHMIS).
 - .1 Material Safety Data Sheets (MSDS).
- .3 Province of Quebec
 - .1 An Act Respecting Occupational Health and Safety, R.S.Q. last edition.

1.2 SUBMITTALS

- .1 Make submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit site-specific Health and Safety Plan prior to commencement of Work that must include:
 - .1 Results of site specific safety hazard assessment.
 - .2 Results of safety and health risk or hazard analysis for site tasks and operation found in work plan.
- .3 Submit copies of Contractor's authorized representative's work site health and safety inspection reports to Ministerial Representatives.
- .4 Submit copies of reports or directions issued by Federal, Provincial and Territorial health and safety inspectors.
- .5 Submit copies of incident and accident reports.
- .6 Submit WHMIS MSDS - Material Safety Data Sheets in accordance with Section 01 33 00 - Submittal Procedures.
- .7 Ministerial Representatives will review Contractor's site-specific Health and Safety Plan and provide comments to Contractor after receipt of plan. Revise plan as appropriate and resubmit plan to Ministerial Representatives within five (5) days after receipt of comments from Ministerial Representatives.
- .8 Ministerial Representatives review of Contractor's final Health and Safety plan should not be construed as approval and does not reduce the Contractor's overall responsibility for construction Health and Safety.

- .9 Medical Surveillance: where prescribed by legislation, regulation or safety program, submit certification of medical surveillance for site personnel prior to commencement of Work, and submit additional certifications for any new site personnel to Ministerial Representatives.

1.3 SAFETY ASSESSMENT

- .1 Perform site specific safety hazard assessment related to project.

1.4 PROJECT/SITE CONDITIONS

- .1 See expert report in appendix – Caractérisation des matériaux susceptibles de contenir de l'amiante et des peintures susceptibles de contenir le plomb.

1.5 GENERAL REQUIREMENTS

- .1 Develop written site-specific Health and Safety Plan based on hazard assessment prior to beginning site Work and continue to implement, maintain, and enforce plan until final demobilization from site. Health and Safety Plan must address project specifications.
- .2 Ministerial Representatives may respond in writing, where deficiencies or concerns are noted and may request re-submission with correction of deficiencies or concerns.

1.6 RESPONSIBILITY

- .1 Be responsible for health and safety of persons on site, safety of property on site and for protection of persons adjacent to site and environment to extent that they may be affected by conduct of Work.
- .2 Comply with and enforce compliance by employees with safety requirements of Contract Documents, applicable federal, provincial, territorial and local statutes, regulations, and ordinances, and with site-specific Health and Safety Plan.

1.7 COMPLIANCE REQUIREMENTS

- .1 Comply with Act Respecting Occupational Health and Safety, R.S.Q., last edition.
- .2 Comply with Canada Labour Code, Canada Occupational Safety and Health Regulations.

**1.8 UNFORSEEN
HAZARDS**

- .1 When unforeseen or peculiar safety-related factor, hazard, or condition occur during performance of Work, follow procedures in place for Employee's Right to Refuse Work in accordance with Acts and Regulations and advise Ministerial Representatives verbally and in writing.

**1.9 POSTING OF
DOCUMENTS**

- .1 Ensure applicable items, articles, notices and orders are posted in conspicuous location on site in accordance with Acts and Regulations, and in consultation with Ministerial Representatives.

**1.10 CORRECTION OF
NON-COMPLIANCE**

- .1 Immediately address health and safety non-compliance issues identified by authority having jurisdiction or by Agency Representatives.
- .2 Provide Ministerial Representatives with written report of action taken to correct non-compliance of health and safety issues identified.
- .3 Ministerial Representatives may stop Work if non-compliance of health and safety regulations is not corrected.

1.12 WORK STOPPAGE

- .1 Give precedence to safety and health of public and site personnel and protection of environment over cost and schedule considerations for Work.

PART 2 - PRODUCTS

NOT USED.

PART 3 - EXECUTION

NOT USED.

END OF SECTION

PARTIE 1 - GENERAL**1.1. APPLICATION**

1. This section should be read with each of the other sections of the contract documents and applies to all work.
2. Complementarity of documents: some elements are specified on the plans and others in this quote. The documents are complementary.
3. The requirements of this section supplement the information in PWGSC's tender documents and, in particular, the "General Conditions". For a subject dealt with in one or other of these documents, the most stringent requirement applies.

1.2. RELATED WORKS

1. Section 01 00 00 – Complementary general conditions

1.3. FIRE

1. Fires and burning of garbage on site are not permitted.

1.4. DISPOSAL OF WASTE AND SOLID WASTE OUTSIDE

1. Comply with the additional general requirements for the management and disposal of waste.
2. No waste or waste material should be buried on site.
3. It is prohibited to dispose of waste, volatile materials, mineral spirits, hydrocarbons, paint thinner or any other harmful and polluting material in a watercourse or in a storm or sanitary sewer.

1.5. DRAINAGE

1. Not applicable

1.6. PREVENTION OF POLLUTION

1. Assurer Provide control of gases and emissions from equipment, equipment, tools and facilities as required by local agencies.
2. Prevent sanding materials and other foreign matter from contaminating air and waterways beyond the application area by constructing temporary shelters.
3. Water dry materials and cover garbage to prevent wind from lifting dust or debris.

END OF SECTION

PART 1 - GENERALITIES**1.1 SECTION CONTENT**

- .1 Inspection and testing, administrative and operational requirements;
- .2 Testing and dosage form;

1.2 RELATED SECTIONS

- .1 Section 01 33 00 – Submittal procedures;
- .2 Section 01 78 00 – Closeout submittals

1.3 INSPECTION

- .1 Ministerial representatives need access to the construction site. If parts of the work are performed outside of the site, access to this place must also be assured for the duration of the work.
- .2 In case the works should be subject to inspections, approvals or special tests ordered by the Ministerial representatives or required under local regulations to the site, make that request within a reasonable time.
- .3 If the Contractor has covered or allowed a job to be covered before it has been subjected to inspections, approvals or required special tests, he must uncover the work in question, to see the allow for the inspections or tests required to satisfy the competent authorities then put the work in its original state and pay for it.
- .4 The Ministerial representatives may order the inspection of any part of the job when conformity with the contract documents is in doubt. If, after review, the job in question is found not to comply with the requirements of the contract documents, the Contractor shall take the necessary measures to make the work conform to specified requirements and undertake the inspection and repair costs. If the work in question is found to comply with the contract documents, the Owner shall bear the costs of inspection and rehabilitation so incurred.

1.4 TESTING ORGANIZATIONS AND INDEPENDENT INSPECTIONS

- .1 Ministerial representatives will take care to retain the services of testing organizations and independent inspections. The cost of these services will be borne by the Employer.
- .2 Provide the material required by the organization mandated for carrying out the tests and inspections.

- .3 The use of testing organization and inspection does not relieve the Contractor from its responsibility for the execution of works according to the requirements of the contract documents.
- .4 If defects are detected during tests and / or inspections, the designated agency will require further inspection and / or additional tests to accurately define the nature and extent of these defects. The Contractor shall correct the defects and imperfections as directed by the Ministerial representatives, without additional cost to the Owner, and assume the cost of tests and inspections that should be performed after these corrections.

1.5 ACCESS TO SITE

- .1 Enable testing organizations to have access to the site as well as to workshops that are located offsite.
- .2 Collaborate with these organizations and take all reasonable measures so that they have the necessary means of access.

1.6 PROCEDURE

- .1 Notify in advance the appropriate agency and the Ministerial representatives when tests are to be performed so that all parties may be present.
- .2 Submit samples and / or equipment and materials needed for the testing according to the requirements of the specifications, within a reasonable timeframe and in a predetermined order so as not to delay the execution of the work.
- .3 Provide labour and facilities for collecting and handling samples and materials on site. Also provide the space required for storage and treatment samples.

1.7 REPORTS

- .1 Provide three (3) copies of the test reports to the Ministerial representatives.
- .2 Provide copies of these reports to subcontractors responsible for works that are to be inspected or tested.

1.8 WORKS REJECTED

- 1. Remove the defective items found to be non-compliant with the contractual documents and rejected by the Consultant, either because they were not executed according to the rules of the art, or because they were made with materials or defective products, even if they have already been incorporated into the work. Replace or redo the elements in accordance with the requirements of the contract documents.

2. If necessary, repair without delay the works of other contractors who have been damaged during the aforementioned repair or replacement work.
3. If, in the opinion of the Consultant, it is not advisable to repair the defective works or found to be non-compliant with the contractual documents, the Employer will deduct from the contract price the difference in value between the work executed and the one prescribed in the contract documents, the amount of this difference being determined by the consultant.

1.9 TEST DOSAGE FORMS

- .1 Provide three (3) copies of the test reports and the required dosage forms.
- .2 The cost of testing and dosing formulas that were not specifically required under the contractual documents or local regulations for the site will be subject to the approval of the Ministerial representatives and will later be reimbursed.

1.10 WORK SAMPLES

- .1 Not applicable.

1.11 FACTORY TESTS

- .1 Submit factory test certificates that are required and prescribed in the various sections of this specifications document.

PART 2 - PRODUCTS

- 2.1** Not applicable.

PARTIE 3 - EXECUTION

- 3.1** Not applicable

END OF SECTION

January 31, 2020

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PART 1 - GENERALITY**1.1. APPLICATION**

1. This section should be read with each of the other sections of the contract documents and applies to all work.
2. Complementarity of documents: some elements are specified on the plans and others in this quote. The documents are complementary.
3. The requirements of this section supplement the information in PWGSC's tender documents and, in particular, the "General Conditions". For a subject dealt with in one or other of these documents, the most stringent requirement applies

1.2. RELATED WORKS

1. Including, but not limited to:
 1. Section 01 11 01 – Summary of works

1.3. ACCESS TO WORKPLACES AND GUARDIAN

1. The Contractor shall, throughout the duration of the work, maintain the safe passage of public roads, the safety of the construction site and the building during and outside working hours.
2. The owner will not assume any responsibility for materials, tools, equipment or workmanship of the Contractor, who is responsible for their protection and supervision on site.
3. The owner does not insure the guarding of the site. It is the responsibility of the Contractor to ensure the safety of his site and to pay for the costs of guarding when the circumstances so require. Notwithstanding the foregoing, the Contractor shall provide security at his expense, when a complaint from the representative of the City and / or the borough security department is forwarded to the Contractor to correct a security breach of the construction site.
4. The Contractor shall maintain and clean daily, one or more times per day if necessary, access roads to the site and any other perimeter routes affected by traffic around the work.

1.4. CONSTRUCTION OF THE SITE

1. Construction site access:
 1. Maintain the entrance and clean the access roads to the site according to their use, repair any damage to the access roads according to their use.
 2. Any damage that may arise from the use that has been made must be repaired at the expense of the Contractor. Allowing the circulation of vehicles at the perimeter of the building at all times.
2. Installation and removal of temporary works:
 1. The Contractor must supply and install the construction equipment and temporary works necessary to allow the work to be performed without delay, for each of the execution phases.

2. Once the work is completed, the Contractor must evacuate all these temporary works from the site or when the Ministerial representatives deems it appropriate.
3. In the case of interrupted work, assume the service of the facilities until the Ministerial representatives or the City authorizes the interruption and its removal.
4. Public protection:
 1. The Contractor shall take all necessary measures to protect the public and workers from injury and public or private property from damage, in accordance with the requirements and regulations of the Commission for Occupational Health and Safety.
 2. The Contractor must comply with all the technical prescriptions of the city.
5. Services equipments:
 1. Provide, install and maintain all temporary service and protection equipment, such as ladders, scaffolding, ramps, landings, etc., necessary for the efficient performance of the work in accordance with applicable laws and codes in force.
6. All scaffolding must be securely closed, not allowing access to unauthorized persons.
- .7 Access road and traffic on the property:
 1. The contractor can not block any access to the property without first coordinating its work with the owner. These must be kept free at all times for pedestrian and fire service traffic.

1.5. LIFTING EQUIPMENT

1. The Contractor shall provide any lifting equipment required for the execution of the work.
2. Provide and install winches and cranes for the movement of workers, materials / equipment and equipment, and maintain and maneuver. Make the necessary financial arrangements with subcontractors for the use of lifting equipment.
3. The operation of winches and cranes must be entrusted to qualified workers.
4. The Contractor shall submit to the Ministerial representatives information indicating the locations and characteristics of winches and cranes proposed for demolition work.

1.6. ON-SITE STORAGE / ADMISSIBLE LOAD

1. Ensure that the work is performed within the limits indicated in the contract documents. Do not clutter the premises unreasonably with materials and equipment.
2. Do not overload or allow overload any part of the work so as not to compromise its integrity.

1.7. PARKING

1. In coordination with the owner, the Contractor may establish at the beginning of the worksite a parking area within the work zone. The number of acceptable parking spaces in the work area and their location will be coordinated at the first site meeting. Following the execution of the work, if it becomes impossible for the Contractor to use this area for parking purposes, the Contractor must then use the parking lots located in the areas authorized by the owner.

1.8. ON SITE OFFICE

- .1 Not applicable.

1.9. STORAGE OF EQUIPMENT, MATERIALS AND TOOLS

The Contractor shall provide, install, and maintain in a clean and orderly condition, lockable weatherproof shelters, with raised floor to allow the storage of equipment, materials, tools and equipment. The Contractor will be solely responsible for his equipment and tools on site

1.10. TOILET INSTALLATION

1. The Contractor shall provide its own sanitary facilities for the duration of the work.
2. Provide toilet facility workers with all applicable regulations and ordinances.
3. Post notices and take precautions prescribed by local public health authorities. Ensure the safety of premises and premises at all times.

1.11. GARBAGE CONTAINERS

1. The Contractor may place a garbage container inside the work area. The container will never be placed less than 5m from any existing building. It will have a metal cover, which will be locked every night and at each interruption of the work.

1.12. SIGNALISATION DE CSITE SIGNALING, PROTECTION AND INDICATOR PANELS

1. The Contractor must respect all the prescriptions, general and specific conditions of the City.

1.13. PROTECTION OF SURROUNDING PUBLIC AND PRIVATE PROPERTIES

1. Protect nearby public and private properties against any damage that may result from the execution of the work.
2. If applicable, assume full responsibility for damage.

1.14. PROTECTIVE CLOSURES OF THE BUILDING

1. Provide the openings of the building with temporary weatherproof protective closures until the permanent elements are installed. Install partitions and temporary structures, including lockable doors as appropriate.

2. Closures shall be constructed to facilitate the placement of materials and work within the construction site.
3. Closures must be designed to withstand wind and snow loads.

1.15. ÉLECTRICAL POWER

1. Provides free of charge according to the needs of the work.
2. Coordinate with the owner the availability of services.

1.16. WATER SUPPLY

1. Provides free of charge according to the needs of the work.
2. Coordinate with the owner the availability of services.

1.17. VENTILATION AND HEATING

1. Not applicable.

1.18. CONSTRUCTION FENCES

- .1 The Contractor must provide and install a construction site fence throughout the entire duration of the work to prevent the public or any unauthorized person from having access to the work site and the building.
- .2 The fence shall be fine-gridded and must be hot-galvanized steel of at least 1,830 mm high and be assembled with steel rods at the top and bottom, and firmly anchored to the ground. The product is same as or equivalent to construction site fence EE6868 from Simplex
- .3 The fence must have a door of sufficient size for the entry and exit of personnel as well as for vehicles and equipment. Sections of fences not anchored and held with a steel wire as a door are prohibited.
- .4 The Contractor must provide a set of keys to the Owner to ensure that authorized personnel always have access to the site.

1.19. FREIGHT ELEVATOR

- .1 The Contractor must take into account that the existing freight elevator of the radar station is not available.

PART 2 - PRODUCTS

- 2.1** Not applicable.

PART 3 - EXECUTION

- 3.1** Not applicable.

END OF THE SECTION

PART 1 – GENERAL CONDITIONS**1.1 SECTION CONTENT**

- .1 Quality, ease of procurement, storage, handling, protection and product transportation.
- .2 Manufacturer's instructions.
- .3 Implementation, coordination and fasteners.
- .4 Reference standards and codes.

1.2 RELATED SECTIONS

- .1 Section 01 73 00 – Executions

1.3 REFERENCE STANDARDS AND CODES

- .1 In the specification text, references to the standards of the organizations listed below can be found :

ACI -American Concrete Institute
ACIB -Association canadienne de l'industrie du bois
ACNOR-Association canadienne de normalisation
ACTTM -Association canadienne de terrazzo, tuile et marbre
AISC -American Institute of Steel Construction
AMCQ -Association des maîtres-couvreurs du Québec
ANSI -American National Standards Institute
ASTM -American Society for Testing and Materials
CCE -Code canadien de l'électricité (publié par l'ACNOR)
CEMA -Canadian Electrical Manufacturer's Association
CNB -Code national du bâtiment
CPCA -Canadian Painting Contractor's Association
CPCI -Canadian Prestressed Concrete Institute
FM -Factory Mutual Engineering
ICCA -Institut canadien de la construction en acier
IEEE -Institute of Electrical and Electronic Engineers
IPCEA -Insulated Power Cable Engineers Association
NAAMM-National Association of Architectural Metal Manufacturers
NEMA -National Electrical Manufacturer's Association
ONGC -Office des normes générales du Canada
ULC -Underwriters' Laboratories of Canada

- .2 References to relevant standards can be made in each section of the specifications document. Comply with the standards listed, in whole or in part as prescribed by the specifications document.

- . 3 In cases where there is doubt as to the compliance of certain products to relevant standards, the Ministerial representatives have the right to verify by testing.
- . 4 If products or systems comply with the contract documents, the costs of these tests shall be borne by the owner, otherwise they shall be borne by the Contractor.
- .5 If no date or specified edition is mentioned or if the specified date has passed, conform to the latest standards at the time of bid submission.
- . 6 Perform the work in accordance with the Quebec Construction Code - Chapter 1, Building, and National Building Code of Canada 2010 building (modified) including amendments and any other state or local codes that apply with modifications, when filing your submission. In the event of any discrepancy or inconsistency, the more stringent requirements shall prevail.

1.4 QUALITY

- .1 Products, materials, equipment, appliances and parts (called "products" in the specifications document) used for carrying out the work must be new, in perfect condition and of the highest quality (according to the terms of the specifications document) to the purposes for which they are intended. If necessary, provide evidence establishing the nature, origin and quality of products supplied.
- .2 Products found to be defective before the end of the work will not be accepted, whatever the findings of previous inspections. Inspections are not intended to relieve the Contractor of his responsibilities, but simply to reduce the risk of omission or error. The Contractor shall ensure the removal and replacement of defective products at his expense, and will be responsible for delays and resulting costs.
- .3 In case of conflict as to the quality or suitability of the products, only the Ministerial representatives will decide upon the matter based on the requirements of the contract documents.
- .4 Unless otherwise stated in the specifications, promote consistency by ensuring that the materials or elements are of the same type and from the same manufacturer.
- .5 Labels, trademarks and permanent nameplates placed prominently on the products used are not acceptable unless they give an operating instruction.

1.5 EASE OF OBTAINING PRODUCTS

- .1 Immediately after signing the contract, consider the requirements for the delivery of products and provide for any delays. If delays in the delivery of products are predictable, notify the Ministerial representatives so that measures can be taken to replace them with alternative products or make the necessary corrections, and to do sufficiently in advance to avoid delays.

- . 2 If the Ministerial representatives have not been notified of foreseeable delivery delays at the start of the work, and it seems likely that the performance of the work will be delayed, the Ministerial representative reserves the right to substitute products with comparable products that can be delivered quickly, and the price of the contract shall not be increased as a result.

1.6 STORAGE, HANDLING AND PRODUCTS PROTECTION

- .1 Handle and store products to avoid any damage, do not alter them or dirty them, and follow the manufacturer's instructions, if any.
- .2 Store the materials in the original packaging or products as grouped into lots; leave packaging intact, showing the manufacturer's label. Do not unpack or untie the products before they are incorporated into the work.
- . 3 Products likely to be damaged by the weather must be kept in a secure storage area.
- .4 Store the timber and sheathing materials on rigid supports so they do not rest directly on the floor. Give a slight slope to facilitate the flow of condensation.
- .5 Store and mix paint products in a heated and well ventilated area. Every day, remove oily rags and other flammable waste from site. Take all necessary precautions to avoid the risk of spontaneous combustion.
- . 6 Replace, at no additional charge, all damaged products to the satisfaction of the Ministerial representatives.
- .7 Refinish, to the satisfaction of the Ministerial representatives, all surfaces that have been damaged. Use refinishing products identical to those used for the original finish. It is prohibited to apply a finish or to retouch nameplates and labels on doors and frames.

1.7 TRANSPORTATION

- .1 Pay the transportation costs of products required for the execution of the work.

1.8 MANUFACTURER'S INSTRUCTIONS

- .1 Unless otherwise prescribed in the specifications, install or implement the products according to the manufacturer's instructions. Do not rely on the information on the labels and containers provided with the products. Obtain, directly from the manufacturer, a copy of their written instructions.

- . 2 Notify in writing the Ministerial representatives of any discrepancies between the requirements of the specifications and the manufacturer's instructions, so that they can take appropriate action.
- . 3 If the manufacturer's instructions have not been followed, the Ministerial representatives may require, without an increase to the contract price, removal and installation of the products that have been set up or installed incorrectly.

1.9 QUALITY OF WORKS

- .1 The work must be of the highest possible quality and the work must be performed by skilled workers, and they must be skilled in their respective disciplines. Notify the Ministerial representatives if the work to be performed is such that they will likely not get the desired results.
- .2 Do not hire unqualified workers or workers who don't have the abilities to carry out the work entrusted to them. The Ministerial representative has the right to refuse any worker found to be incompetent, negligent, insubordinate or whose presence will not be tolerated on the site.
- .3 Only the Ministerial representative can resolve disputes concerning the quality of work and skills of the workforce, and their decision is to be final.

1.10 COORDINATION

- .1 Ensure that workers cooperate among themselves to ensure the realization of the work.

1.11 ELEMENTS TO COVER

- .1 Before covering elements, inform the Ministerial representative of abnormal situations. Perform the installation as directed by the Ministerial representative.

1.12 REPAIR

- .1 Remediation work shall be required to repair or replace parts of elements found to be defective or unacceptable. Coordinate the work to be performed on the affected adjacent work as required.
- .2 The restoration work must be done by specialists familiar with the materials and equipment used; the work must be done so that no part of the work is damaged or is likely to be.

1.13 LOCATION OF DEVICES

- .1 The location shown for devices, outputs and other electrical or mechanical equipment is approximate. The final location can be modified by the Ministerial representatives free of charge.

- .2 Inform the Ministerial representatives of problems that may be caused by the choice of the location of a electromechanical device and install as directed.

1.14 FASTENERS – GENERAL CONDITIONS

- .1 Unless otherwise indicated, provide accessories and metal fittings with the same texture, color and finish as the element on which they are fixed.
- .2 Avoid electrolytic action between metals or dissimilar materials.
- .3 Unless stainless steel fasteners or other materials are prescribed in the relevant section of the specifications, use, for securing the outer works, fasteners and anchors that are corrosion proof and galvanized by hot immersion.
- .4 It is important to determine the spacing of the anchors within the limits loads and shear strength to ensure a permanent anchor. Wooden pegs or other organic matters are not accepted.
- .5 Minimize the use of exposed fasteners; space them out evenly and place them carefully.
- .6 Attachments that could cause chipping or cracking of the element in which they are embedded will be rejected.
- .7 For all appliances and equipments, provide nailing strips for all required locations: walls, floors and ceilings.

1.15 MOUNTING MATERIALS

- .1 Provide fasteners in shapes and standard commercial dimensions, suitable material having a finish surface suitable for the intended use.
- .2 Unless otherwise indicated, use robust fasteners, semi-fine quality, with hex heads. Use stainless steel 304 or the appropriate grade in the case of outdoor installations.
- .3 Stems of bolts must not exceed the top of the nuts by more than the length equivalent to their diameter.
- .4 Use flat washers on equipment and sheet metal lock washers with flexible gaskets on places where there are vibrations. To secure material on stainless steel components, use stainless steel washers.

1.16 PROTECTION OF WORK IN PROGRESS

- .1 Do not overload any part of the building. Unless otherwise indicated, obtain written authorization from the Ministerial representatives before cutting or drilling a structural member or installing a sleeve.

1.17 MATERIAL COMPATIBILITY

- .1 It is essential that the components of assemblies and contiguous materials are compatible. Provide the Ministerial representatives a written declaration that the materials and components assemblies are compatible.
- .2 It is the responsibility of each subcontractor to ensure compatibility between their products and assemblies and assemblies products and other sections.
- .3 Provide the Ministerial representatives a written notice of the incompatibility of some materials and systems so that they can dictate the required changes.

PART 2 - PRODUCTS**2.1 Not applicable.****PART 3 - EXECUTION****3.1 Not applicable.****End of section**

PART 1 - GENERALITIES**1.1 SECTION CONTENT**

- .1 Requirements and restrictions for the execution of the work.

1.2 RELATED SECTIONS

- .1 All other relevant specifications sections, especially when piercing, cutting or refinishing work is required. It is important to warn the Contractor and all other subcontractors in advance of this type of work.

1.3 EXECUTION REQUEST FOR CUTTING AND REFINISHING WORK

- .1 Submit a written request prior to any cutting and refinishing work that may affect the following:
 - .1 the structural integrity of any element of the work;
 - .2 the integrity of the elements exposed to weather or water repellent items;
 - .3 the efficiency, maintenance or safety of any functional element;
 - .4 the aesthetic qualities of all apparent elements.
- .2 The request must specify or include the following:
 - .1 the designation of the project;
 - .2 the location and description of the affected elements;
 - .3 a statement explaining why it is necessary to perform the cutting and refinishing work;
 - .4 a description of the suggested work and products that will be used;
 - .5 alternatives to cutting and refinishing work;
 - .6 the time and date of when the work will be executed.

1.4 MATERIALS

- .1 Materials required for the work, and to refinish the work identically to the existing adjacent materials.
- .2 Any changes in materials must be subject to a request for substitution in accordance with the requirements of Section 01 33 00 - Submittal Procedures.

1.5 PREPARATORY WORKS

- .1 Inspect the construction site to examine the existing conditions and to identify any items that could be damaged or moved during the cutting and refinishing work.
- .2 After taking out the discovered items, inspect them in order to determine any condition that may affect the execution of the work.

- .3 The beginning of the cutting and refinishing work means acceptance of any existing conditions.
- .4 Supply and install visible supports to ensure the structural integrity of the adjacent elements. Provide devices and consider methods to protect other elements that may be used in the work process against any damage.
- .5 Provide protection for surfaces that might be exposed to the weather after uncovering the work.

1.6 EXECUTION

- .1 Execute the cutting jobs, repairing and refinishing work necessary for the realisation of the work.
- .2 Adjust the different elements together so they fit well with the rest of the work.
- .3 Uncover the work to allow the execution of steps which, for one reason or another, should have been made at a different time.
- .4 Remove or replace the defective or non-compliant elements.
- .5 Use methods that are not damaging to the other elements of the work and that will provide surfaces suitable to the work of repairing and refinishing.
- .6 Cut rigid materials using a masonry saw or a core drill. Without prior authorization, it is forbidden to use pneumatic or percussion tools on masonry.
- .7 Deliver the work with the level of finish, quality and products as specified in the requirements of the contract documents.
- .8 Finish the surfaces to ensure consistency with the adjacent finishes. For continuous surfaces, finish all elements up the nearest intersection between two elements; in the case of an assembly of elements, completely refinish the surfaces.

PART 2 - PRODUCTS

- 2.1** Not applicable.

PART 3 - EXECUTION

- 3.1** Not applicable.

END OF SECTION

PART 1 – GENERAL CONDITIONS**1.1 SECTION CONTENT**

- .1 Cleaning during the execution of the work.
- .2 Final cleaning.

1.2 RELATED SECTION

- .1 Section 01 77 00 – Closeout procedures.

1.3 SITE CLEANLINESS

- .1 Keep the site clean and free from accumulation of debris and waste materials other than those generated by the Owner.
- .2 Evacuate debris and waste materials from the site at predetermined intervals or eliminate as directed by the Ministerial representatives. Waste materials should not be burned on site.
- .3 Clean the inside surfaces before the finishing work and keep these areas free of dust and other impurities during the work in question.
- .4 Ensure good ventilation while using volatile or toxic substances. It is forbidden to use the building's ventilation system for this purpose.
- .5 Use only cleaning products recommended by the manufacturer of the surface to be cleaned, and use them according to the product manufacturer's recommendations.

1.4 FINAL CLEANING

- .1 At the substantial completion of the work, remove surplus materials, tools, equipment and construction materials that are no longer necessary for the execution of the remaining work
- .2 Remove debris and waste materials and leave the place clean and ready to occupy.
- .3 Before the final inspection, remove surplus materials, tools, equipment and construction materials.
- .4 Remove all debris and waste materials other than those generated by the Owner.
- .5 Discharge waste materials from the site at predetermined intervals or eliminate as directed by the Ministerial representative. Waste materials cannot be burned on site.

- .6 Make the necessary arrangements and obtain permits from the competent authorities for the removal of debris and scrap materials.
- .7 Clean and polish the windows, hardware parts, wall tiles, chrome and enameled surfaces, laminate surfaces, elements of stainless steel or porcelain-enamel as well as mechanical and electrical devices. Replace any broken windows, or that are scratched or damaged.
- .8 Dust the interior surfaces of the building and vacuum behind the grids, louvers, shutters, registers and screens.
- .9 Examine finishes, accessories and materials to ensure they meet the requirements prescribed for the operation and quality of execution.

PART 2 - PRODUCTS

- 2.1** Not applicable.

PART 3 - EXECUTION

- 3.1** Not applicable.

END OF SECTION

1. PART 1 - GENERAL**1.1. WASTE MANAGEMENT GOALS**

1. Prior to start of Work conduct meeting with Consultants to review and discuss PWGSC's Waste Management Plan and Goals
2. Waste Management Goal is to reduce the total flow of construction / demolition waste to landfills. Provide documentation certifying that comprehensive measures and procedures for waste management, recycling, reuse / reuse of recyclable and reusable materials have been extensively practiced.

1.2. DEFINITIONS

1. Class III: non-hazardous waste - construction, renovation and demolition waste.
2. Inert Fill: inert waste - exclusively asphalt and concrete.
3. Materials Source Separation Program (MSSP): consists of series of onsite activities to separate reusable and recyclable waste material into material categories from other types of waste at point of generation.
4. Recyclable: ability of product or material to be recovered at end of its life cycle and re-manufactured into new product for reuse.
5. Recycle: process by which waste and recyclable materials are transformed or collected for purpose of being transferred into new products.
6. Recycling: process of sorting, cleansing, treating and reconstituting solid waste and other discarded materials for purpose of using in altered form. Recycling does not include burning, incinerating, or thermally destroying waste.
7. Separate Condition: refers to waste sorted into individual types.

1.3. DOCUMENTS AND SUBMITTALS

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

1.4. WASTE PROCESSING SITES

1. Provide contact information and the site's waste management strategy and obtain approval before initiating the disposal of materials.

1.5. STORAGE, HANDLING AND PROTECTION

1. Protect structural components not removed for demolition from movement or damage.
2. Support affected structures. If safety of building is endangered, cease operations and immediately notify Consultants.

1.6. DISPOSAL OF WASTES

1. Do not bury rubbish or waste materials
2. Do not dispose of waste, volatile materials, mineral spirits, hydrocarbon, oil, paint thinner into waterways, storm, or sanitary sewers.

1.7. USE OF SITE AND FACILITIES

1. Execute work with least possible interference or disturbance to normal use of premises.
2. Maintain security measures established by existing facility and provide temporary security measures required for the facility.

1.8. SCHEDULING

1. Not used.

2. PRODUCTS

1. Not used.

3. EXECUTION

1. Not used.

END OF SECTION

PART 1 – GENERAL CONDITIONS**1.1 SECTION CONTENT**

- .1 Administrative arrangements required prior to preliminary and final inspections of the work.

1.2 RELATED SECTIONS

- .1 Section 01 78 00 – Closeout submittals

1.3 INSPECTION AND DECLARATION OF SUBSTANTIAL COMPLETION

- .1 Inspection by the Contractor: The Contractor and subcontractors must inspect the work, identify faults and failures and make the necessary repairs so that everything is consistent with the requirements of the contract documents;
 - .1 Send the Ministerial representatives a written notice once the contractor's inspection is completed and corrections are done.
 - .2 Then present a request that the work be inspected by the Ministerial representatives.
- .2 Inspection by the Ministerial representatives: the Ministerial representatives will conduct an inspection with the contractor of the work in order to identify shortcomings and obvious defects. The Contractor shall make the requested corrections.
- .3 Completion: Submit written documents justifying the following;
 - .1 Work is completed and has been inspected by the Contractor, and found to comply with the requirements of Contract Documents.
 - .2 Malfunctions and defects found during inspections were corrected.
 - .3 Devices and systems have been tested, adjusted and balanced, and they are fully operational.
 - .4 Certificates required by the utilities companies have been submitted.
 - .5 Owner 's staff received the training necessary for the operation of devices and systems.
 - .6 The work is completed and ready for final inspection.
- .4 Final inspection: Once all the aforementioned steps are completed, work is subject to final inspection, which will be conducted jointly by the owner, the Ministerial representatives and the Contractor. If the work is found to be incomplete by the owner and by the Ministerial representatives complete the elements that have not been executed and demand a new inspection be undertaken at a later date.
- .5 Statement of Substantial Completion: When the owner and the Ministerial representatives consider that the shortcomings and defects were corrected and that contract requirements

seem largely satisfied, apply for the production of a certificate of substantial completion of the work.

- .6 Start of the guarantee period and lien period: The date of acceptance by the Employer of the substantial completion of the submitted work will be the starting date of the builder's lien period and the warranty period, unless otherwise prescribed by the law at the place of the work.
- .7 Final Payment: When the owner and the Ministerial representatives consider that the shortcomings and defects have been corrected and that contract requirements are fully met, make an application for final payment. If the work is found to be incomplete by the owner and by the Ministerial representatives, complete the elements that have not been properly executed and reapply for a final inspection.
- .8 Holdback: After the issuance of the certificate of substantial completion of the work, submit a holdback payment request.

1.4. DOCUMENTS

1. Submit the appropriate documents before applying for final payment.
2. Provide guarantees and signed bonds.
3. Carry out the transfer formalities for the payment of labor and materials payment to the warranty period.
4. Provide the following documents:
 1. sworn declaration that all wages or wages of workers have been paid in accordance with the minimum wage scale of the collective labor agreement of the construction industry;
 2. sworn declaration that all subcontractors have been paid;
 3. sworn declaration that all materials incorporated in the project have been paid for;
 4. all the required guarantees;
 5. certificates of compliance with the regulations of the Health and Safety at Work Act; the General Contractor and all subcontractors involved in the project;
 6. operation and maintenance manuals;
 7. for all subcontractors and / or suppliers who have declared their contract to the Owner, provide, for the release of the contractual retention, the final receipts.
 8. any other item required by the

PART 2 - PRODUCTS

- 2.1** Not applicable

PART 3 - EXECUTION

- 3.1** Not applicable.

End of section

PART 1 - GENERALITIES**1.1 SECTION CONTENT**

- .1 Project file, samples and specifications;
- .2 Equipment and devices;
- .3 Product data, materials, equipment and finishes, and related information;
- .4 Sheets and operating and maintenance manuals;
- .5 Replacement materials and equipment, special tools and spare parts;
- .6 Warranties and guarantees.

1.2 RELATED SECTIONS

- .1 Section 01 45 00 – Quality control.
- .2 Section 01 77 00 – Closeout procedures

1.3 PRESENTATION

- .1 Present data in the form of an instruction manual.
- .2 Use rigid binders: vinyl, three D-rings, flip 219 mm x 279 mm, with back and sleeves.
- .3 When providing multiple binders, gather the data in a logical order. Indicate the content of the bindings on the back of each.
- .4 On the cover of each binder, type the name of the document, the name of the project as well as the table of contents.
- .5 Arrange the content according to the numbered sections of the specifications and the order in which they appear in the table of contents.
- .6 Provide for each product and each system, a separator tab on which must be typed the product description and the list of major pieces of equipment.
- .7 The text must consist of printed data provided by the manufacturer or typed data.
- .8 Provide the drawings in a reinforced and perforated tab. Insert them in the binding and fold the large drawings in the format of the text pages.
- .9 Provide all CAD files in DWG and PDF on CD.

1.5 CONTENT OF EACH VOLUME

- .1 Contents: indicate the name of the project:
 - .1 The date of submission of documents;
 - .2 The name, address and telephone number of Ministerial representatives and the Contractor and the names of their representatives;
 - .3 A list of products and systems, indexed to the content volume.
- .2 For each product or system, indicate the following:
 - .1 Name, address and telephone number of subcontractors and suppliers, as well as local distributors of spare parts.
- .3 Product Data: mark each record to clearly identify the specific products and parts as well as the installation data. Remove all the irrelevant information.
- .4 Drawings: drawings are used to complete the worksheets and to illustrate the relationship between the various elements of hardware and systems.
- .5 Typed text: as required to complete the worksheets. Give instructions in a logical order for each procedure, incorporating the manufacturer's instructions specified in Section 01 45 00 - Quality Control.

1.6 DOCUMENTS AND SAMPLES TO BE INCLUDED IN THE PROJECT FILE

- .1 In addition to the documents mentioned in the General Conditions, keep on site, for Ministerial representatives and the owner, a copy of the following documents:
 - .1 Contract drawings;
 - .2 Specifications;
 - .3 Addenda;
 - .4 Change orders and other contract amendments;
 - .5 Shop drawings, revised data sheets and samples in their latest approved versions;
 - .6 Records of tests performed on site;
 - .7 Inspection certificates;
 - .8 Certificates issued by the manufacturers;
- .2 Keep the documents and samples projects filed in the site office, separately from the documents used for work. Provide cabinets and shelves and a safe storage place.
- .3 Label documents and classify them according to the list of section numbers in the table of contents of the project file. Register clearly "Project Folder" in block letters on the label of each document.
- .4 Keep records of the project file dry and legible. Do not use them as documentation of works.

1.7 RECORDING OF WORK CONDITIONS

- .1 Record information on an opaque set of drawings in a copy of the project file that will be handed over to the Ministerial representatives.
- .2 Record information using felt tip markers by providing a different color for each major system.
- .3 Record information as the work takes place. Do not conceal the works before the required information has been recorded.
- .4 Contract Drawings and Shop Drawings: legibly indicate all data in order to show the works as they are, including the following:
 - .1 Location of interior accessories, measured against visible and accessible building elements;
 - .2 Changes about the size and structure of the details;
 - .3 Changes due to change orders;
 - .4 Details that are not included in the original contract documents;
 - .5 References to shop drawings and related changes.
- .5 Work: clearly describe the construction work as it is, including the following:
 - .1 Manufacturer's name, brand name and catalog number of each product actually installed, including optional items and replacement parts;
 - .2 Works resulting from which addendum or change order.
- .6 Other Documents: keep manufacturer certificates, inspection certificates and records of tests performed on site in each of the prescribed specifications sections.

1.8 EQUIPEMENT AND SYSTEMS

- .1 For each piece of equipment and each system: provide a description of the device or system and its constituent parts; indicate its function, normal operating characteristics and constraints; give the characteristic curves with technical data and test results; also be listed as well as the commercial number of replaceable parts.
- .2 Provide manufacturer's written instructions concerning the operation and maintenance of items.
- .3 Provide the list of the original manufacturer parts and illustrations, drawings and assembly diagrams necessary for maintenance.
- .4 Provide a list of spare parts OEM indicating the current prices and the amounts recommended to keep in stock.
- .5 Additional requirements: in accordance with various specifications sections.

1.9 MATERIALS AND FINISHING PRODUCTS

- .1 Construction materials, finishing products and other products apply: provide technical data and provide the catalog number, size, composition and the designations of colors and textures of products and materials. Provide the information necessary to order special products.
- .2 Provide instructions for agents and cleaning methods and the recommended schedules for cleaning and maintenance, and the precautions to be taken against harmful practices and harmful products.
- .3 Water repellents and products exposed to the weather products: provide manufacturer's recommendations relating to agents and cleaning methods and the recommended schedules for cleaning and maintenance, and the precautions to be taken against harmful methods and harmful products.
- .4 Additional requirements: in accordance with various specifications sections.

1.10 SPARE PARTS

- .1 Provide spare parts in the quantities specified in individual specification sections.
- .2 Parts supplied must be from the same manufacturer and be of the same quality as the elements incorporated in the work.
- .3 Deliver and store spare parts at the specified location.
- .4 Receive and catalog all the pieces, and then submit the inventory list to the Ministerial representatives. Insert the list approved in the maintenance manual.
- .5 Obtain receipts of all delivered parts and submit before the final payment.

1.11 REPLACEMENT MATERIALS / EQUIPMENT

- .1 Not applicable.

1.12 SPECIAL TOOLS

- .1 Not applicable.

1.13 STORAGE HANDLING AND PROTECTION

- .1 Not applicable.

1.14 WARRANTIES AND GUARANTEES

- .1 Separate each guarantee or warranties with a separator tab marked according to the list given in the table of contents.
- .2 Provide a list of contractors, suppliers and manufacturers, with the name, address and telephone number of the designated lead for each.
- .3 Obtain warranties and bonds signed in duplicate by subcontractors, suppliers and manufacturers, within ten (10) days of completion of the work package concerned.
- .4 Except for items commissioned with the approval of the Ministerial representatives, do not change the effective date of the guarantee until the substantial completion date has been determined.
- .5 Ensure that documents are in proper form, they contain all the necessary information and are notarized.
- .6 Countersign documents to submit when needed.
- .7 Retain warranties and bonds until the prescribed time for their recovery.

PART 2 - PRODUCTS

- 2.1** Not applicable.

PART 3 - EXECUTION

- 3.1** Not applicable.

End of section

1. GENERALITY**1.1. SECTIONS CONNEXES**

1. Not applicable.

1.2. DESCRIPTION

1. Two (2) weeks prior to the date of the provisional completion of the work, demonstrate to the Owner's personnel the operation and maintenance operations of the installed appliances, equipment and systems.
2. The Employer will provide a list of the staff members who will take this training and will, at the agreed times, attend the sessions organized for this

1.3. QUALITY CONTROL

1. When required by certain sections, require an authorized representative of the manufacturer to demonstrate the operation of the devices, equipment and systems, provide appropriate training to the Owner's personnel, and provide a written document confirming that such demonstration was carried out and that related training was given.

1.4. DEMONSTRATION AND FORMATION

1. Demonstrate how to get started, operate, control, adjust, troubleshoot, maintain and maintain each device, hardware and system.
2. Teach staff all stages of the operation and maintenance of equipment, materials and systems using the operation and maintenance manuals provided.
3. Conduct a detailed review of the contents of these manuals to explain all aspects of operation and maintenance.
4. Gather, where appropriate, the additional data used during the training and insert them in the appropriate form in the operation and maintenance manuals

2. PRODUCTS

1. Not applicable.

3. EXÉCUTION

1. Not applicable.

END OF THE SECTION

Part 1 General**1.1 RELATED REQUIREMENTS**

- .1 Section 21 05 00 - Common Work Results for Fire Suppression.
- .2 Section 23 05 93 - Testing, Adjusting and Balancing for HVAC.
- .3 Section 23 11 13 - Facility Fuel-Oil Piping.
- .4 Section 23 31 13.01 - Metal Ducts: Low Pressure to 500 Pa.
- .5 Section 26 12 16.01 - Dry-Type Transformers up to 600 V.
- .6 Section 26 24 16.01 - Panel Boards: Breaker Type.
- .7 Section 26 28 16.02 - Moulded Case Circuit Breakers.
- .8 Section 26 29 10 - Motor Starters to 600 V.
- .9 Section 26 32 13.03 - Installations of Electric Power Generating Equipment.
- .10 Section 26 36 23 - Automatic Transfer Switches.
- .11 Section 26 50 00 - Lighting.

1.2 REFERENCE STANDARDS

- .1 ASHRAE Guideline 0-2005.
- .2 ASHRAE Guideline 1.1-2007.
- .3 Building Commissioning Association Standard (BCA).
- .4 ACG Commissioning Guideline.
- .5 Commissioning Guide for the New Construction ("CanmetÉnergie/Ressources naturelles Canada").
- .6 CSA-Z320-11 - Building Commissioning.

1.3 OBJECTIVES

- .1 The commissioning is a quality process that aims to ensure that all building systems reach the planned objectives. This methodology begins with the design phase and continues to project construction and acceptance with the verification of system performance, and validation, optimization of operating sequence. The main goals of the commissioning are:
 - .1 Verify installed equipment, systems and integrated systems operate in accordance with contract documents, design criteria, and Departmental Representative requirements;
 - .2 Complete project on schedule;
 - .3 Verify and document performance of all systems and equipment;
 - .4 Ensure appropriate documentation is compiled into the Building Management Manual;
 - .5 Effectively train O&M staff;
 - .6 Optimize life cycle costs of equipment and improve the energy performance of systems;
 - .7 Reduce operating costs and maintenance.

1.4 ACRONYMS

- .1 CxA : Commissioning Agent.
- .2 Cx: Commissioning.
- .3 OPR: Departmental Representative's Project Requirements.
- .4 BOD: Basis of design.
- .5 TAB: Testing, Adjusting and Balancing.
- .6 CxRO: Commissioning Representative for the Departmental Representative.
- .7 CxRC: Commissioning Representative for the Contractor.
- .8 BAS: Building Automation System.
- .9 GS : General and sub-contractors.

1.5 DEFINITION

- .1 The Cx Authority: Person appointed by the Departmental Representative to lead the process of CX and submit a final report to the Departmental Representative on performance of the systems and the whole process.

- .2 Cx Team: The team members are Cx Authority, the project manager, Departmental Representative, the Architect, the design Engineer, the General Contractor, the equipment suppliers and the Subcontractors.
- .3 Commissioning Plan: An evolutive document that defines the activities of the Cx project, the schedule, the documentation requirements, and the roles and responsibilities of team members.
- .4 Cx Calendar: General Contractor must coordinate with the Cx Authority to establish a protocol and a timetable for Cx systems and equipment, which will be updated with progress.
- .5 Deficiencies and Noncompliances Register: It is an official and evolutive directory of the deficiencies and anomalies (with solution when required) that the Cx Authority or other member of the Cx team will have observed during the process.
- .6 PERFORMANCE VERIFICATION (PV) FORMS: PV forms to be used for checks, running dynamic tests and adjustments carried out on equipment and systems to ensure correct operation, efficiently and function independently and interactively with other systems as intended with project requirements.
- .7 PRODUCT INFORMATION (PI) REPORT FORMS: Product Information (PI) forms compiles gathered data on items of equipment produced by equipment manufacturer, includes nameplate information, parts list, operating instructions, maintenance guidelines and pertinent technical data and recommended checks that is necessary to prepare for start-up and functional testing and used during operation and maintenance of equipment. This documentation is included in the BMM at completion of work.
- .8 Installation Control Form/and start-up: Forms provided by the manufacturer or the Departmental Representative, which include checklist for proper installation of equipment.
- .9 Cx Coordinator of the Contractor: Person at the service of the Contractor, responsible for coordinating the activities of the commissioning.
- .10 Cx Coordinator of the Departmental Representative: Person at the service of the Departmental Representative, responsible for coordinating the activities and for supporting the commissioning activities.

Part 2 CX steps**2.1 CX PROCESS**

- .1 Use this Cx Plan as master planning document for Cx:
 - .1 Outlines organization, scheduling, allocation of resources, documentation, pertaining to implementation of Cx;
 - .2 Communicates responsibilities of team members involved in Cx Scheduling, documentation requirements, and verification procedures;
 - .3 Sets out deliverables relating to O&M, process and administration of Cx;
 - .4 Describes process of verification of how works meet design requirements to ensure that the design requirements are met;
 - .5 Produces a complete functional system prior to issuance of the certificate of occupancy;
 - .6 Management tool that sets out scope, standards, roles and responsibilities, expectations, deliverables, and provides:
 - .1 Overview of Cx;
 - .2 Commissioned systems;
 - .3 Construction checklists;
 - .4 The overview of the Cx activities during the pre-design, design, construction, occupation, and operation phases;
 - .5 Cx schedule;
 - .6 Process and methodology for successful Cx;
 - .7 The expected objectives and results of the Cx;
 - .8 The list of team members, their responsibilities and expected deliverables;
 - .9 The training documents;
 - .10 O&M manual requirements.
- .2 Refinement of Cx Plan: During construction phase, revise, refine and update Cx Plan to include:
 - .1 Changes resulting from Client program modifications;
 - .2 Approved design and construction changes;
 - .3 Results of previous steps.
- .3 Overview of the process:
 - .1 Develop the Departmental Representative's Project Requirements (OPR), and ensure they are included in the basis of design (BOD).
 - .2 Develop a Cx plan and presenting it to the Cx team at the starting meeting.
 - .3 Coordinate with Contractors to establish a methodology for functional tests of equipment.

- .4 Develop a record of anomalies and deficiencies.
- .5 Oversee staff training.
- .6 Reviewing operation and maintenance manuals.
- .7 Optimize and validate the sequences of operation and solve the identified problems.

2.2 CONFLICTS

- .1 Report conflicts between requirements of this section and other sections to Departmental Representative before start-up and obtain clarification.
- .2 Failure to report conflict and obtain clarification will result in application of most stringent requirement.

2.3 COMPOSITION AND RESPONSIBILITIES OF CX TEAM

- .1 Cx Authority (Stantec):
 - .1 Organize and lead the Cx team.
 - .2 Develop a Cx plan and include it in the construction document as well as updating it regularly.
 - .3 Organize and conduct Cx meetings, and draw up the minutes.
 - .4 Provide the Construction Checklists.
 - .5 Perform site inspections, check functional performance and attend tests.
 - .6 Oversee the process of training staff.
 - .7 Review operation and maintenance manuals.
 - .8 Maintain up to date the list of the validity dates of the guarantees.
 - .9 Approve or oversee the Commissioning process, balancing reports and sequences of operation in collaboration with the Cx Coordinator of the Departmental Representative.
 - .10 Prepare a final Cx report summarizing undertaken works and the results of all tests.
 - .11 Issuing a Cx acceptance report to validate the certificate of provisional acceptance.
- .2 Departmental Representative:
 - .1 Assist to Cx meetings.
 - .2 Verify installations.
 - .3 Attend selectively to installation Cx.
 - .4 Make lists of deficiencies relating to the installation and testing.
 - .5 Provide appropriate training sessions on the concept and the objectives of different systems.
 - .6 Verify Cx reports.

- .7 Help resolve any problem related to the design, equipment, installation or operation.
- .3 Contractors, Contractor's representative and Sub-contractors:
 - .1 Assist to Cx meetings.
 - .2 Consolidate Cx steps in the construction schedule.
 - .3 Perform tests and functional tests on equipment and systems.
 - .4 Fill the Performance Verification (PV) Forms and Product Information (PI) Report Forms.
 - .5 Complete and provide to the Cx Authority the Cx schedule.
 - .6 Submit the different required reports.
 - .7 Coordinate and convene manufacturer representatives at the different steps of the Cx and to the meetings when requested.
 - .8 Produce operation and maintenance manuals.
 - .9 Provide training sessions required for installed equipment as recommended by the Cx Authority.
 - .10 Correct deficiencies.
 - .11 Issue the appropriate warranties
 - .12 Perform seasonal testings.
- .4 Departmental Representative, Users, Cx coordinator for Departmental Representative, and Operation and Maintenance Members:
 - .1 Attend Cx meetings.
 - .2 Participate to training sessions.
 - .3 Facilitate the coordination work between the Cx Authority and the General Contractor.
 - .4 Raise any issues found during the Cx.
 - .5 Follow the process and work with the Cx Authority.

2.4 MANUFACTURER'S INVOLVEMENT

- .1 Employ the following Cx participants to verify performance of equipment and systems:
 - .1 Installation contractor/subcontractor.
 - .1 Equipment and systems except as noted.
- .2 Equipment manufacturer: equipment specified to be installed and started by manufacturer:
 - .1 To include performance verification.
- .3 Factory testing: manufacturer to:
 - .1 Coordinate time and location of testing;

- .2 Provide testing documentation for approval by Cx Authority;
- .3 Arrange for Cx Authority to witness tests;
- .4 Obtain written approval of test results and documentation from Cx Authority before delivery to site.
- .4 Obtain manufacturers installation, start-up and operations instructions prior to start-up of components, equipment and systems and review with Cx Authority:
 - .1 Compare completed installation with manufacturer's published data, record discrepancies, and review with manufacturer.
 - .2 Modify procedures detrimental to equipment performance and review same with manufacturer before start-up.
- .5 Integrity of warranties:
 - .1 Use manufacturer's trained start-up personnel where specified elsewhere in other divisions or required to maintain integrity of warranty.
 - .2 Verify with manufacturer that testing as specified will not void warranties.
 - .3 Qualifications of manufacturer's personnel:
 - .1 Experienced in design, installation and operation of equipment and systems;
 - .2 Ability to interpret test results accurately;
- .6 Specialized companies: required participation in the case of equipment and systems supplied and installed by a specialist company.

2.5 COMMISSIONED SYSTEMS

- .1 Commission mechanical systems and associated equipment:
 - .1 HVAC and exhaust systems.
 - .1 HVAC ducts and systems.
 - .2 Cooling and heating systems.
 - .2 Fire and life safety systems.
 - .1 Wet pipe sprinkler systems.
 - .2 Standpipe and hose systems.
 - .3 Fire extinguishers.
 - .3 Noise and vibration control systems for mechanical systems.
 - .4 Seismic restraint and control measures.
 - .5 Building management system (BMS).
- .2 Commissioning of electrical systems and equipment:
 - .1 Low voltage below 750 V.
 - .1 Low voltage equipment.

- .2 Low voltage distribution systems.
- .2 Lighting systems.
 - .1 Lighting equipment.
 - .2 Distribution systems.
 - .3 Emergency lighting systems, including battery packs.
 - .4 Fire exit emergency signage.
- .3 Fire alarm systems, equipment.
 - .1 Detection system.
 - .2 Signalling system.
- .4 Generator.
 - .1 Provide an on-site load bank of sufficient capacity to test the generator at 100% rated power.

2.6 INSTRUMENTS

- .1 Each report must indicate what tools were used for measures in the report.
 - .1 Balancing devices.
 - .2 Thermometers and manometers.
 - .3 Air quality devices.
 - .4 Multimeters.
 - .5 Luxmeter.
- .2 The operation and maintenance manual must include the list of instruments used, including: serial number, the current certificate of calibration, calibration date, date of expiration of the calibration and the accuracy of the calibration.
- .3 Upon request, submit the instruments and equipment for the examination and approval by the Cx Authority.

2.7 DELIVERABLES RELATING TO THE CX PROCESS

- .1 Audit of the principles of basis of design, ensure that they meet the requirements of the Departmental Representative.
- .2 Cx Plan.
- .3 Static verification of installation and components.
- .4 Quality and performance control by using functional tests on systems and equipment.
- .5 Training Plans.
- .6 Operation and maintenance manual.

- .7 Final Cx Reports.

2.8 COMMISSIONING MEETINGS

- .1 Convene Cx meetings.
- .2 Purpose: to explain process, resolve issues, monitor progress, identify deficiencies, relating to Cx.
- .3 Continue Cx meetings on regular basis until commissioning deliverables have been addressed.
- .4 At 60% construction completion stage, Departmental Representative must call a separate Cx scope meeting to review progress, discuss schedule of equipment start-up activities and prepare for Cx. Issues at meeting to include:
 - .1 Review duties and responsibilities of Contractor and subcontractors, addressing delays and potential problems.
 - .2 Determine the degree of involvement of trades and manufacturer's representatives in the commissioning process.
- .5 Thereafter, Contractor must call CX meetings with Sub-Contractor, to be held until project completion and as required during equipment start-up and functional testing period.
- .6 Meeting will be chaired by Cx Agent, who will record and distribute minutes.
- .7 Ensure subcontractors and relevant manufacturer representatives are present at Cx meetings when there as required.

2.9 AUTHORITIES HAVING JURISDICTION

- .1 Where specified start-up, testing or commissioning procedures duplicate verification requirements of authority having jurisdiction, arrange for authority to witness procedures so as to avoid duplication of tests and to facilitate expedient acceptance of facility.
- .2 Obtain certificates of approval, acceptance and compliance with rules and regulation of authority having jurisdiction.
- .3 Include certificates of approval, acceptance and compliance with the operation and maintenance manual, and provide copies upon request Departmental Representative.

2.10 AERAULIC AND HYDROLIC BALANCING

- .1 Perform aeraulic and hydrolic balancing, as specified in the relevant sections. Validate the balancing method with the Cx Authority or the Departmental Representative. Produce

reports within 10 days after a series of interventions. Reports must indicate the observed anomalies.

2.11 CONTROL CX

- .1 Perform Cx control, as required in the relevant sections.
- .2 Submit graphic trends (30 days) for the main control loop.
- .3 Produce reports and verifications as Cx forms.

2.12 STARTUP OF INTEGRATED EQUIPMENT

- .1 Make the startup of equipment that require prior completion of the various disciplines. These devices can be started when:
 - .1 The installation is complete.
 - .2 The power supply is checked.
 - .3 Water network balancing is completed.
 - .4 Auxiliary services are completed.
- .2 Obtain the list of manufacturers to confirm compliance of the installation before the Cx equipment.
- .3 Fill in the Cx forms of equipment, submitted by the Cx Authority or manufacturers, if they include all required information.
- .4 Cx reports must specify the conditions under which the startup was made. These conditions include:
 - .1 External ambient conditions.
 - .2 The supply voltage.
 - .3 The pressure and supply temperature of auxiliary services.
 - .4 Any special condition that may influences the performance.
- .5 Integrated systems include the following:
 - .1 Systems related to indoor air quality.
 - .2 Automatic regulation systems for rooms.
 - .3 Fire alarm systems.
 - .4 Fire pumps and controllers.
 - .5 Emergency lighting systems.

2.13 CONSTRUCTION CHECKLISTS (STATIC VERIFICATION FORMS)

- .1 These control forms of the installation must include the following:

- .1 Installation instructions provided by the manufacturer and controls recommended by the manufacturer;
- .2 Specific procedures established in technical relevant section;
- .3 Procedures considered as good practice in installation and construction of mechanical/electrical, and deemed necessary to a proper and effective operation of the equipment and systems.
- .2 The control forms for the installation, provided by the manufacturer, are also acceptable. If the Cx Authority deems them necessary, lists of additional data will be required in case of projects with special conditions.
- .3 Use control forms to verify the installation of equipment and systems involved. Confirm on the document the verifications carried out, indicate anomalies and deficiencies identified and corrective measures implemented.
- .4 Provide to the Cx Authority the control forms which have been duly signed by the subcontractor concerned or the representative of the manufacturer, once the process is completed, to confirm that the audits and inspections were actually performed. These forms will be required at the time of Cx and will be joined in the operation and maintenance manual at the project completion.
- .5 The control forms that are used in the Cx must be strictly complied with at the time of equipment and systems Cx.

2.14 FUNCTIONAL TESTINGS (DYNAMICS)

- .1 Before testing begins, check:
 - .1 That the Construction Checklist forms are available and filled.
 - .2 That the installation of components, equipment, systems and related subsystems is completed.
 - .3 That the requirements and test procedures are well understood by all interveners.
 - .4 That the design criteria, the design intention and characteristics are well understood.
 - .5 That complete Cx documentation is up to date and available.
 - .6 That the Cx calendar is up to date.
 - .7 That all systems are completely cleaned.
 - .8 That the required tests in the different sections were made and reports were submitted.
 - .9 That the TAB operations of equipment and systems are completed and that relevant reports have been submitted to Departmental Representative, for consideration and approval.
 - .10 That the provisions related to records are taken.

- .11 Provide an on-site load bank of sufficient capacity to test the generator at 100% rated power.
- .12
- .2 Duration of Testing:
 - .1 All equipment and systems specified in Cx plan must be subjected to functional tests for a continuous period of 30 days. During this period, the Contractor must correct the deficiencies and make necessary adjustments to optimize the systems and obtain the specified performance. The changes must be recorded and documented.
 - .2 During the testing period, conduct periodic audits and produce reports every three days to confirm the sequence of tests.
- .3 The Cx forms are documents on which are recorded the results of audits, functional tests (dynamic) and adjustments that have been carried out on equipment and systems concerned in order to ensure they work efficiently and effectively, alone or in interaction with others, as required by work.
- .4 The Cx forms also include documents on which the Contractor has recorded the readings and the data measured during functional testing and in the control process of the performance of equipment and systems concerned.

2.15 TESTS RECORDING

- .1 Before testing starts, the Contractor must take required dispositions and set up recording equipment required to produce reports that assess test compliance.
- .2 When possible, the permanent monitoring equipment can be used if the equipment were calibrated following the procedures and using instruments with calibration certificates that have been submitted.
- .3 Equipment must be able to record the required measures every 15 or 30 minutes throughout the duration of the tests, or more frequently if required for the test validation, when requested by Departmental Representative or Cx Authority.
- .4 The required measures must allow to certify:
 - .1 The stability of the equipment and measured values.
 - .2 The proper functioning of equipment with required efficiencies under different loads, including operation at full load and at minimum conditions.
 - .3 The startup sequence of equipment.
- .5 If testing and measurement does not confirm the operation under conditions considered representative, the Cx Authority may require additional specific tests. At least one additional test will be asked for verification of networks in heating or cooling mode, depending on whether the official 30-day trials have been carried out in summer or winter.

- .6 The General Contractor must assume the responsibilities and inspection costs, including disassembly and reassembly after approval, testing and adjustment of equipment and systems, as well as the provision of test equipment.

2.16 PERFORMANCE VERIFICATION TOLERANCES

- .1 Application tolerances:
 - .1 Specified range of acceptable deviations of measured values from specified values or specified design criteria. Except for special areas, to be within $\pm 10\%$ of specified values.
- .2 Instrument accuracy tolerances:
 - .1 To be of higher order of magnitude than equipment or system being tested.
- .3 Measurement tolerances during verification:
 - .1 Unless otherwise specified actual values to be within $\pm 2\%$ of recorded values.

2.17 COMMISSIONING SCHEDULE

- .1 The General Contractor, in collaboration with the Cx Authority, prepare a detailed Cx schedule, which must include the following:
 - .1 Cx meeting program.
 - .2 Sequence of testing of equipment and systems, interrelation between the various tests, test duration and periods of training.
 - .3 Expected date of installation control of each equipment and system.
 - .4 Expected date for the Cx of each equipment and system.
 - .5 Expected date for the transmission of operation and maintenance manuals.
 - .6 Expected date for training.
 - .7 Expected date for the delivery of Cx final report.
 - .8 Expected date of seasonal tests if applicable.
- .2 Detailed training schedule to demonstrate no conflicts with testing, completion of project and hand-over.
- .3 After approval, incorporate Cx Schedule into Construction Schedule.
- .4 The Cx team must monitor the progress of the Cx with respect to schedule and update as needed.

2.18 STANDARDS AND PROCEDURES FOR CX OF MECHANICAL INSTALLATIONS

- .1 Wet Automatic Sprinkler Systems.
 - .1 Perform tests of installed systems in accordance with NFPA 13.
- .2 Fire pumps, pressure regulators, transfer switches, and controllers.
 - .1 Perform tests in accordance with NFPA 20.
 - .2 Ensure regulatory pumps have enough capacity to prevent the repetition start of fire pumps.
- .3 Fire Protection Systems Integrated.
 - .1 Upon testing different systems completed, test the integrated systems to ensure that the different components work together as designed.
 - .2 Once the fire alarm connections and the Cx regulatory pressure pumps are completed, test the flow sprinklers.
- .4 Energy meters for hot water systems, chilled water, and electricity.
 - .1 Make Cx of energy meters after the power systems, in order to modify the ranges and make necessary adjustments to reflect actual operating conditions.
- .5 Plumbing Systems.
 - .1 Place the water plumbing systems; conduct inspections prior to the Cx. Then proceed with rinsing, cleaning and disinfecting the systems.
 - .2 Make testing of plumbing systems and associated piping in conjunction with the test systems and water treatment systems, control/regulation related.
- .6 HVAC Systems.
 - .1 Prior to conceal HVAC systems, test and certify the air ducts, pipes and ducts to conceal in accordance with the standards indicated;
 - .2 Perform the initial audit checklists HVAC systems, subjecting them to a trial run in stand-alone mode and conduct inspections prior to the Cx.
 - .3 Do not proceed with the Cx of the HVAC systems until the construction dust generating is completed and the areas concerned have been dusted.
 - .4 Turn on HVAC systems to replace the temporary heating source, after obtaining the written approval of the Departmental Representative.
 - .5 Operate HVAC systems to allow the holding TAB operations and ensure they are fully compliant with the contract documents, once installed fire damper, caulking and sealing envelope completed, bulkheads and interior doors installed, and return air plenums in place.

- .7 Hydraulic Systems.
 - .1 Perform cleaning and rinsing of these systems once they were completed, and proceed with the initial startup of the pumps in stand-alone mode and inspections prior to the start-up were performed.
 - .2 Perform Cx hydraulic systems and ensure that water treatment systems have been commissioned.
 - .3 Those systems must be commissioned at the same time as the TAB operations for HVAC.
- .8 HVAC and Hydraulic Systems Related.
 - .1 Test these systems in conjunction with the testing of system power management and fire and smoke detection systems.
- .9 At this stage, the elements that may have a negative effect on the operation and maintenance must be the subject of a preliminary intervention. These elements must be commissioned simultaneously with the integrated equipment and systems.
 - .1 Integrated systems.
 - .1 Monitor performance of Building Management Systems, fire protection and other integrated systems once TAB operations of these systems are completed, to ensure their compliance with prescribed requirements.
 - .2 Vibration isolation and measurements and seismic protection devices.
 - .1 Test these devices at the same time as the test systems which they are connected to.
 - .3 Equipment and systems subject to standards and codes specified or approved by a competent authority.
 - .1 Make Cx of the equipment and systems as required by codes, standards and authorities concerned.
 - .2 Where tests are subject to regulatory requirements and that there are appropriate procedures for Cx, ensure that these tests are carried out in accordance with these requirements (e.g. codes). For the purposes of quality assurance, these tests must be performed in the presence of the Departmental Representative and Cx Authority.
- .10 Building Automation System.
 - .1 The system test performance and point to point must be performed by the Contractor under the supervision of the Departmental Representative or Cx Authority, and then checked through the control system.
 - .2 Demonstrate the operation of all systems in all operating conditions, before the trial period of 30 days, in the presence of the Departmental Representative and Cx Authority. This demonstration must include simulated trials in opposite seasons. Conduct an audit of programming and operating sequences of ECMS after TAB operations completed during the probationary period prescribed for

30 days. Data gathered during these tests must be registered to control panels or ECMS.

2.19 STANDARDS AND PROCEDURES FOR THE CX OF THE ELECTRICAL INSTALLATIONS

- .1 Low Voltage Systems.
 - .1 These systems include low voltage lighting systems.
- .2 Lighting Security Systems.
 - .1 Verify the operation of these systems by cutting the normal supply.
 - .2 Then verify if the area illuminated by the devices is appropriate.
- .3 Fire Alarm Systems.
 - .1 Make functional tests after considering all other aspects of the safety of persons and property.
 - .2 Testing must be reviewed fully in accordance with the requirements of ULC.

2.20 CORRECTION OF DEFICIENCIES

- .1 The Cx Authority must give Cx lists of deficiencies in accordance with specific conditions.
- .2 If equipment, systems, components and control/regulation devices have been incorrectly installed or have anomalies during the Cx, correct anomalies, repeat equipment and components verification of the non-operating system, including related systems therefore, if the Departmental Representative and the Cx Authority ask for them to ensure that the system works as it should.
- .3 The Contractor must assume all costs associated with corrections, inspections and additional tests to determine the acceptability and performance of these elements. These costs will be deducted from payments or will be retain.

2.21 VERIFICATION OF THE RESULTS

- .1 Labor:
 - .1 Provide manpower and instrumentation to verify up to 30% of reported results, unless specified otherwise in other sections. Number and location to be at discretion of Cx Authority.
- .2 Conduct tests repeated during verification under same conditions as original tests, using same test equipment, instrumentation.
- .3 Review and repeat commissioning of systems if inconsistencies found in more than 20% of reported results.

- .4 Perform additional commissioning until results are acceptable to Departmental Representative and Cx Authority.

2.22 REPEAT VERIFICATIONS

- .1 Assume costs incurred by Departmental Representative and Cx Authority for third and subsequent verifications where:
 - .1 Verification of reported results fails to receive Departmental Representative's approval.
 - .2 Repetition of second verification again fails to receive approval.
 - .3 Departmental Representative and Cx Authority deems Contractor's request for second verification was premature.

2.23 TEST RESULTS

- .1 If start-up, testing and/or PV produce unacceptable results according to Departmental Representative or Cx Authority, repair, replace or repeat specified starting and/or PV procedures until acceptable results are achieved.
- .2 Provide labor and materials, assume costs for re-commissioning.

2.24 SEASONAL TESTING:

- .1 If requested by the Cx Authority, additional testing during the opposite season may be performed.

2.25 EXTRAPOLATION OF RESULTS

If the Commissioning is sensitive to occupancy, weather, or seasonal variations and it can not be performed with design parameters, the results may be extrapolated for partial loads, however it must be approved by the Departmental Representative and the Cx Agent. The extrapolation must be carried out in accordance with the instructions of the equipment and systems manufacturer, using the data from the manufacturer and with his assistance, using an approved form.

2.26 ACTIVITIES UPON COMPLETION OF COMMISSIONING

- .1 When changes are made to baseline components or system settings established during Cx process, provide updated Cx form for affected item.

2.27 DEPARTMENTAL REPRESENTATIVE'S PERFORMANCE TESTING

- .1 Performance testing of equipment or system by Departmental Representative will not relieve Contractor from compliance with specified start-up and testing procedures.

2.28 ACTIVITIES DURING WARRANTY PERIOD

- .1 Cx activities must be completed before issuance of Interim Certificate, it is anticipated that certain Cx activities may be necessary during Warranty Period, including:
 - .1 Fine tuning of HVAC systems.
 - .2 Adjustment of ventilation rates to promote good indoor air quality and reduce deleterious effects of VOCs generated by off-gassing from construction materials and furnishings.
 - .3 Seasonal adjustments: Control Contractor have to provide 10 hours for multiples site visits for fine tuning or complains.

2.29 TRAINING SCHEDULE

- .1 Following training sessions are required:
 - .1 Section 21 13 13 - Common Work Results for Fire Suppression (2 hr.).
 - .2 Section 25 90 01 - EMCS: Site Requirements Applications and Systems Sequences of Operation (8 hr.).
- .2 Each training responsible must provide:
 - .1 Training plan.
 - .2 List of persons that must attend training.
 - .3 Training location.
 - .4 Objectives.
 - .5 Subjects (description, time, techniques, etc.).
 - .6 Training duration for each subject.
 - .7 Training methods.
- .3 Coordinate trainings to be given according to the requirements of the different sections, with the initial training will be given by the Departmental Representative.
- .4 The training by the Departmental Representative must include the following:
 - .1 Review of facility and occupancy profile.
 - .2 Functional requirements.
 - .3 System philosophy, limitations of systems and emergency procedures.
 - .4 Verification of operation and maintenance documents.
 - .5 Review of all systems using simplified diagrams for the cooling water systems, water condensers or heat exhausts, heating systems, gas supply, fuel, air and exhaust system.
- .5 The training by the Contractor must include the following:
 - .1 Review of system layout, equipment, components and controls.

- .2 Equipment and system start-up, operation, monitoring, servicing, maintenance and shut-down procedures.
- .3 System operating sequences, including step-by-step directions for starting up, shut-down, operation of valves, dampers, switches, adjustment of control settings and emergency procedures.
- .4 Maintenance and servicing.
- .5 Trouble-shooting diagnosis.
- .6 Inter-Action among systems during integrated operation.
- .6 Deliver training during regular working hours, training sessions to be 3 hours in length.
- .7 Training to be completed prior to acceptance of facility.
- .8 Visual recordings of trainings can be requested by the Departmental Representative.

2.30 OPERATION AND MAINTENANCE MANUAL

- .1 Operating and maintenance manuals must be checked by the Cx Authority before final inspection by the Departmental Representative who retains the final copies.
- .2 Operation and maintenance manuals must include the following:
 - .1 A summary;
 - .2 The list of the Contractors and emergency information;
 - .3 Command and regulation network diagrams of each network, including ambient circuit;
 - .4 A description of each system or each installation and its control device;
 - .5 A description of the operation of each system or each installation, under various loads, with program of setpoint and indication of seasonal variations modifications;
 - .6 Instructions on the operation of each system or each facility and each component;
 - .7 A description of measures to be taken in case of equipment failure;
 - .8 A color code;
 - .9 Instructions for maintenance, repair, operation and how to identify defects in each piece of equipment;
 - .10 The information on the periodicity of tasks to be done, as well as tools, parts and time needed for all these tasks;
 - .11 The performance data provided by the equipment manufacturer stating the points of use of equipment, once the Cx is completed;
 - .12 The Cx forms for all equipment and systems;
 - .13 Any other specific performance data specified elsewhere in the contract documents;
 - .14 TAB reports for each system;

- .15 The name, address and phone number of the manufacturer or supplier and the Contractor who performed the installation;
 - .16 The shop drawings approved;
 - .17 The "As-built" drawings;
 - .18 The description of the exact operation, step by step, of each system installed;
 - .19 The description of the procedure, step-by-step, for the start up and stopping, in order to have a safe and reliable operation;
 - .20 A list of the different parts of the equipment that could be replaced on a regular basis, giving the replacement interval;
 - .21 The list of spare parts and the names, address and telephone numbers of suppliers of all equipment, engines and accessories supplied and installed, with reference to the appropriate section.
 - .22 The final Cx report.
- .3 Approval:
- .1 For approval, submit to the Cx Authority and to the Departmental Representative, the copy of the operation and maintenance manual draft. Unless otherwise directed by the Cx Authority and the Departmental Representative, the forms must not be submitted individually.
 - .2 Make the necessary changes in the operation and maintenance manual and resubmit as directed by the Cx Authority and the Departmental Representative.
 - .3 Provide a final copy of the operation and maintenance manual to the Cx Authority and 3 final copies to the Departmental Representative.
- .4 Additional Information:
- .1 Prepare additional information forms and attach them to the operation and maintenance manual when the demonstrations or the instruction execution described above demonstrate that such records are necessary.
- .5 The operation and maintenance manual must be presented in a ring binder and must respect the order of the sections in the specifications.

END OF SECTION

APPENDIX 1
(Section 01 91 13.13)
FRENCH ONLY

**TRAVAUX PUBLICS ET SERVICES
GOUVERNEMENTAUX CANADA**

**Remise en état et mise aux normes de
la salle de la génératrice**

Dossier SPAC n° : R.098079.001

**PLAN DE MISE EN SERVICE
(Section 01 91 13.13)
Version 1**



Préparé pour :

TPSGC

Préparé par :

**Aboubakeur Bensikhelifa, ing., CBCP,
LEED AP BD+C | Agent de mise en service**

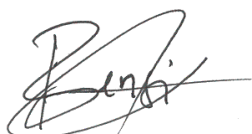
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1.0 INTRODUCTION

La mise en service (ci-après MES) d'une nouvelle installation est un processus intensif d'assurance de la qualité qui commence dès la conception, et qui se poursuit pendant les phases de construction et d'exploitation.

Ce processus garantit que le nouveau bâtiment fonctionne selon les attentes initiales, qu'il répond aux exigences du Propriétaire, que les installations électromécaniques performant selon les critères de conception et que le personnel du bâtiment a en sa possession les documents et la formation, pour être en mesure d'opérer et d'entretenir tous les systèmes et les équipements.

Ce plan de MES est un document évolutif qui définira les activités de MES dans ce projet, son calendrier, ses exigences en matière de documentation, ainsi que les rôles et les responsabilités de l'équipe de MES.

Entre autres, ce plan inclura :

- Un descriptif du processus de MES utilisé dans ce projet;
- Les membres de l'équipe de MES;
- Les détails concernant les activités de MES.

Des détails additionnels concernant le processus de mise en service figurent dans la section 01 91 13 (Mise en service (MS) - Exigences générales) du devis.

2.0 VUE D'ENSEMBLE DU PROCESSUS

2.1 PHASE DE CONCEPTION

Voici une brève description du processus de mise en service qui sera mis en place durant la phase de conception :

- Définir les objectifs de la MES.
- Définir les exigences du Propriétaire pour le projet, qui guideront la conception, la construction et l'opération du futur bâtiment.
- Élaborer un plan de MES préliminaire et le mettre à jour.
- Incorporer les spécifications de la MES dans le devis de construction.
- Vérifier la conception afin de s'assurer qu'elle reflète les besoins du Propriétaire.

2.2 PHASE DE CONSTRUCTION

Voici une brève description du processus de mise en service qui sera mis en place durant la phase de construction :

- Tenir des réunions de coordination de MES.
- Établir un calendrier de MES.
- Tenir une revue des dessins d'atelier (accès sur l'opération).
- Vérifier l'installation des systèmes et des équipements.
- Vérifier l'opération et la performance des systèmes électromécaniques.
- Vérifier et optimiser les séquences de fonctionnement.
- Faire le suivi de la formation ainsi que la vérification des manuels d'exploitation et d'entretien.
- Fournir un rapport final de MES (version finale du plan de MES).

2.3 PHASE D'EXPLOITATION

Voici une brève description du processus qui sera mis en place durant la phase d'exploitation :

- Réaliser des tests saisonniers pour vérifier l'opération des systèmes selon les diverses conditions.
- Effectuer des enregistrements et l'analyse de tendances pour superviser les paramètres de fonctionnement.

3.0 ACTIVITÉS ET OBJECTIFS DU PROCESSUS DE MISE EN SERVICE

Lors de la phase de construction, les objectifs fixés sont :

- S'assurer que tous les intervenants de l'équipe de MES comprennent bien leur rôle.
- Établir un calendrier de MES pour la phase de construction.
- Effectuer la vérification globale de l'installation.
- Documenter la performance des systèmes.
- Faire le suivi de la formation ainsi que la vérification des manuels d'exploitation et d'entretien.

4.0 ÉQUIPE DE MISE EN SERVICE

MEMBRE DE L'ÉQUIPE	COMPAGNIE	PERSONNE-RESSOURCE / TÉLÉPHONE / ADRESSE ÉLECTRONIQUE (COURRIEL)
Agent de mise en service		
Client (services techniques)		
Représentant du Client pour la MES		
Entrepreneur général		
Entrepreneur en électricité		
Entrepreneur en balancement		
Entrepreneur en contrôle		
Entrepreneur en ventilation		
Entrepreneur en plomberie		
Entrepreneur en alarme incendie		
Expert-conseil		
Architecte		

5.0 RÔLES ET RESPONSABILITÉS

ACTIVITES	AMES	CLIENT	A/E	ES
PHASE DE CONCEPTION				
Définir les besoins liés à l'exploitation et à l'entretien des équipements	P	P	P	
Examen de la base de conception	P	P	P	
Organiser et diriger l'équipe de MES	R	P	P	
Incorporer la MES dans les documents d'appel d'offres	R	P	R	
PHASES DE CONSTRUCTION ET D'OPERATION				
Élaborer et mettre à jour un registre des déficiences et des anomalies	R		P	
Suivre le plan de MES et aider à résoudre les déficiences inscrites au registre	R	P	P	P
Organiser des réunions de MES	R			
Assister aux réunions de MES	P	P	P	R
Soumettre les dessins d'atelier des systèmes et des équipements	R		P	
Tenir une revue des dessins d'atelier	P		R	
Développer les procédures de tests	R		P	P
Effectuer une revue du plan de MES	R			
Élaborer et mettre à jour un registre des déficiences et des anomalies	R			
Suivre le plan de MES et aider à résoudre les déficiences inscrites au registre	R	P	P	P
Vérifier la conformité des installations et résoudre les déficiences	P	P	R	P
Élaborer un calendrier de MES et le soumettre à l'AMES pour validation	P	P	P	R
Compléter les fiches de contrôle	P			R
Réaliser les essais (essais de fonctionnement / essais de rendement)	P	P	P	R
Soumettre les différents rapports et produire les manuels d'exploitation				R
Donner les séances de formation			P	R
Vérifier les rapports	P	P	R	
Faire le suivi de la formation et vérifier les manuels d'exploitation	P	P	P	R
Faire une révision des garanties	P			P
Préparer un rapport final de MES récapitulant les travaux entrepris	R			

P : participant

R : responsable

6.0 PROCESSUS DE MISE EN SERVICE

Cette section détaille les activités de mise en service.

6.1 PHASE DE CONCEPTION

Lors de cette phase, on doit s'assurer que les besoins du Propriétaire sont reflétés dans la phase de conception du projet et on doit également s'assurer d'obtenir la documentation nécessaire. Il faut aussi prendre en considération les besoins liés à l'exploitation et l'entretien.

6.1.1 Besoins du Propriétaire et phase de conception

La documentation de la phase de conception doit inclure les éléments suivants :

- Performance énergétique;
- Codes et standards appliqués pour le projet;
- Caractéristiques de l'enveloppe du bâtiment;
- Calcul des charges thermiques;
- Vibration et niveau sonore;
- Paramètres de conception (température et humidité);
- Dimensionnement des équipements;
- Qualité d'air intérieur;
- Éclairage;
- Zonage de l'alarme incendie;
- Systèmes d'alimentation d'urgence.

6.1.2 Plan de mise en service

Élaborer un plan de MES qui servira de lignes directrices tout au long du projet. Ce plan de MES doit inclure toutes les informations nécessaires et doit être mis à jour régulièrement. La version finale du document servira pour la réalisation de la mise en service.

6.1.3 Évaluation des besoins de la formation

L'Agent de MES, conjointement avec le Propriétaire, les Ingénieurs et les Architectes, évaluera les besoins en formation, de même que la rigueur de celle-ci, et communiquera ces informations aux responsables de la formation du personnel.

Inclure également la formation dans le calendrier de MES et soumettre celui-ci, pour approbation, ainsi que les plans de cours à l'Agent de MES.

Les fiches de formation sont fournies en annexe au présent document (annexe 4).

6.1.4 Spécifications de la mise en service dans le devis de soumission

La MES doit être incorporée dans le devis afin que les soumissionnaires puissent évaluer les besoins réels. De plus, les procédures des tests ainsi que les responsabilités doivent être dûment développées dans la section « Mise en service » du devis.

6.1.5 Vérification du concept et des plans

Une revue générale de la conception et des plans aux étapes 40 %, 95 % et 100 % est nécessaire, et doit porter sur les éléments suivants :

- S'assurer que les standards de TPSGC sont respectés dans la base de conception;
- Vérifier les besoins de la maintenance et de l'exploitation;
- S'assurer de la présence des outils nécessaires pour le balancement de l'installation;
- Vérifier les besoins en formation.

6.2 PHASE DE CONSTRUCTION

Les activités de MES durant la phase de construction doivent être réalisées à partir du bas niveau jusqu'au plus haut niveau de complexité des systèmes et des sous-systèmes. De façon générale, l'ordre des tests doit suivre le processus suivant :

- Contrôle de l'installation (par exemple : vérification des composantes et test d'étanchéité);
- Démarrage (vérification dynamique des équipements);
- Vérification point par point pour le contrôle;
- Balancement;
- Interaction entre les systèmes et vérification de la performance.

Se reporter à l'annexe 2 pour les fiches de contrôle de l'installation.

6.2.1 Revue des dessins d'atelier

L'Agent de MES doit faire une revue sélective des dessins d'atelier pour les besoins de la MES. Cette vérification doit porter sur les éléments suivants :

- S'assurer que les équipements correspondent aux spécifications;
- Vérifier si toute l'information nécessaire est disponible;
- Cette revue ne remplace pas celle effectuée par les Ingénieurs de conception.

6.2.2 Visite au chantier

L'Agent de MES planifiera des visites périodiques afin de superviser l'installation des systèmes et des équipements, celles-ci seront coordonnées avec les Entrepreneurs ou le Client.

L'Agent de MES élaborera et mettra à jour le registre des déficiences et des anomalies. Ce registre inclura des photos et les actions à prendre pour corriger ces déficiences.

Aussi, l'Agent de MES assistera d'une façon sélective aux réunions de chantier afin de se tenir informé de l'avancement des travaux.

6.2.3 Calendrier de mise en service

L'Entrepreneur général doit fournir, pour approbation, un calendrier de mise en service pour chaque équipement et chaque système. Ce calendrier doit être mis à jour selon l'avancement du projet. Se reporter à l'annexe 3 pour le calendrier de MES.

6.2.4 Fiches de contrôle de l'installation (vérification statique)

Ces vérifications permettront de s'assurer que les équipements et les systèmes sont connectés et opérationnels, afin de procéder aux essais de performance (exemples de point contrôlé : niveau d'huile, la tension de courroie de ventilateur, étiquettes fixées, l'alignement, calibration des sondes, etc.).

Aucune stratégie d'échantillonnage n'est utilisée. En général, les Entrepreneurs compléteront les fiches pour tous les équipements et les systèmes avant de débiter les essais de performance (se reporter à l'annexe 2 pour les fiches de contrôle de l'installation).

6.2.5 Essais de fonctionnement et de performance (vérification dynamique)

L'essai fonctionnel servira à vérifier l'opération complète du système ou de l'équipement (plutôt que seulement les composants). La procédure d'essai inclura l'évaluation des différents modes de fonctionnement (faible charge, grande charge, chauffage, refroidissement, inoccupée, l'interaction avec l'alarme incendie et fonctionnement sur l'urgence, si applicable) ainsi que la vérification complète de la séquence de contrôle.

Les balancements aéraulique et hydraulique des systèmes doivent être complétés et les résultats approuvés afin de procéder aux essais de performance.

Après chaque essai, des rapports ou les résultats d'essai seront fournis au Client, les constatations ainsi que les recommandations seront annotées.

Ces essais seront effectués en utilisant le système de gestion du bâtiment (SGB).

Voici les prérequis pour les essais :

- Toutes les fonctions du SGB sont programmées, les graphiques complétés ainsi que l'ajustement des boucles (PID).
- Toute la tuyauterie de plomberie nettoyée.
- Les systèmes de traitement d'eau fonctionnels.
- Balancement d'air et d'eau terminé et approuvé.
- Déficiences corrigées.

L'Entrepreneur, sous la supervision de l'Agent de MES, doit effectuer des vérifications et des essais (statiques et dynamiques) sur les systèmes et les équipements afin d'évaluer leur performance. Les résultats doivent être documentés dans les fiches de MES par l'Agent de MES.

Les vérifications des composantes électriques moins critiques, telles que les interrupteurs, les prises, l'éclairage et autres équipements semblables, seront effectuées selon un échantillonnage entre 10 % et 30 % (à définir lors des réunions de MES).

6.2.6 Régulation automatique

Ajustements saisonniers : l'entrepreneur en contrôle doit prévoir une banque de quarante heures, afin d'effectuer les ajustements saisonniers. Ces heures seront utilisées uniquement sur appel et instructions de l'agent de mise en service.

L'entrepreneur en contrôle doit fournir et installer pour l'agent de mise en service tous les logicielles et les accès requis afin de lui permettre d'accéder à distance au système de gestion du bâtiment, ceci inclus les licences.

6.2.7 Réunions de mise en service

Tenir des réunions périodiques avec l'équipe de MES afin d'expliquer le processus, d'obtenir l'information sur l'état d'avancement et de régler les éventuels problèmes observés. Des procès-verbaux des réunions seront émis par l'Agent de MES.

6.2.8 Manuels d'exploitation et d'entretien

Assembler les documents relatifs aux manuels d'exploitation et d'entretien, et les soumettre à l'Agent de MES aux fins d'approbation. Les manuels d'exploitation et d'entretien doivent comprendre ce qui suit :

- Sommaire;
- Liste des Entrepreneurs et toute information d'urgence;
- Dessins d'atelier vérifiés;
- Fiches techniques des équipements;
- Fiches d'entretien préventif;
- Plans « Tel que construit »;
- Garanties;
- Certificats des essais en usine et sur le chantier concernant l'équipement ou le système spécifié;
- Rapports d'essais et de nettoyage des réseaux;
- Rapports de balancement.

6.2.9 Rapport final de mise en service (MES)

L'Agent de MES fournira un rapport final de MES qui doit inclure les éléments suivants :

- Fiches de MES;
- Résultats des tests et des essais;
- Évaluation du programme de formation et des manuels d'exploitation et d'entretien;
- Questions en suspens;
- Plan de recommissioning.

ANNEXE 1

Systèmes inclus dans la mise en service

SYSTÈMES INCLUS DANS LA MISE EN SERVICE

FICHE	SYSTÈMES ET ÉQUIPEMENTS	PRÉSENCE REQUISE LORS DU DÉMARRAGE	DOCUMENTS À SOUMETTRE	DATE DE MES
Systèmes de CVCA				
1_21 05 00	Lutte contre les incendies - Exigences générales concernant les résultats des travaux	Entrepreneur général, Protection incendie, Agent MES	Rapport d'essais selon NFPA 13 et 25	
2_23 11 13	Tuyauterie de mazout pour installation	Entrepreneur général, Plomberie, Agent MES	Rapport d'essai	
3_23 05 93	Essai, réglage et équilibrage de réseaux de CVCA	Entrepreneur général, Ventilation, Contrôle, Plomberie, Agent MES	Rapport préliminaire, Rapport de certification des équipements de mesure et Rapport de balancement	
4_23 31 13	Conduits d'air métalliques – basse Pression, jusqu'à 500 Pa	Entrepreneur général, Ventilation, Contrôle, Plomberie, Agent MES	Rapport d'essais selon les exigences de SMACNA	
5_23 82 19	Traitement de l'air - Appareils monobloc	Entrepreneur général, réfrigération, Plomberie, Agent MES	Rapport de mise en service.	
6_25 90 01	Séquences d'opération	Entrepreneur général, Contrôle, Plomberie, Agent MES	Fiche de contrôle de l'installation	
Électricité				
7_26 50 00	Éclairage	Entrepreneur général, Électricien, Agent MES	Fiche de contrôle de l'installation	
8_26 28 16	Disjoncteur sous boîtier moulé	Entrepreneur général, Électricien, Agent MES	Rapport d'essai incluant les ajustements.	
9_26 12 16.01	Transformateur secs - Primaire jusqu'à 600V	Entrepreneur général, Électricien, Agent MES	Rapport d'essai	
10_26 24 16.01	Panneaux de distribution à disjoncteurs	Entrepreneur général, Électricien, Agent MES	Fiche de contrôle de l'installation, Rapport d'essai	
11_26 29 10	Démarrateurs jusqu'à 600V	Entrepreneur général, Électricien, Agent MES	Fiche de contrôle de l'installation, Rapport d'essai	
12_26 32 13.01	Installations des groupes électrogènes	Entrepreneur général, Électricien, Agent MES	Fiche de contrôle de l'installation, Rapport d'essai	
13_26 36 23	Appareillage automatique de commutation de charge	Entrepreneur général, Électricien, Agent MES	Rapport d'essai	
14_28 46 01	Détection et alarme incendie	Entrepreneur général, Électricien, Agent MES	Rapport d'essai	

ANNEXE 2

Fiches de contrôle de l'installation

R.098079.001	TPSGC	Fiche 6	N° :
	Remise en état et aux normes de la salle de génératrice	1 de 1	
ANNEXE 2 - FICHE DE MISE EN SERVICE			

SÉQUENCES DE CONTRÔLE

IDENTIFICATION	Nom du système :
	Description du système :
	Contrôle : <input type="checkbox"/> S/O <input type="checkbox"/> Interne <input type="checkbox"/> Externe Pneumatique <input type="checkbox"/> Électrique <input type="checkbox"/> Numérique Communication / Intégration : <input type="checkbox"/> Coordonnée avec SGE <input type="checkbox"/> S/O

SÉQUENCE DE CONTRÔLE	VÉRIFIÉ	COMMENTAIRES
Toutes les sondes ainsi que les actionneurs sont calibrés, bien localisés et fonctionnent correctement		
Horaires d'occupation, mode prédémarrage ou abaissement de nuit configurés		
Position minimale du volet d'air neuf		
Modulation des soupapes et des volets		
Boucles de contrôle de pression, de température et d'humidité		
Boucles de contrôle de la température d'alimentation et de mélange		
Protections mécaniques (gel, haute pression, preuve de débit, haute température et haute humidité)		
Point de consigne de pression statique (en fonction du circuit de contournement sur l'air ou d'un variateur de vitesse)		
Position des systèmes à l'arrêt		
Variateur de vitesse (vitesse minimale, rampe d'accélération et décélération) et circuit de contournement		
Alarmes de pression, de température, d'humidité et de CO ₂		
Fonctionnement des boîtes terminales		
Boucles de refroidissement et de chauffage		
Système de détection de gaz (CO, CO ₂ , NO ₂ et réfrigérant)		
Systèmes spéciaux (récupération et mesurage d'énergie)		

NOTE DE SERVICE (Déficiences, réparations effectuées, bruit, entretiens, vibration, etc.)	STATUT
	<input type="checkbox"/> Conforme
	<input type="checkbox"/> À vérifier
	<input type="checkbox"/> À compléter
	<input type="checkbox"/> Hors fonction
	<input type="checkbox"/> Non conforme

Nom du technicien :	Date :
Approuvé par : (responsable MES)	Date :

R.098079.001	TPSGC	Fiche 7	N° :
	Remise en état et aux normes de la salle de génératrice	1 de 2	
ANNEXE 2 - FICHE DE MISE EN SERVICE			

ÉCLAIRAGE

IDENTIF.	Bloc :	Niveau :	Secteur :
	Panneau à relais :	Marque :	Modèle :
	Nos des plans :		

ESSAIS	VÉRIFICATION DE L'ÉCLAIRAGE ET DE LA COMMANDE D'ÉCLAIRAGE	O	N	s/o	Nos
	Les luminaires sont installés conformément aux plans				
	Tous les luminaires fonctionnent correctement (pas de lampes brûlées, pas de clignotement, etc.)				
	Le niveau d'éclairement est adéquat				
	L'éclairement est uniforme (pas de taches noires, etc.)				
	Les commandes par interrupteur fonctionnent correctement				
	Les commandes par détecteurs de mouvement fonctionnent correctement				
	Les commandes par gradateurs fonctionnent correctement				
	L'éclairement est normal à tous les niveaux de gradation depuis le minimum jusqu'à 100 %				
	Le panneau à relais fonctionne correctement				

NOTE DE SERVICE (Déficiences, réparations effectuées, bruit, entretiens, vibration, etc.)	STATUT
	<input type="checkbox"/> Conforme
	<input type="checkbox"/> À vérifier
	<input type="checkbox"/> À compléter
	<input type="checkbox"/> Hors fonction
	<input type="checkbox"/> Non conforme

Nom du technicien :	Date :
Approuvé par : (responsable MES)	Date :

R.098079.001	TPSGC	Fiche 7	N° :
	Remise en état et aux normes de la salle de génératrice	2 de 2	
ANNEXE 2 - FICHE DE MISE EN SERVICE			

ÉCLAIRAGE

DÉFAUT / ANOMALIE	N°	SALLE	ÉLÉMENT	DESCRIPTION DU DÉFAUT / COMMENTAIRES
	1			
	2			
	3			
	4			
	5			
	6			
	7			
	8			
	9			
	10			
	11			

Nom du technicien :	Date :
Approuvé par : (responsable MES)	Date :

R.098079.001	TPSGC	Fiche : 10	N° :
	Remise en état et aux normes de la salle de génératrice	1 de 2	
FICHE DE MISE EN SERVICE			

TABLEAU À DISJONCTEURS

IDENTIFICATION	N° d'équipement :		N° de plan :	
	Marque :		Localisation :	
	Type :		Adresse Fourn. :	
	Montage : <input type="checkbox"/> Plancher <input type="checkbox"/> Encastré <input type="checkbox"/> En surface		Enceinte NEMA :	
	Volts / phases / Fils : / /	Ampérage de barre :	Ancrage de barre (kA) :	
	Calibre disj. principal :	Nombre de circuits :	Barres : <input type="checkbox"/> Cu <input type="checkbox"/> Al	
	Câble d'alimentation :	Câble MALT :	Raccordé à :	

INSPECTION	Description	O	N	s/o	Commentaires / Observations
	Plaque signalétique lisible				
	Répertoire des circuits dans la porte				
	Connexion principale bien serrée				
	Identification des phases des barres omnibus				
	Bonne mise à la terre				
	Dégagement adéquat autour du tableau				
	Disjoncteurs de réserves fournis et installés				
Ventilation adéquate					

NOTE DE SERVICE (Déficiences, réparations effectuées, bruit, entretiens, vibration, etc.)	STATUT
	<input type="checkbox"/> Conforme
	<input type="checkbox"/> À vérifier
	<input type="checkbox"/> À compléter
	<input type="checkbox"/> Hors fonction
	<input type="checkbox"/> Non conforme

Nom du technicien :	Date :
Approuvé par : (responsable MES)	Date :

R.098079.001	TPSGC	Fiche : 10	N° :
	Remise en état et aux normes de la salle de génératrice	2 de 2	
FICHE DE MISE EN SERVICE			

TABLEAU À DISJONCTEURS

ESSAIS	Essais divers			Commentaires / Observations
	Essai de rigidité électrique de l'artère (MΩ)* :		Ph ABC/T :	
	Phase A-B :	Phase B-C :	Phase C-A :	
	Essai de tension :			
	V _{AN} :	V _{BN} :	V _{CN} :	
	V _{AB} :	V _{BC} :	V _{CA} :	
	Essai d'équilibrage de charge :			
	I _A :	I _B :	I _C :	
	*Remarque : l'équipement doit être isolé de toute source d'alimentation			

Nom du technicien :	Date :
Approuvé par : (responsable MES)	Date :

R.098079.001	TPSGC	Fiche : 11	N° :
	Remise en état et aux normes de la salle de génératrice	1 de 2	
FICHE DE MISE EN SERVICE			

DÉMARREUR

IDENTIFICATION	Identification :		N° de plan :	
	Marque :		Localisation :	
	N° du catalogue :		Réf. du moteur :	
	Type : <input type="checkbox"/> Manuel <input type="checkbox"/> Direct <input type="checkbox"/> Étoile-triangle <input type="checkbox"/> Autotransformateur <input type="checkbox"/> Autre :			
	Action : <input type="checkbox"/> 1 sens <input type="checkbox"/> 2 sens		Montage : <input type="checkbox"/> Séparé <input type="checkbox"/> Dans un CCM réf. :	
	Calibre NEMA :		Boîtier NEMA :	
	Tension :		Phase / Nbre de pôles : /	Tension de commande :
	Interrupteur : <input type="checkbox"/> Oui <input type="checkbox"/> Non		Type fusible :	Dimension :
	Disj. à boîtier moulé : <input type="checkbox"/> Oui <input type="checkbox"/> Non		Type :	Déclat :
	Relais de surcharge : <input type="checkbox"/> Oui <input type="checkbox"/> Non		Type :	Ajustement :

NOTE DE SERVICE (Déficiences, réparations effectuées, bruit, entretiens, vibration, etc.)	STATUT
	<input type="checkbox"/> Conforme
	<input type="checkbox"/> À vérifier
	<input type="checkbox"/> À compléter
	<input type="checkbox"/> Hors fonction
	<input type="checkbox"/> Non conforme

Nom du technicien :	Date :
Approuvé par : (responsable MES)	Date :

R.098079.001	TPSGC	Fiche : 11	N° :
	Remise en état et aux normes de la salle de génératrice	2 de 2	
FICHE DE MISE EN SERVICE			

DÉMARREUR

INSPECTION ET ESSAIS	Description	O	N	s/o	Commentaires / Observations
	Étiquette d'identification lisible :				
	Dégagement adéquat pour le sectionneur :				
	Lampes témoins opérationnelles :				
	Boutons-poussoirs « Marche-Arrêt » opérationnels :				
	Relais de contrôle opérationnel :				
	Relais de surcharge opérationnel :				
	Bouton-poussoir de remise en marche :				
	Relais de thermistance opérationnel :				
	Commande séquentielle correcte :				
	Interverrouillage de sécurité opérationnel :				

MESURES	Mesure				Commentaires / Observations
	V _{A-B} :	V	I _A :	A	
	V _{B-C} :	V	I _B :	A	
	V _{C-A} :	V	I _C :	A	

Nom du technicien :	Date :
Approuvé par : (responsable MES)	Date :

R.098079.001	TPSGC	Fiche : 15	N° :
	Remise en état et aux normes de la salle de génératrice	1 de 4	
FICHE DE MISE EN SERVICE			

GROUPE ÉLECTROGÈNE

IDENTIFICATION	N° d'équipement :		N° de plan :	
	Marque :		Localisation :	
	Modèle :		Adresse Fourn. :	
			Rapport d'essai en usine joint : <input type="checkbox"/> O <input type="checkbox"/> N	
	Moteur :	Manufacturier :	Modèle :	
	N° de série :	Capacité (kW) :	CV au frein :	
	Temps :	Cylindres :	RPM :	
	Régulateur :	Radiateur :	Pompe de refroidissement :	
	Chauffe-moteur :	Démarrreur :	Capacité rés. journalier :	
	Alternateur :	Manufacturier :	Modèle :	
	N° de série :	Capacité (kW/kVA) :	Régime :	
	Tension (V) :	Phase / Fils :	Fréquence (Hz) :	
	Courant nominal (A) :	Facteur de puissance :	Cap. au démar. (skVA)	
	Classe d'isolation :	Thermistances :	Excitatrice :	
	Batteries et chargeur de batteries :	Marque batteries :	Type :	
	Nombre :	Tension :	Capacité (Ah) :	
	Marque chargeur :	Modèle :	Capacité :	
	Panneau de contrôle :	Manufacturier :	Modèle :	
	Enceinte NEMA :	Montage : <input type="checkbox"/> sur le groupe <input type="checkbox"/> à distance		
	Disjoncteur de groupe :	Manufacturier :	Modèle :	
Calibre / déclic (A) :	Montage : <input type="checkbox"/> sur le groupe <input type="checkbox"/> à distance			

NOTE DE SERVICE (Déficiences, réparations effectuées, bruit, entretiens, vibration, etc.)	STATUT
	<input type="checkbox"/> Conforme
	<input type="checkbox"/> À vérifier
	<input type="checkbox"/> À compléter
	<input type="checkbox"/> Hors fonction
	<input type="checkbox"/> Non conforme

Nom du technicien :	Date :
Approuvé par : (responsable MES)	Date :

R.098079.001	TPSGC	Fiche : 15	N° :
	Remise en état et aux normes de la salle de génératrice	2 de 4	
FICHE DE MISE EN SERVICE			

GROUPE ÉLECTROGÈNE

INSPECTION	Description	O	N	s/o	Commentaires / Observations
	Plaque signalétique lisible				
	Signaux d'avertissement				
	Équipement propre / pas d'égratignure ou dégât				
	Installation / supports antivibratoires :				
	Dégagement adéquat autour de l'appareillage				
	Ventilation adéquate				
	Niveau des liquides adéquat				
	Bonne connexion des câbles électriques				
	Bonne mise à la terre				
	Tension de la batterie correcte				

ESSAIS	Essai à pleine charge																
	Temps	T _{amb} (°C)	P _{huile} (kPa)	T _{huile} (°C)	T _{liq refr.} (°C)	T _{gaz éch.} (°C)	T _{air refr.} (°C)	Tension (V)			Courant (A)			P _{eff.} (kW)	Fréq. (Hz)	cos Φ	V _{batterie} (V)
								V _{AB}	V _{BC}	V _{CA}	I _A	I _B	I _C				
	00:00																
	00:30																
	01:00																
	01:30																
	02:00																
	02:30																
	03:00																
03:30																	
04:00																	
04:30																	
05:00																	
05:30																	
06:00																	
06:30																	
07:00																	
07:30																	
08:00																	
Commentaires / Observations :																	

Nom du technicien :	Date :
Approuvé par : (responsable MES)	Date :

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GROUPE ÉLECTROGÈNE

ESSAIS					
	Description	O	N	s/o	Commentaires / Observations
	Essai de fonctionnement des dispositifs d'arrêt et des alarmes				
	Période excessive de tentatives de lancement				
	Régime excessif du moteur				
	Température élevée du moteur				
	Basse pression du lubrifiant				
	Court-circuit				
	Ouverture des disjoncteurs (délai d'arrêt)				
	Surtension à la sortie de l'alternateur				
	Basse tension de la batterie				
	Dispositif manuel d'arrêt d'urgence				
	Température élevée de l'alternateur				
	Essai de variation de la charge (essai avec enregistreur à bande)				
	De 0 % à 100 % - stabilisation - à 0 %				
	De 0 % à 70 % - stabilisation - à 0 %				
	De 0 % à 20 % - stabilisation - à 0 %				
	De 20 % à 40 % - stabilisation - à 0 %				
	De 40 % à 60 % - stabilisation - à 0 %				
	De 60 % à 80 % - stabilisation - à 0 %				
	De 80 % à 100 % - stabilisation - à 0 %				
	De 80 % à 110 % - stabilisation - à 0 %				
	Essai des modes de fonctionnement				
	Mode Auto : dém., comm., retour secteur, arrêt				
	Fonctionnement des inverseurs de charges				
	Délai total coupure secteur - alimentation charge d'urgence (sec)				
	Mode Manuel : démarrage et arrêt				
	Mode Essai : démarrage et transfert				
	Mode Démarrage : démarrage				
	Essais de vibration par une firme spécialisée				
	Remplacement filtres d'huile et d'air après essais				

Nom du technicien :	Date :
Approuvé par : (responsable MES)	Date :

R.098079.001	TPSGC	Fiche : 15	N° :
	Remise en état et aux normes de la salle de génératrice	4 de 4	
FICHE DE MISE EN SERVICE			

GROUPE ÉLECTROGÈNE

	Mesure de bruit à pleine charge		
	à 1 m à l'extérieur de l'atténuateur de son (dB)		
	à 5 m à l'extérieur de l'atténuateur de son (dB)		
	à 12 m à l'extérieur de l'atténuateur de son (dB)		

Nom du technicien :	Date :
Approuvé par : (responsable MES)	Date :

ANNEXE 3

Calendrier de mise en service



CALENDRIER DE MISE EN SERVICE

Projet : TPSGC / Remise en état et aux normes de la salle de généralice		Date :																														Mise à jour le :						
Tâches / Activités		Mois		Semaines																												Commentaires						
				Conception																																		
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23														
Phase de conception																																						
1 - Démarrage et vérification																																						
Établir les besoins du client																																						
Émettre un plan de mise en service																																						
Insérer la documentation de mise en service dans le devis																																						
Revue de conception																																						
Phase de construction																																						
1 - Démarrage et vérification																																						
Réunion de mise en service																																						
Réseau aéraulique (réseau de conduit)																																						
Essai, réglage et équilibrage de réseaux de CVCA																																						
Nettoyage et mise en route des réseaux de tuyauterie d'installations mécaniques																																						
Tour de refroidissement																																						
Refroidisseur																																						
Séquences d'opération																																						
Pompes																																						
Démarrage jusqu'à 600 V																																						
Éclairage																																						
Protection incendie																																						
2 - Formation																																						
Validation des plans de cours																																						
Agenda de formation																																						
3 - Documentation de mise en service																																						
Élaboration des manuels d'entretien et d'exploitation																																						
Vérification des garanties																																						
Plan de mise en service final (rapport final de mise en service)																																						

ANNEXE 4

Formation

PLAN DE FORMATION

(À remplir par le responsable de la mise en service)

Équipement / Système	Section devis	Heures totales (si spécifié)	Niveau de formation	Personnel formé	Instructeur	Calendrier de formation
Mécanique / CVCA / Électrique						
Contrôle						
Ventilation						
Gicleurs						
Plomberie						
Éclairage et alarme incendie						
Recommissionning¹						
Architecte²						
Ingénieur / concept mécanique³						
Ingénieur / concept électricité⁴						

¹Recommissioning : l'Agent de mise en service doit expliquer la procédure des tests périodiques des différents équipements avec les listes des vérifications.

²Architecte : doit fournir une vue d'ensemble sur l'installation et expliquer tous les aspects architecturaux.

³Ingénieur concept mécanique : doit fournir une vue d'ensemble sur l'installation, les équipements, l'objectif du concept et l'interaction du système avec d'autres éléments, et discuter des éventuels changements ou modifications.

⁴Ingénieur concept électricité : doit fournir une vue d'ensemble sur l'installation, les équipements, l'objectif du concept et l'interaction du système avec d'autres éléments, et discuter des éventuels changements ou modifications.

⁵Niveaux de formation :

- A Une vue d'ensemble sur le fonctionnement de l'équipement, incluant les tâches du personnel formé.
- B Niveau intermédiaire, avec des informations techniques sur les modes d'opération et maintenance.
- C Niveau technique, avec une vue approfondie sur le mode d'opération, les pannes éventuelles et la maintenance préventive.

Fiche d'évaluation de la formation

Équipement / Système : _____

Section : _____

Section 1. Général (À remplir par l'Agent de mise en service)

Personnel recevant la formation : (Entrer le nombre)

____ Service de gestion ____ Service d'ingénierie ____ Techniciens ____ Gestionnaire du projet ____ Locataire
 ____ Autres : _____

Objectifs et niveaux de la formation : (Cocher si applicable)

- ____ A. Une vue d'ensemble sur le fonctionnement de l'équipement.
 ____ B. Niveau intermédiaire avec des informations techniques sur les modes d'opération et maintenance.
 ____ C. Niveau technique avec une vue approfondie sur le mode d'opération, les pannes éventuelles et la maintenance préventive.

Section 2. Instructeurs (À remplir par le l'instructeur)

<u>ID</u>	<u>Nom du formateur</u>	<u>Compagnie</u>	<u>Titre</u>
1)	_____	_____	_____
2)	_____	_____	_____
3)	_____	_____	_____

Section 3. Plan de cours (À remplir par l'instructeur et soumettre pour approbation au Responsable de mise en service, joindre le plan de formation, si disponible)

Lieu : _____

Date : _____

Points couverts :

	<u>Durée</u> (min.)	<u>Instructeur</u> (ID)	<u>Complétée</u> (√)
____ Objectifs et besoins (but de la conception)	_____	_____	_____
____ Utilisation des manuels d'exploitation et d'entretien	_____	_____	_____
____ Contrôle et dessins d'atelier	_____	_____	_____
____ Démarrage, arrêt, changement de mode, changement de saison, si applicable	_____	_____	_____
____ Contrôle intégré (« Package ») : programmation, pannes, alarmes et manuel d'opération	_____	_____	_____
____ Intégration au système de gestion du bâtiment (SGB), programmation, pannes et alarmes	_____	_____	_____
____ Interactions avec les autres systèmes ou équipements	_____	_____	_____
____ Aspect de sécurité	_____	_____	_____
____ Modes et stratégies de conservation d'énergie	_____	_____	_____
____ Garantie	_____	_____	_____
____ Redondance, messages d'erreurs et outils de diagnostic	_____	_____	_____
____ Service d'entretien périodique et entretien préventif (Pièces de rechange, etc.)	_____	_____	_____
____ Période questions et réponses	_____	_____	_____

Remise en état et aux normes de la salle de génératrice
Autres sujets couverts par la formation :

<u>Durée</u>	<u>Instructeur</u>	<u>Complété</u>
(min.)	(ID)	(√)
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

Durée totale de la formation (heures)----->

Section 4. Approbation de la formation (À remplir par le formateur et approuvée par le Responsable de la mise en service. Une copie doit être remise au Client)

Section 5. Commentaires sur la formation (À remplir par le personnel formé)

Le plan de formation a été approuvé

Client

Date

Agent de mise en service

Date

FICHE DE PRÉSENCE

Équipement ou système : _____

Signature	Total heures demandées	Total heures reçues	Date	Signature de l'instructeur	Initiale AMES
1.					
2.					
3.					
4.					
5.					
6.					
7.					
8.					
9.					
10.					

Notes jointes (O/N) : _____

Approbation finale de la formation :

Client

Date

Agent de mise en service

Date

DIVISION 02

Existing Conditions

Part 1 General**1.1 SUMMARY**

- .1 This Section includes requirements for removal fuel storage tanks, liquid, and associated work, including soil removal as indicated on Drawings:
 - .1 Fuel tank liquid removal including testing of tank contents (liquid), removal and disposal of tank contents, and certification of contents and disposal.
 - .2 Fuel tank cleaning and disposal including evacuation of combustible vapours, tank cleaning, disassembling of tank, and certification for proper disposal of tank.
- .2 Departmental Representative has been monitoring fuel levels on a monthly basis and indicate that tank is secure.

1.2 REFERENCE STANDARDS

- .1 American Petroleum Institute (API).
 - .1 API 1604-96, Closure of Underground Petroleum Storage Tanks.
- .2 ASTM International (ASTM).
 - .1 ASTM E1739-95 (2015), Standard Guide for Risk-Based Corrective Action Applied at Petroleum Release Sites.
 - .2 ASTM E1912-98/2004, Standard Guide for Accelerated Site Characterization for Confirmed or Suspected Petroleum Releases.
 - .3 ASTM E1943-98/2015 Guide for Remediation of Ground water by Natural Attenuation at Petroleum Release Sites.
- .3 Canadian Federal and Provincial Legislation and Guideline.
 - .1 Canadian Environmental Protection Act (CEPA), 1999.
 - .2 Canadian Environmental Assessment Act (CEAA), 1995.
 - .3 Environment Canada - Technical Assistance Bulletin TAB 8, Tanks.
 - .4 Transportation of Dangerous Goods Act (TDGA), 1992.
 - .5 Motor Vehicle Safety Act (MVSA), 1995.
 - .6 Canadian Council of Ministers of the Environment (CCME).
 - .7 PN1327, Environmental Code of Practice for Aboveground and Underground Storage Tank Systems Containing Petroleum and Allied Petroleum Products.
 - .8 Alberta Environment, Risk Management Guidelines for Petroleum Storage Tank Sites, 2001.
 - .9 Fuel Industry Certificates, Ontario Regulation 215/01, as amended. 4.8 Certification of Petroleum Equipment Mechanics. Ontario Regulation 216/01.

- .4 National Fire Protection Agency (NFPA).
 - .1 NFPA 30: Flammable and Combustible Liquids Code (the most up-to-date).
 - .2 NFPA 326: Standard for Safeguarding of Tanks and Containers for Entry, Cleaning, or Repair (the most up-to-date).
 - .3 NFPA 329: Recommended Practice for Handling Releases of Flammable and Combustible Liquids and Gases (the most up-to-date).
- .5 Petroleum Tank Management Association of Alberta (PTMAA).
 - .1 Regulations for Underground Storage Tank Closures.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide required information in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit a written report describing in detail procedures used to remove liquid from storage tank, cleaning and removing of storage tank, and disposal of liquid residues; provide verification that materials were disposed of in an environmentally responsible waste disposal facility; provide photographic documentation of work, including lab and field results, and receipts from disposal sites for tank and liquid residue.
- .3 Submit a written contingency plan for actions to be taken in the event of a release or emergency including:
 - .1 Emergency contact numbers;
 - .2 Classification of land use;
 - .3 Plans for covering/containing contaminated soil;
 - .4 Plans for site assessment/remediation work;
 - .5 Reducing risk to human health.

1.4 QUALITY ASSURANCE

- .1 Refer to laws, by administrative laws, ordinances, rules, regulations, and orders of Authority Having Jurisdictions, and other legally enforceable requirements applicable to Work at that area; or become in force during Work performance.
- .2 Underground fuel tank removal and disposal shall comply with requirements of Authorities Having Jurisdiction.

Part 2 Products

2.1 NOT USED

- .1 Not used.

Part 3 Execution**3.1 PREPARATION**

- .1 Provide all necessary personal protective equipment, purging and inert gases, and electrical protection equipment, and verify that equipment is working properly before starting work of this Section.

3.2 STORAGE TANK REMOVAL

- .1 Liquid Removal:
 - .1 Provide samples of liquids from fuel storage tank to a certified hazardous waste testing facility for laboratory analysis and approval for liquid disposal and disposal location.
 - .2 Remove liquid from tank for disposal.
 - .3 Obtain disposal facility receipts noting proper liquid disposal.
- .2 Storage Tank Cleaning:
 - .1 Measure levels of combustible vapours and oxygen, and ventilate tank if required to bring vapour or oxygen levels to safe limits:
 - .1 Ventilate tank using a small gas exhauster until vapour concentration is reduced to 10% or less of lower explosive limit.
 - .2 Oxygen content shall range from 19.5% to 23.5%.
 - .3 Cut access ports for cleaning into tank after vapour and oxygen concentrations are at a safe level.
 - .2 Clean tank by mopping, scraping, sweeping or steam cleaning interior of tank.
 - .3 Collect, contain and place residuals removed from tank in a 200-L capacity drum for transporting and disposal acceptable to Authorities Having Jurisdiction.
 - .4 Obtain disposal facility receipts noting proper effluent disposal.
- .3 Storage Tank Disposal:
 - .1 Verify that final vapour and oxygen concentrations are within requirements noted above before proceeding to cut and dismantle tank for its disposal.
 - .2 Remove dismantled tank to a disposal facility acceptable to Authorities Having Jurisdiction.
 - .3 Obtain disposal facility receipts noting proper tank disposal.

END OF SECTION

1 PART 1 - GENERAL INFORMATION

1.01 RELATED REQUIREMENTS

This section has been developed to clarify general practices and procedures for the following:

- .1 The handling and removal of manufactured articles containing asbestos, provided they are and remain in a non-friable condition, such as the fibrocement pipe used for stormwater drainage (roof drain) at the Île Charron radar station, must be carried out in a work area prepared for decontamination work at a "low risk" level as specified in section 3.23.2°1 of the Safety Code for the Construction industry (CSTC).

1.02 REFERENCE STANDARDS

Comply with federal, provincial and local requirements. In the event of any discrepancy between these requirements of different jurisdictions, the most stringent requirement shall have precedence. Comply with the following directives and regulatory requirements (but not limited to):

- .1 Department of Justice Canada
 - .1 Canadian Environmental Protection Act (CEPA) S.C. 1999, c. 33
 - .2 Hazardous Products Act R.S.C. 1985, c. H-3
 - .3 Hazardous Products Regulations SOR/2015-17
 - .4 Transportation of Dangerous Goods Act, 1992 (TDGA) S.C. 1992, c. 34
- .2 Government of Quebec
 - .1 Act respecting occupational health and safety (OHSA), R.S.Q., c. S-2.1
 - .2 Regulation respecting occupational health and safety (ROHS), R.R.Q., c. S-2.1, r.13
 - .3 Safety Code for the construction industry (SCCI), R.R.Q., c. S-2.1, r.4
 - .4 Regulation respecting hazardous materials, R.R.Q., c. Q-2, r. 32
 - .5 Environmental Quality Act (EQA), R.R.Q., chapter Q-2
- .3 Reference standards
 - .1 Canadian Standards Association (CSA) "Selection, Care and Use of Respirators", CSA No. Z94.4-93
 - .2 Standard "Respiratory protective devices - Filtering half masks against particles - Requirements, testing, marking", No EN 149 of the European Committee for Standardization.

1.03 DEFINITIONS

- .1 Asbestos-containing materials (ACM): materials with an asbestos concentration of at least 0.1%.
- .2 Authorized visitors: representative(s) designated by the client, and representative(s) of the appropriate regulatory authorities.
- .3 Competent worker: in the case of a specific job, refers to a worker:
 - .1 Who, by virtue of his or her knowledge, training and experience, is qualified to perform the work;
 - .2 Who is familiar with provincial and federal laws and the provisions of the regulations that apply to the work;
 - .3 Who has knowledge of all potential or actual occupational health and safety risks associated with the work, including the risks of working in the presence of asbestos.
- .4 Friable material: material that can be crumbled, pulverized or powdered manually when dry or that is crumbled, pulverized or powdered.
- .5 Non-friable materials: materials which, in the dry state, cannot be crushed, powdered or sprayed by hand pressure.
- .6 Treated water: water with the addition of a surfactant wetting agent, non-ionic, to reduce its surface tension in order to promote good impregnation of asbestos fibres.
- .7 HEPA vacuum cleaner: a vacuum cleaner equipped with a very high efficiency filtration system designed to collect and retain 99.97% of the fibres of a dimension that exceeds 0.3 micrometres.
- .8 Occupied area: any part of the building or site outside the enclosure.
- .9 Working area: place where work is carried out that may emit asbestos dust.
- .10 Polyethylene: polyethylene sheet or tear-proof polyethylene sheet whose edges, crossings, notches, tears and other openings have been sealed with tape to ensure adequate protection and containment.
- .11 Sprayer: A sprayer or spraying equipment without compressed air, capable of producing a mist or fine droplets. The flow rate of the sprayer used must be adapted to the work to be done.
- .12 Asbestos waste container: 0.15 mm thick sealable polyethylene bag or puncture-proof barrels.
- .13 Contractor: The Contractor is the company specializing in asbestos removal work, with respect to the work contract, who carries out the work for the contracting authority.
- .14 Consultant: The Consultant shall designate representatives who have the mandate to supervise the work.

- .15 Owner: The owner is the person (legal entity, private or public) on whose behalf the building works are carried out.

1.04 DOCUMENTS TO BE SUBMITTED

- .1 Comply with federal and provincial government requirements for asbestos protection. In the event of any discrepancy between these requirements and those provided for in this quotation, the most stringent shall prevail. Comply with the regulations in effect at the time the work is performed.
- .2 Before the start of the work, identify in writing and make the following information available at the workplace :
 - .1 The equipment and tools necessary to carry out the work and the measures to be taken for their installation, use, maintenance, protection and movement;
 - .2 The risks, safety and health measures to be taken according to the work to be carried out;
 - .3 The methods and equipment to be used for individual or collective protection;
 - .4 The measures to be taken in the event of an emergency, which must include the location of emergency exits in the work area and exits to evacuate the building;
 - .5 Training certificates of first aiders.
- .3 Prepare and submit a notice of opening and closing of a construction site. This form must be completed by the Contractor, submitted to the Commission des normes, de l'équité, de la santé et de la sécurité du travail (CNESST) at least 10 days before the start of the work, and contain information that meets the regulatory requirements.
- .4 Prepare and submit documentation demonstrating that the Contractor has liability insurance covering asbestos removal work.
- .5 Prepare and submit documentation demonstrating that all asbestos workers have received adequate training and education regarding the risks associated with asbestos exposure, personal hygiene and the procedures for entering and leaving asbestos removal areas, the techniques and protective measures to be followed when working in asbestos removal areas, the use, cleaning and disposal of breathing apparatus and protective clothing.
- .6 Prepare and submit documentation demonstrating that the operation and fit of the respirators provided to each worker has been verified and tested in accordance with the requirements of CSA Standard Z94.4 (most recent edition) and that workers have been subjected to leak tests within the last two years.

- .7 Prepare and submit documents demonstrating that appropriate measures have been taken for the disposal of asbestos waste, in accordance with the requirements of the competent authorities: for example, permits required for the transport and disposal of asbestos waste and follow-up chains of custody.

1.05 RELEVANT INFORMATION AND TRAINING

- .1 Before the start of the work, provide documents ensuring that all workers and supervisors have obtained the relevant information and adequate training, as required by SCCI (section 3.23.7), concerning, in particular, asbestos-related risks, personal hygiene measures, including protective clothing, entry and exit procedures, the various aspects of work methods and the rules to be followed for the use, cleaning and disposal of breathing apparatus and protective clothing.
- .2 Information and training on respiratory protective devices shall include at least adequate fit testing, inspection, maintenance, disinfection, and restrictions on the use of respiratory devices.
- .3 Relevant information and training shall be provided by a qualified and competent person.
- .4 The Contractor shall provide the number of first aiders required by regulation.

1.06 WORKER PROTECTION

- .1 The protective clothing and equipment that workers must use when entering the work area, both for the preparation of the work area and for the performance of the work, includes the following:
 - .1 Respiratory protection:
 - .1 Half-mask respirator with a high-efficiency filter (N-100, R-100 or P 100), provided to the employee, ensuring adequate protection against asbestos and acceptable to the appropriate provincial authorities.
 - a. It is certified at least FFP2 according to EN 149 - tests, requirements, marking by the European Committee for Standardization, by a laboratory accredited by the Committee.
 - b. It is included in the *Guide des appareils de protection respiratoire utilisés au Québec*, published by the Institut de recherche Robert-Sauvé en santé et en sécurité du travail, as it reads at the time it applies.

- .2 The breathing apparatus must ensure a sealed contact with the person's face, unless it is equipped with a hood or helmet. The respiratory equipment must be cleaned, disinfected and inspected before and after each use. Any part of the respirator that is damaged or deteriorated must be replaced before the respirator is used by a worker. When not in use, the respirator should be stored in a convenient, clean and sanitary place.
- .3 The employer shall establish procedures for the selection, use and maintenance of respirators; a copy of these procedures shall be provided and explained to each worker required to wear a respirator. The respirator must be selected, adjusted, operated and maintained in accordance with CSA Z94.4-93.
- .4 No worker shall be assigned to a task requiring the use of a respirator unless he or she has the physical ability to perform the task while wearing the respirator.
- .5 Ensure that the airtight seal of the respirator mask of any worker entering the work area is not compromised by facial hair or hair or any other material.
- .6 Filters shall be replaced daily due to the possibility of mould spores forming on the wet filter material.
- .2 Body protection :
 - .1 The worker may wear a disposable suit that does not retain or allow asbestos fibres to penetrate or work clothing that must be decontaminated with a HEPA vacuum cleaner before leaving the asbestos removal area. Disposable suits must be placed in asbestos waste containers before leaving the asbestos removal area.
 - .2 Protective footwear that meets the requirements of the SCCI Article 2.10.6, with non-slip soles on wet surfaces.
 - .1 Protective gloves shall be resistant to hazards in work areas while allowing sufficient dexterity for the worker to perform his tasks without having to remove them. Attention should be paid to the mechanical protection (cutting edge, abrasion and perforation) and slippery materials.
 - .3 Eye and head protection :
 - .1 Eye protection in accordance with CAN/CSA-Z94.3 must be worn in the work areas.
 - .2 A safety helmet approved by CSA Z94.1 shall be worn in work areas.

.4 Hearing protection :

- .1 Hearing protection in accordance with CAN/CSA-Z94.2 shall be worn in work areas when using mechanical equipment that emits more than 85 decibels. Attention should be paid to the effects of their use on communications between the worker and the foreman/consultant.

- .3 It is forbidden to eat, drink, chew gum or smoke in the work areas.
- .4. The use of compressed air is prohibited in the work areas except for compressed air necessary for the operation of a breathing apparatus.
- .5 Provide facilities for hand and face washing in or near work areas.
- .6 Ensure that workers wash their hands and face when leaving an asbestos removal area.

2 PART 2 - PRODUCTS

2.01 MATERIALS

- .1 Polyethylene sheets: unless otherwise specified, sheets at least 0.15 mm thick, of sufficient size to ensure that there are as few joints as possible.
- .2 Reinforced polyethylene sheets: woven fibre reinforced fabric at least 0.15 mm thick, bonded on each side to a polyethylene sheet.
- .3 Tape: fibreglass reinforced adhesive tape, of the type used for air ducts, capable of sealing polyethylene sheets, both in dry and humid environments with treated water.
- .4 Wetting Agent: A solution consisting of 50% polyoxyethylene ester and 50% polyoxyethylene ether, or any other product approved by the Consultant, mixed with water in sufficient concentration to ensure adequate penetration and saturation of the ACM.
- .5 Asbestos waste containers: place waste in double-walled containers :
- .1 The inner envelope shall be a 0.15 mm thick sealable polyethylene bag;
- .2 The outer envelope, into which the inner envelope will be inserted, shall be a sealable fibre or metal container when the waste contains sharp-edged elements; if not, the outer envelope may be a simple fibre or metal sealable bag, or a second 0.15 mm thick sealable polyethylene bag.
- .3 Labelling requirements: Apply a printed warning label indicating the risks associated with asbestos to all ACM containers so that it is clearly visible once the container is sealed and ready for disposal. Containers must be labelled in accordance with the regulations.

- .6 Slow drying filler: transparent, non-staining, water-dispersed filler that remains sticky to the touch for at least eight hours after the application and is designed to trap residual asbestos fibres.

2.02 TOOLS AND EQUIPMENT

- .1 Tools and equipment: suitable for the removal of moulds and fungi, and resistant to post-use decontamination methods.
- .2 Personal protective equipment (including disposable protective clothing and respiratory protective devices): provided in sufficient quantities throughout the work.
- .3 Vacuum cleaners: equipped with HEPA filters.
- .4 Ladders and/or scaffolding: of appropriate length and strength, in sufficient quantities to facilitate the proper progress of the work.

3 PART 3 - EXECUTION

3.01 PROCEDURE

- .1 Inform the Consultant of the presence of any material likely to contain asbestos discovered during the work, which has not been previously identified on the plans, in the specifications or in the reports relating to the present work. Do not touch these materials and wait for instructions from the Consultant.
- .2 Inform all trades of the presence of ACM as per section 1.8 on existing condition.
- .3 Before work begins, clearly delineate the asbestos removal area by identifying all access points, using, at a minimum, printed warning labels indicating, in both official languages, the risks associated with asbestos.
- .1 At each access point to a work area install yellow warning signs measuring 500 mm in height and 350 mm in width indicating the following, in both official languages, in black type :

Information	Character Dimension
ASBESTOS	50 mm
DANGER	40 mm
Do not breathe dust particles	15 mm
Mandatory protective equipment	15 mm

- .2 Remove visible dust from surfaces in the work area if it is likely to get into the ambient air during the work. Use a HEPA vacuum cleaner or a damp cloth unless this method is dangerous. The use of compressed air is prohibited.
- .3 Remove furniture from the asbestos work area or protect it with asbestos fibre-tight membranes.
- .4 Cover carpets and floors where dust and contamination cannot be safely collected with a polyethylene FR protective cloth.
- .4 Prevent the dispersion of dust from the asbestos work area by means of measures appropriate to the work to be carried out.
- .5 If possible, disassemble the fibrocement pipes by hand, by disassembling the pipe sections. If this method is not applicable, make pipe cuts using manual tools, such as chain knives, or using suitable tools, such as pipe saws with low cutting speed. Do not use high-speed power tools (saw or abrasive discs).
- .6 During the work, fibrocement pipes shall be handled in such a way as to minimize any excessive handling that may release asbestos fibres into the air.
 - .1 Do not dry cut pipes. Water the pipes and keep them moist until they are placed in asbestos waste containers.
 - .2 Avoid breaking pipes. If pipe breaks cannot be avoided, wet the pipe before and during breakage work.
 - .3 Dismantled pipes must be handled carefully (e.g. do not throw on the ground or in asbestos waste containers). At all times, the pipes must be transported in such a way as to prevent the release of asbestos fibres (e.g., to avoid slipping and friction of the pipes on the ground).
 - .4 Place materials directly into lined bags and seal immediately. Do not overload the bags. If asbestos fibre membranes are used to pack pipes, ensure that the openings are tightly closed and that a warning label is affixed to the asbestos hazards.
- .7 When the cutting work is completed, carefully remove asbestos dust that may be present on the surfaces surrounding the work site by one of the following methods :
 - .1 Moisten the floor and all contaminated surfaces before sweeping;
 - .2 Moisten the floor with water on all contaminated surfaces before wiping with damp cloths;
 - .3 Clean all contaminated surfaces on the floor with a vacuum cleaner equipped with a high-efficiency filter.

- .8 Use a low-flow, fine mist spray bottle to wet asbestos-containing materials. The work must not cause dust to disperse. This work may be subject to visual inspection and air quality monitoring. If contamination of the occupied area is noted, it should be completely isolated and cleaned.
- .9 Asbestos removal work shall not begin before :
 - .1 Waste disposal arrangements have been made ;
 - .2 Tools, equipment, materials and waste containers are on site and within reach ;
 - .3 Arrangements have been made to maintain the safety of the building, including the presence of the required number of fire extinguishers in accordance with the Safety Code for Construction Activities in Quebec.
 - .4 Warning signs have been installed at access points to work areas ;
 - .5 That all notices have been given and all other preparations have been made.

3.02 RESTORATION AND CLEANING

- .1 Asbestos dust and waste must be cleaned frequently during the work and immediately at the end of the work by using a HEPA vacuum cleaner or wetting them before removing them.
- .2 Debris from materials containing asbestos and dust shall be placed in sealable containers appropriate to the type of debris on a regular basis during and at the end of the shift.
- .3 Protective cloths and disposable protective clothing are considered asbestos waste. They must be moistened, then folded to enclose all the dust they retain and placed in a sealed container.
- .4 Clean the exterior of asbestos waste containers using a wet cloth or HEPA vacuum and place them in a second uncontaminated container immediately before removing them from the asbestos work area.
- .5 Seal asbestos waste bags and move them out of the work area. Dispose of in accordance with applicable regulatory requirements. Supervise loading into transport vehicles. Ensure that the operator is aware of the risks associated with asbestos and that the regulatory provisions concerning asbestos removal are respected. Verify that the landfill operator is well informed of the danger posed by the materials brought into the landfill.

- .6 At the end of asbestos work, the asbestos work area and its surroundings shall be cleaned with a vacuum cleaner equipped with a high-efficiency filter or by first wetting the surfaces to be cleaned.

3.03 WASTE DISPOSAL

- .1 Place in asbestos waste containers substances that meet the definition of asbestos dust and friable scrap material. A label must be present on each waste container and contain the following information :
 - .1 Asbestos-containing material
 - .2 Toxic by inhalation
 - .3 Keep container tightly closed
 - .4 Do not breathe in dust
- .2 Handle and dispose of hazardous materials in accordance with CEPA, TDGA and applicable provincial regulations.
- .3 Ensure that asbestos waste from asbestos removal operations is disposed of in accordance with applicable federal and provincial regulations.
- .4 Remove asbestos waste in lined and sealed bags or sealed drums. Carefully mark waste bags or drums using appropriate warning labels. These containers must be dustproof and asbestos-proof, suitable for this type of waste, marked as containing asbestos waste, and cleaned with a damp cloth or HEPA vacuum cleaner immediately before being removed from the work area. These containers should be frequently removed, at regular intervals.
- .5 Clean garbage bags with a wet cloth or with a vacuum cleaner equipped with a HEPA filter before removing them from the work area.
- .6 Ensure the transportation of waste containers, by approved means, to authorized disposal sites.
- .7 Provide chain of custody / evidence of disposal of authorized disposal sites.

END OF THE SECTION "LOW-RISK ASBESTOS WORK"

APPENDIX 2

Rapport sur l'inventaire de matières dangereuses à
la station radar de l'Île Charron (02 82 00.01) -

FRENCH ONLY

**Rapport sur l'inventaire de matières
dangereuses à la station radar de l'Île
Charron**



Préparé pour :
TPSGC

Préparé par :
Stantec Experts-conseils ltée

Projet n° 157102430
27 septembre 2018

Registre d'approbation

Le présent document, intitulé *Rapport sur l'inventaire des matières pour la station radar de l'île Charron, Qc*, a été préparé par Stantec Experts-conseils ltée (« Stantec ») pour le compte de TPSGC (le « Client »). Toute utilisation de ce document par une tierce partie est strictement défendue. Le contenu de ce document illustre le jugement professionnel de Stantec à la lumière de la portée, de l'échéancier et d'autres facteurs limitatifs énoncés dans le document ainsi que dans le contrat entre Stantec et le Client. Les opinions exprimées dans ce document sont fondées sur les conditions et les renseignements qui existaient au moment de sa préparation et ne sauraient tenir compte des changements subséquents. Dans la préparation de ce document, Stantec n'a pas vérifié les renseignements fournis par d'autres. Toute utilisation de ce document par un tiers engage la responsabilité de ce dernier. Ce tiers reconnaît que Stantec ne pourra être tenue responsable des coûts ou des dommages, peu importe leur nature, le cas échéant, engagés ou subis par ce tiers ou par tout autre tiers en raison des décisions ou des mesures prises en fonction de ce document.

Préparé par  _____
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François Parent, Ing.
Réviser technique

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Stantec Experts-conseils ltée (Stantec) a été mandatée par TPSGC pour effectuer un inventaire de matières dangereuses à la station radar de l'Île Charron, Québec. L'inventaire des matières dangereuses a été effectué dans le cadre de la remise en état et aux normes de la salle de la génératrice, projet °R098079.011. Les matières visées comprennent les matériaux contenant de l'amiante (MCA), le plomb dans les revêtements de peinture et les substances appauvrissant la couche d'ozone (SACO).

Ces travaux ont été réalisés le 8 septembre 2018 par Mme Dao Quach, spécialiste en hygiène du travail de Stantec.

Sur la base des observations et des résultats analytiques, des matériaux et équipements contenant des matières dangereuses ont été identifiés dans le bâtiment. Le tableau 1 ci-dessous présente un résumé des observations et des résultats pour chacun des paramètres évalués ainsi que des recommandations.

Tableau 1 : Sommaire des observations, résultats analytiques et recommandations

Matière	Commentaires	Recommandations
Amiante	Un total de dix (10) échantillons de MSCA a été prélevé. Les résultats d'analyses ont permis d'identifier la présence d'amiante à une concentration de 20% chrysotile et 15% crocidolite dans le matériau de fibrociment dont est fabriqué le drain de toit.	Advenant que des travaux soient prévus pouvant affecter les matériaux de fibrociment contenant de l'amiante, effectuer les travaux en condition à risque faible. Tout travail de démolition ou de rénovation impliquant les MCA identifiés dans cette étude doivent être exécutés selon les procédures de travail édictées par la Politique ministérielle PM 057 sur la Gestion de l'amiante, la Directive et norme sur la gestion de l'amiante de Services publics et Approvisionnement Canada (SPAC) ainsi que selon les procédures de travail édictées au Code de sécurité pour les travaux de construction (CSTC).
Peintures contenant du plomb	Selon les résultats obtenus, la peinture grise au plancher du rez-de-chaussée a une concentration de 530 mg/kg de plomb et la peinture blanche ne contient pas de plomb. Les résultats analytiques des essais de lixiviation ont révélé une concentration inférieure à la norme de 5 mg/L du	Advenant que des travaux de sablage ou autre activité pouvant affecter les matériaux en présence de peinture contenant du plomb et générer une grande quantité de poussière dans l'air, des mesures de protection des travailleurs doivent être entreprises pour la gestion des matériaux afin d'éviter l'exposition des travailleurs à la poussière de plomb. Durant ces travaux, mettre en œuvre

Inventaire des matières dangereuses
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Matière	Commentaires	Recommandations
	Règlement sur les matières dangereuses du Québec (RDM) pour l'échantillon de peinture grise. À cet effet, les types de peintures prélevés et les substrats qui leur sont associés ne sont donc pas considérés comme des matières dangereuses résiduelles.	les mesures de prévention correspondantes à la technique, porter des équipements de protections individuelles (EPI) adaptés aux tâches à réaliser et réduire l'empoussièrement par des dispositifs d'atténuation de poussières à la source. Selon le Règlement sur la santé et la sécurité du travail (RSST) et American Conference of Governmental Industrial Hygienists (ACGIH), l'exposition individuelle à la poussière de plomb dans l'air ou de fumées ne doit pas dépasser 0,05 mg/m ³ .
SACO	Aucun appareil ou équipement contenant des SACO n'a été constaté.	Aucune précaution particulière n'est requise.

Le sommaire doit être lu conjointement avec la Section 7.0 « Limitations générales » de ce rapport, et est sujet aux mêmes limitations.

1.0 INTRODUCTION

Stantec Experts-conseils ltée (Stantec) a été mandatée par TPSGC pour effectuer un inventaire de matières dangereuses à la station radar de l'Île Charron, Québec. L'inventaire des matières dangereuses est effectué dans le cadre de la remise en état et aux normes de la salle de la génératrice, projet °R098079.011. Les matières visées comprennent les matériaux contenant de l'amiante (MCA), le plomb dans les revêtements de peinture et les substances appauvrissant la couche d'ozone (SACO).

1.1 ÉTENDUE DES TRAVAUX

Les tâches complétées dans le cadre de ce mandat sont les suivantes :

- Visite des lieux afin d'identifier les matières dangereuses ;
- Prélèvement d'échantillons pour déterminer la présence de fibres d'amiante dans les matériaux susceptibles de contenir de l'amiante (MSCA);
- Prélèvement d'échantillons de peinture écaillés recouvrant certains matériaux afin de déterminer leur concentration en plomb ;
- Inventaire des équipements pouvant contenir des SACO.

1.2 DESCRIPTION DU BÂTIMENT

Selon les informations fournies par le client, la station radar de l'Île Charron a été construite approximativement en 1988. Le bâtiment comprend notamment un niveau de rez-de-chaussée, un niveau supérieur, ci-après nommé « niveau 4 », et une mezzanine sur le même niveau. Une cage d'escalier et un ascenseur permet d'accéder au niveau 4.

Sur la base des observations, le plancher du rez-de-chaussée est en béton et recouvert d'une couche de peinture grise, et, au niveau 4 les planchers sont couverts de tuiles de vinyle. Les plafonds du rez-de-chaussée sont faits en panneaux de gypse jointés tandis qu'au niveau 4, les plafonds sont couverts d'un isolant giclé. Les murs au rez-de-chaussée et au niveau 4 sont faits de panneaux de gypse. Un isolant en styromousse se trouve derrière les panneaux de gypse.

Selon les plans d'architecture et les informations du personnel technique, des travaux de rénovation ont été effectués en 2018 et comprennent notamment le remplacement de la membrane sur le toit, le remplacement des fenêtres existantes par de nouvelles fenêtres en aluminium, le remplacement des portes existantes par de nouvelles portes en acier et une nouvelle application de peinture de couleur beige sur la façade extérieure en béton.

2.0 CADRE RÉGLEMENTAIRE

2.1 AMIANTE

2.1.1 Code canadien du travail, Partie II et Règlement canadien sur la santé et la sécurité au travail

La partie II du Code canadien du travail intitulée *Santé et sécurité au travail* présente les exigences en matière de santé et sécurité pour les entreprises fédérales. Selon l'article 125.1, l'employeur est tenu de veiller à ce que « les concentrations des substances dangereuses se trouvant dans le lieu de travail soient contrôlées conformément aux normes réglementaires. »

Le RCSST (article 10.19) stipule qu'aucun employé ne doit être exposé à une concentration d'un agent chimique dans l'air excédant la valeur établie pour cet agent chimique par le American Conference of Governmental Industrial Hygienists (ACGIH). Les valeurs établies par l'ACGIH sont des valeurs moyennes pondérées sur 8 heures de travail (appelées TWA : Time-Weighted Average). Lorsqu'il est probable que la concentration d'un agent chimique dans l'air excède la valeur visée ci-dessus, des échantillons d'air doivent être prélevés et la concentration de l'agent chimique doit être calculée conformément aux normes de l'ACGIH, du National Institute of Occupational Safety and Health (NIOSH) ou autre méthode approuvée sur le plan scientifique.

La partie X du RCSST liées aux substances dangereuses utilisées, produites ou manipulées dans le lieu de travail, ou entreposées dans ce lieu pour y être utilisées, dans le but de prévenir les accidents, les blessures et les maladies professionnelles qui pourraient en découler. Les dispositions du Règlement visent, entre autres à rendre obligatoire la tenue des registres, à assurer la divulgation des informations, à assurer une inspection régulière et à empêcher une surexposition aux travailleurs.

Le RCSST, dans la partie X, section II, encadre les activités concernant l'amiante. Ce règlement inclut, entre autres, les exigences concernant le programme de gestion de l'exposition à l'amiante, le plan de contrôle de l'exposition à l'amiante, les mesures à prendre pour l'enlèvement des poussières, de résidus et de débris d'amiante, la décontamination ainsi que l'échantillonnage de l'air. Ainsi, aucun employé, selon l'article 2.1.2, ne doit être exposé à une concentration de 0,1 fibre par centimètre cube (f/cm³) selon l'ACGIH.

2.1.2 Politique ministérielle PM 057 sur la Gestion de l'amiante (Travaux publics et Services gouvernementaux Canada)

Cette politique ministérielle, et le code de pratique associé, s'appliquent à tout bâtiment ou installation dans lequel un matériau (friable ou non friable) pouvant contenir de l'amiante a été utilisé, ainsi qu'aux réparations, aux modifications ou à l'entretien d'un bâtiment ou d'une installation où se trouvent des matériaux pouvant contenir de l'amiante. Le code de pratique exige qu'un inventaire des matériaux contenant de l'amiante (MCA) soit établi et tenu à jour et présente les règles à respecter si des MCA sont présents.

2.1.3 Directive et norme sur la gestion de l'amiante de Services publics et Approvisionnement Canada (SPAC)

La directive et la norme sur la gestion de l'amiante de SPAC sont applicables aux immeubles et aux ouvrages techniques appartenant à l'État et loués dont SPAC est le gardien et dans lesquels :

- la présence de matériaux contenant de l'amiante a été confirmée;
- aucune attestation professionnelle indiquant que l'immeuble ne renferme pas de matériaux qui sont connus comme contenant de l'amiante n'a été obtenue.

Ces documents présentent les exigences relatives à la gestion de l'amiante et aux travaux d'entretien et aux activités de réparation.

2.1.4 Loi et règlement sur la santé et la sécurité du travail

Au Québec, la *Loi sur la santé et la sécurité du travail* (LSST) (RLRQ, c. S-2.1) et le *Règlement sur la santé et la sécurité du travail* (RSST) (RLRQ, c. S-2.1) exigent que l'employeur (ou le propriétaire) prenne les mesures nécessaires pour protéger la santé et assurer la sécurité et l'intégrité physique des travailleurs et que leur exposition à cette substance soit réduite au minimum.

Au Québec, les matériaux ayant une concentration d'au moins 0,1 % de fibre d'amiante sont considérés comme des matériaux contenant de l'amiante (MCA).

2.1.5 Code de sécurité pour les travaux de construction

Afin de protéger les travailleurs exposés aux fibres d'amiante pendant les travaux de construction, le *Code de sécurité pour les travaux de construction* (CSTC) (RLRQ, c. S-21, r. 4) exige que l'employeur ou le propriétaire assure l'analyse de la concentration des fibres d'amiante dans l'air de la zone de chantier lors de travaux générant de la poussière d'amiante. La concentration de fibres dans l'air ne doit pas être supérieure aux normes établies dans l'article 41 du RSST. Le CSTC requiert aussi que tout matériau endommagé contenant de l'amiante soit retiré selon les procédures appropriées (section 3.23 : « Travaux susceptibles d'émettre de la poussière d'amiante »). De plus, avant que des travaux de démolition ne soient entrepris, les matériaux susceptibles d'émettre de la poussière d'amiante doivent être extraits selon les exigences de sécurité requises par le CSTC (article 3.23.3.2.).

2.2 PLOMB

En 2010, en vertu de la Loi sur les produits dangereux, de la Loi sur la sécurité des produits de consommation et le Règlement sur les revêtements, le taux a été fixé à 90 mg/kg (ou 90 ppm ou 0,009% en poids) pour les nouvelles peintures. Cette valeur est utilisée à titre de référence par Santé Canada.

Au Québec, l'exposition des travailleurs au plomb ne doit pas dépasser la valeur d'exposition moyenne pondérée (VEMP) de 0,05 mg/m³. Selon l'ACGIH, la limite d'exposition pour 8 heures est aussi établie à

Inventaire des matières dangereuses Station radar de l'Île Charron

0,05 mg/m³. Des précautions additionnelles s'appliquent selon le RSST et le RCSST pour les travaux de récupération du plomb ou de produits plombifères et les autres opérations connexes.

Le United States Environmental Protection Agency (EPA) et le United States Department of Housing and Urban Development (HUD) considère que les valeurs de référence suivantes sont positives pour le plomb dans les peintures/revêtements considéré comme contenant du plomb:

- 1 mg/cm²
- 5,000 µg/g (mg/kg) ou 5,000 ppm.
- 0.5 % en poids

Ce seuil est utilisé comme référence pour calculer le niveau d'exposition au plomb dont la limite d'exposition moyenne pondérée est de 0,05 mg/m³. Ainsi, si la peinture ou le revêtement de surface contenant 0,5% en poids de plomb était complètement mis en suspension dans l'air et que la limite d'exposition pour la poussière totale de 10 mg/m³ n'est pas dépassée, alors la limite d'exposition pour le plomb ne peut pas être dépassée.

Selon les lignes directrices et guides de références actuelles, il n'existe aucune corrélation directe entre les teneurs de plomb total obtenues dans la peinture (en mg/kg ou ppm) et la limite d'exposition de 0,05 mg/m³. À cet effet, Stantec recommande les seuils suivants comme critère de référence afin d'établir les mesures d'interventions selon les concentrations :

Tableau 2 : Critère de référence pour le plomb

Seuil de concentration de plomb (mg/kg)	Critère de référence
Moins de 90	La peinture est considérée comme contenant très peu ou sans plomb
Entre 90 et 1000	La peinture est considérée contenir une faible concentration de plomb
Entre 1000 et 5000	La peinture est considérée comme contenant du plomb
Plus de 5000	La peinture est considérée contenir une concentration élevée de plomb

Toutefois, pour tous les travaux pouvant mettre suspension une quantité importante de poussière au plomb dans l'air, soit par des techniques d'élimination agressives sur des matériaux contenant moins de 5000 mg/kg de plomb, il est recommandé d'effectuer une surveillance de la qualité de l'air pour confirmer que les concentrations de plomb dans l'air sont inférieures à 0,05 mg/m³. Bien que les teneurs en plomb soient des indicateurs de la présence du plomb dans la peinture, des évaluations de la concentration en milieu de travail sont nécessaires afin de déterminer si les concentrations dans l'air peuvent être dépassées lors de travaux impliquant l'enlèvement de ces peintures.

Selon le règlement sur les matières dangereuses du Québec (RMD) (Q-2, r. 32), tout matériau dont la concentration en plomb des essais de lixiviation est supérieure à 5 mg/L est considéré comme matière dangereuse et il devrait être éliminé dans un centre autorisé.

2.3 SUBSTANCES APPAUVRISANT LA COUCHE D'OZONE (SACO)

Au Canada, la gestion des halocarbures est réglementée par les gouvernements fédéraux, provinciaux et territoriaux. Au niveau fédéral, deux règlements sont applicables en vertu de la Loi canadienne sur la protection de l'Environnement (LCPE) : le *Règlement sur les substances appauvrissant la couche d'ozone et les halocarbures de remplacement* qui contrôle l'importation, l'exportation, la fabrication, l'utilisation, la vente et la mise en vente des substances appauvrissant la couche d'ozone ; et le *Règlement fédéral sur les halocarbures* (2003) qui vise à diminuer et à prévenir les émissions d'halocarbures dans l'environnement provenant des systèmes de réfrigération, de climatisation, d'extinction d'incendie et de solvants. Étant donné qu'il s'agit d'un édifice fédéral, la réglementation provinciale en matière des halocarbures n'est pas applicable.

3.0 MÉTHODOLOGIES

3.1 INSPECTION VISUELLE

3.1.1 Amiante

Au Canada, l'utilisation de l'amiante dans la plupart des biens de consommation est interdite depuis avril 1980. Conséquemment, il est retenu que les bâtiments construits avant cette date peuvent renfermer des matériaux contenant de l'amiante (MCA). Considérant qu'une certaine période de transition, permettant l'écoulement des stocks de matériaux de construction contenant de l'amiante, doit être prise en compte, les bâtiments construits jusqu'en 1985 sont considérés à risque pour la plupart des matériaux, 1990 pour le flochage et 1999 pour les calorifuges.

Une inspection visuelle des matériaux de construction du bâtiment a été effectuée afin de vérifier la présence de matériaux susceptibles de contenir de l'amiante. Les matériaux comprenaient notamment les tuiles de plancher en vinyle, les isolants de calorifuge, les matériaux de flochage, les composés à joint, les matériaux en fibrociment et les matériaux de calfeutrage. Étant donné que le bâtiment a été construit vers 1988, une seule zone présentant des similitudes d'ouvrage (ZPSO), dont les limites physiques sont définies par les matériaux identiques qui le composent et construites à une même époque, a été considérée pour l'ensemble du bâtiment.

3.1.2 Plomb

Une évaluation visuelle des équipements et installations du bâtiment a été effectuée afin de vérifier la présence de matériaux pouvant contenir du plomb. Ces matériaux comprenaient notamment les applications de peinture écaillées ou endommagées.

3.1.3 Substances appauvrissant la couche d'ozone (SACO)

Les substances appauvrissant la couche d'ozone (SACO) sont des agents chimiques habituellement utilisés dans les équipements de refroidissement et les compresseurs pour la réfrigération. Elles ont également été utilisées comme additifs aérosols et dans la production de mousse d'isolation.

Une inspection visuelle a été menée dans le bâtiment en portant attention à la présence possible de tout appareil ou équipement pouvant contenir des SACO.

3.2 ÉCHANTILLONNAGE DE MATÉRIAUX

3.2.1 Amiante

Le protocole d'échantillonnage est basé sur un modèle aléatoire et statistique d'échantillonnage selon les exigences des dispositions réglementaires relatives à la « Gestion sécuritaire de l'amiante » de la Commission des normes, de l'équité, de la santé et de la sécurité du travail (CNESST). Un résumé du guide est présenté dans le Tableau 3 ci-dessous :

Tableau 3 : Protocole d'échantillonnage

Type de matériau	Dimension de la zone présentant des similitudes d'ouvrage	Nombre minimum d'échantillons qui doivent être prélevés
Tuile de plancher	Par type et/ou par couleur	1 échantillon
Pour les matériaux non homogènes (composé à joint, plâtre, etc.)	Pour une même zone présentant des similitudes d'ouvrage	9 échantillons
Pour les matériaux homogènes (tuile acoustique, tuile de plancher en vinyle, panneaux muraux, etc.)	Peu importe	1 échantillon de chaque modèle et de chaque marque
Matériaux calorifuges	Chaque type de calorifuge sur les sections rectilignes de tuyauterie ou de conduites d'une zone couverte	Au moins 3 échantillons
	Pour les parties refaites qui couvrent moins de 1,8 m de longueur	Au moins 1 échantillon
	Pour les parties refaites qui couvrent plus de 1,8 m de longueur, de façon aléatoire.	Au moins 3 échantillons
	L'enveloppe de protection du calorifuge, les différents ciments, mortiers et enduits recouvrant les coudes, les raccords en T ou entourant les thermomètres, les valves, les soupapes, etc.	Au moins 1 échantillon
Matériaux de flocage	Peu importe	2 échantillons
Tout autre matériau	Peu importe	3 échantillons

La méthode d'échantillonnage des matériaux susceptibles de contenir de l'amiante (MSCA) consiste à prélever un morceau du MSCA pour ensuite le placer dans un sac refermable et étanche de type « Ziploc ». Sur chaque échantillon est inscrit la localisation du lieu d'échantillonnage, la nature du matériau et un numéro séquentiel unique. Les outils de travail ont été nettoyés avant et après chaque prélèvement afin d'éviter toute contamination croisée et l'emplacement des échantillons prélevés a été recouvert d'un ruban adhésif afin d'encapsuler les fibres exposées. Aucune réparation des matériaux prélevés n'a fait partie de ce mandat.

Les matériaux visuellement similaires seront référencés de façon spécifique aux échantillons analysés afin de réduire le nombre d'échantillons prélevés. Les zones présentant des similitudes d'ouvrage (ZPSO) sont des secteurs dont les limites physiques sont définies par les matériaux identiques qui le composent et

construites à une même époque. Ainsi, si un échantillon d'un type de matériau mélangé sur place (comme le plâtre de finition ou les composés à joints) s'avère contenir de l'amiante dans une ZPSO, alors tous les matériaux de nature similaire présents dans cette ZPSO doivent aussi être considérés comme contenant de l'amiante. À l'inverse, si aucun des échantillons analysés dans une ZPSO ne s'avère contenir de l'amiante, il est alors jugé que le matériau visé est exempt d'amiante dans cette ZPSO.

L'analyse en laboratoire permet d'identifier et de quantifier le type de fibre d'amiante ou l'absence d'amiante dans les échantillons. Les échantillons de matériaux seront soumis au laboratoire d'analyse indépendant, accrédité et est spécialisé dans l'identification de l'amiante dans les matériaux. L'analyse de laboratoire consiste en un examen au microscope à lumière polarisée entre 100 et 400X tel que requis par la méthode 244 de l'Institut de Recherche Robert-Sauvé en Santé et en Sécurité du Travail du Québec (IRSST) et par microscopie électronique pour les échantillons de tuiles de vinyle.

3.2.2 Plomb

Une inspection visuelle des revêtements de peinture présente dans le bâtiment a été effectuée afin d'identifier les différents types de peinture. Des échantillons de peinture des couleurs prédominantes dans l'immeuble ont été prélevés afin d'évaluer la teneur en plomb. Chaque échantillon a été clairement identifié (date d'échantillonnage, description d'échantillon et numéro d'échantillon) et l'envoi a été accompagné d'un bordereau de transmission sur lequel on pouvait notamment retrouver la liste des échantillons inclus et l'identification de l'analyse requise.

Les échantillons ont été soumis au laboratoire Maxxam Analytique pour l'analyse de leur teneur en plomb. Le laboratoire Maxxam Analytique, situé à la Ville Saint-Laurent, est accrédité par la Canadian Association for Laboratory Accreditation Inc. (CALA) et par le ministère du Développement durable, de l'Environnement et de la Lutte contre les changements climatiques (MDDELCC). Lorsque les résultats analytiques indiquent que les concentrations de plomb sont supérieures au critère établi dans le *Règlement sur les revêtements* (DORS/2005-109, 20 juin 2011) de 90 mg/kg, alors une estimation des surfaces recouvertes des différentes peintures présentes dans ce bâtiment a été réalisée et des essais de lixiviation ont été effectués afin de déterminer si ces peintures doivent être considérées comme une matière dangereuse selon le RMD (Q-2, r.32).

4.0 LIMITATIONS DE LA PORTÉE DES TRAVAUX

Ce rapport s'appuie sur les observations réalisées aux endroits accessibles du bâtiment ainsi que les résultats d'analyses des matériaux spécifiques échantillonnés, tel que présenté à l'annexe C. Les résultats analytiques reflètent les matériaux échantillonnés aux endroits spécifiques de leur prélèvement.

L'échantillonnage a été réalisé pour les peintures susceptibles de contenir du plomb ainsi que les matériaux susceptibles de contenir de l'amiante. L'évaluation de la présence des autres matières dangereuses a été réalisée sur une base visuelle uniquement et menée dans les espaces accessibles du bâtiment.

Les espaces dissimulés, c.-à-d. ceux derrière une structure du bâtiment (ex. : murs ou plafonds rigides), n'ont pas été inspectés. Les éléments tels que les finitions intérieures et extérieures, les plafonds rigides, les murs, les planchers et les éléments structurels du bâtiment n'ont pas été enlevés dans le but d'accéder

à un espace dissimulé. De plus, la nature généralement complexe de la construction d'un bâtiment rend certains des matériaux visés difficiles d'accès et impose par conséquent les limites ci-dessous à la présente étude :

- Les matériaux pouvant contenir de l'amiante, mais qui n'étaient pas accessibles lors de l'inspection visuelle du bâtiment, comprennent, sans s'y limiter, les éléments suivants :
 - Matériaux enfouis (par exemple, tuyau de drainage en amiante-ciment) ;
 - Matériaux isolants présents à l'intérieur de murs (par exemple : de la vermiculite pouvant contenir de l'amiante à l'intérieur de blocs de béton ou de murs de briques) ;
 - Cloisons sèches ou plâtre ainsi que les matériaux de finition qui leur sont associés dissimulés derrière de nouveaux murs ;
 - Matériaux imperméabilisants utilisés sur le toit ;
 - Ruban tissé à l'intérieur des joints de raccordement de conduites de ventilation ;
 - Isolation mécanique dans les cavités murales, vides sanitaires, tunnels ou autres espaces dissimulés ou confinés ;
 - Matériaux d'isolation à l'intérieur de portes coupe-feu ;
 - Garnitures mécaniques ou matériau isolant à l'intérieur d'appareils de chauffage, de ventilation et de climatisation (CVC) ;
 - Matériaux d'isolation et de protection contre la chaleur à l'intérieur d'installations mécaniques et électriques ainsi que de luminaires.
- Des échantillons de peinture susceptibles de contenir du plomb ont été prélevés à partir de surfaces d'applications majeures de peinture où des couleurs ou types de peinture différents ont été identifiés visuellement. Bien que les surfaces où les échantillons ont été prélevés peuvent contenir plus d'une couche de peinture, les échantillons de peinture sont décrits uniquement par la couleur en surface (visible). Dans la mesure du possible, des mesures ont été prises pour inclure toutes les couches de peinture dans les échantillons prélevés. Étant donné que les résultats analytiques font référence uniquement à la couleur de peinture en surface, le contenu en plomb de toutes les surfaces peintes semblables à celles représentées par la couleur de peinture en surface sera présumé être le même, et ce, indépendamment des couches de peinture sous-jacentes pouvant différer, le cas échéant.
- L'évaluation s'est limitée à des informations verbales et des données techniques fournies par le personnel technique des bâtiments étudiés. Aucun test de ces équipements n'a été effectué. L'équipement ou les matériaux qui n'ont pas été inclus dans cette évaluation, mais qui peuvent contenir des SACO, comprennent, sans s'y limiter, les équipements portables, y compris les réfrigérateurs de

type domestique et les refroidisseurs d'eau, la mousse plastique souple ou la mousse isolante rigide, les solvants, les canettes d'aérosol et l'équipement d'extinction d'incendie.

5.0 RÉSULTATS

5.1 INSPECTION VISUELLE

5.1.1 Amiante

Une inspection visuelle a été effectuée afin d'identifier les MSCA. Le Tableau 4 ci-dessous présente les observations selon les différents types de matériaux de construction. Une sélection de photographies prises lors des travaux de terrain est insérée à l'annexe B.

Tableau 4 : Résumé de l'inspection visuelle pour les MSCA

Matériau	Composant	Localisation	Condition	Observations
Flocage	Plafond	Niveau 4	Bonne condition	Flocage a été constaté au plafond. Un échantillon a été prélevé.
Tuile de vinyle	Plancher	Niveau 4	Bonne condition	Tuile de vinyle 12x12, couleur beige, a été constaté. Un échantillon de la tuile et de la colle a été prélevé.
Calorifuge	Système de ventilation	Rez-de-chaussée, Niveau 4 et mezzanine	Bonne condition	De l'isolant de calorifuge a été constaté sur les systèmes de ventilation. Sur la base des observations, les isolants sont faits de fibre de verre. Un échantillon a été prélevé afin de confirmer hors de tout doute l'absence d'amiante.
Calfeutrant	Porte de l'ascenseur	Niveau 4	Légèrement endommagé	Le calfeutrant de couleur blanche a été observée sur la porte de l'ascenseur. Un échantillon a été prélevé.
Calfeutrant	Persienne extérieure	Extérieur	Légèrement endommagé	Le calfeutrant de couleur grise a été observée sur la porte de l'ascenseur. Un échantillon a été prélevé.
Drain de toit	Tuyauterie	Tous les niveaux	Bonne condition	Le drain de toit, d'une longueur approximative de 50 mètres, a été observé dans l'ensemble du bâtiment. Un échantillon a été prélevé.
Composé à joint	Mur	Niveau 4 et rez-de-chaussée	Légèrement endommagé	3 échantillons de composé de joint ont été prélevés sur les murs afin de confirmer la présence d'amiante.
Les matériaux de toitures	Toit	Toit	Bonne condition	La toiture a été rénovée en 2018 et comprend des nouveaux matériaux. Aucun échantillon n'est requis.
Isolant de styromousse	Mur	Niveau 4 et rez-de-chaussée	Bonne condition	De l'isolation en styromousse a été constaté derrière le revêtement de gypse sur les murs. Ce matériau n'est pas réputé contenir de l'amiante. Aucun échantillon n'est requis.

5.1.2 Plomb

Selon les informations obtenues par le représentant du bâtiment, un nouveau revêtement protecteur acrylique a été appliquée sur la façade extérieure en 2018. Des revêtements de peinture ont été observés sur les murs au niveau 4 et sur le plancher du rez-de-chaussée. Selon les observations, les revêtements de peinture observés sont généralement en bonne condition à l'exception de surfaces limitées couvertes de peinture endommagée au bas du système de ventilation situé au niveau 4.

5.1.3 Substances appauvrissant la couche d'ozone (SACO)

Selon les informations obtenues, aucun système de climatisation n'est présent dans le bâtiment. L'inspection visuelle a permis de confirmer qu'aucun appareil ou équipement susceptible de contenir des SACP n'a été constaté.

5.2 RÉSULTATS ANALYTIQUES

5.2.1 Amiante

Un total de dix (10) échantillons de matériaux susceptibles de contenir de l'amiante ont été prélevés. Les résultats analytiques de ces échantillons sont présentés dans le Tableau 5 ci-dessous. Ces résultats indiquent que les échantillons de fibrociment du drain de toit contiennent de l'amiante à une concentration de 20% chrysotile et 15% crocidolite.

La Figure 1 de l'annexe A présente la localisation des échantillons prélevés. Le certificat d'analyse du laboratoire est inclus à l'annexe C.

Tableau 5 : Résultats analytiques des échantillons de matériaux

Nom de l'échantillon	Localisation	Description	Friable/ Non-Friable	Concentration % et type d'amiante
BS-01	Niveau 4-mezzanine	Drain de toit	Non-friable	20% chrysotile 15% crocidolite
BS-02	Niveau 4	Tuile de vinyle	Non-friable	Non détecté ¹
BS-02	Niveau 4	Colle	Non-friable	Non détecté ¹
BS-03	Niveau 4	Flocage	Non-friable	Non détecté ¹
BS-04A	Niveau 4	Composé à joint	Non-friable	Non détecté ¹
BS-04B	Niveau 4	Composé à joint	Non-friable	Non détecté ¹
BS-04C	Rez-de-chaussée	Composé à joint	Non-friable	Non détecté ¹
BS-05	Niveau 4	Calfeutrante blanc	Non-friable	Non détecté ¹
BS-06	Rez-de-chaussée	Isolant de calorifuge	Non-friable	Non détecté ¹

Nom de l'échantillon	Localisation	Description	Friable/ Non-Friable	Concentration % et type d'amiante
BS-07	Persienne extérieure	Calfeutrant gris	Non-friable	Non détecté ¹

Note 1 : Matériaux dont la concentration est inférieure à 0,1 %

5.2.2 Plomb

Selon les observations, les revêtements de peinture observés sont généralement en bonne condition et endommagé à certains endroits. Un total de deux (2) échantillons de peintures ont été prélevés pour l'analyse de leur teneur en plomb. Les résultats analytiques des échantillons de peinture sont présentés dans le Tableau 6 ci-dessous. Le plan de localisation à l'annexe A présente la localisation des échantillons de peinture prélevés. Des photographies prises lors des travaux de terrain sont insérées à l'annexe B. Le certificat d'analyse du laboratoire est inclus à l'annexe C.

Selon les résultats analytiques obtenus, les concentrations en teneur de plomb total de 530 mg/kg pour la peinture grise sont considérées à une faible concentration de plomb (entre 90 et 1000 mg/kg). Ainsi, les revêtements de peinture observés dans le bâtiment ont une concentration en plomb supérieure au critère établi dans le Règlement sur les revêtements (DORS/2005-109, 20 juin 2011) de 90 mg/kg en plomb.

De plus, sur la base des résultats obtenus, cet échantillon de peinture a été soumis à un essai de lixiviation. Les résultats analytiques ont révélé une concentration inférieure à la norme de 5 mg/L du RMD. À cet effet, les types de peintures prélevés et les substrats qui leur sont associés ne sont donc pas considérés comme des matières dangereuses résiduelles.

Tableau 6 : Résultats analytiques – Échantillons de peinture

Nom de l'échantillon	Localisation	Composant	Peinture	Concentration en plomb (mg/kg)	Lixiviation (mg/L)
PS-01	4 ^e étage (niveau 1)	Mur	Blanche	Non détecté ¹	...(2)
PS-02	Rez-de-chaussée	Plancher	Grise	530	0,1

Note 1 : Sous la limite de détection de la méthode d'analyse du laboratoire de 5 mg/kg

Note 2 : L'analyse des essais de lixiviation du plomb n'est pas requise sur cet échantillon en raison de l'absence de concentration de plomb sur l'échantillon de peinture.

6.0 CONCLUSIONS ET RECOMMANDATIONS

Les informations recueillies, les observations réalisées et les résultats d'analyses obtenus dans le cadre de cet inventaire des matières dangereuses ont permis de formuler les conclusions et les recommandations ci-dessous.

6.1 AMIANTE

Les résultats d'analyses ont permis d'identifier la présence d'amiante sur le matériau de fibrociment du drain de toit. À cet effet, l'ensemble des drains de toit dans le bâtiment est considéré contenir de l'amiante.

Dans l'éventualité que doivent être effectués des travaux pouvant affecter le matériau de fibrociment contenant de l'amiante, ceux-ci devront être effectués en condition de travail à risque faible. Tout travail de démolition ou de rénovation impliquant les MCA identifiés dans cette étude doit être exécuté selon les procédures de travail édictées selon la Politique ministérielle PM 057 sur la Gestion de l'amiante, la Directive et norme sur la gestion de l'amiante de Services publics et Approvisionnement Canada (SPAC) ainsi que selon les procédures de travail édictées au *Code de sécurité pour les travaux de construction (CSTC)*.

6.2 PLOMB

Un total de deux (2) échantillons de peinture a été prélevé dans le bâtiment pour l'analyse de leur teneur en plomb. Les résultats indiquent que la peinture grise appliquée sur le plancher au RDC contient du plomb à une concentration de 530 mg/kg. Aucun des échantillons de peinture et leurs substrats ne sont considérés comme des matières dangereuses résiduelles selon le RMD. À cet effet, aucune précaution particulière n'est requise pour le mode de gestion et d'élimination des débris de peinture.

Dans l'éventualité que doivent être effectués des travaux pouvant affecter la peinture grise, considérer les options suivantes :

- Pour des travaux de rénovation mineurs, n'affectant qu'une petite surface de peinture, effectuer les travaux à l'aide d'outils munis d'une aspiration à la source afin de ne pas générer de poussière aéroportée et considérer les précautions générales décrites ci-dessous.
- Pour des travaux de sablage ou autre activité pouvant générer une quantité importante de poussière aéroportée, effectuer les travaux en condition à risque élevé (se référer au niveau de classement des travaux selon la méthode employée tel que décrite dans le guide ontarien « Environmental Abatement Council of Ontario (EACO) »).

Précautions générales

Tous les travaux pouvant affecter les revêtements de peinture à base de plomb, peu importe la concentration, doivent être entrepris de manière à éviter de générer des poussières. Tous les travaux pouvant mettre en suspension une quantité importante de poussière au plomb dans l'air, mettre en œuvre les mesures de prévention correspondantes à la technique, porter des équipements de protections individuelles (EPI) adaptés aux tâches à réaliser et réduire l'empoussièrement par des dispositifs d'atténuation de poussières à la source. Selon le RSST et l'ACGIH, l'exposition individuelle à la poussière de plomb dans l'air ou de fumées ne doit pas dépasser 0,05 mg/m³.

6.3 SUBSTANCES APPAUVRISANT LA COUCHE D'OZONE

Selon les informations obtenues, aucun système de climatisation n'est présent dans le bâtiment. Lors de l'inspection, aucun autre équipement susceptible de contenir des SACO n'a été identifié. À cet effet, aucune précaution particulière n'est requise relativement aux SACO.

7.0 LIMITATIONS GÉNÉRALES

Le présent rapport documente des travaux menés conformément aux normes professionnelles généralement reconnues et applicables au moment et à l'endroit où les services ont été fournis. Aucune autre déclaration n'est faite et aucune autre garantie n'est donnée quant à l'exactitude et à l'exhaustivité des données ou des conclusions du présent rapport, y compris aucune assurance qu'il englobe tous les risques possibles associés à la propriété en question.

Le présent rapport propose une évaluation de certaines conditions environnementales associées à la partie désignée de la propriété évaluée, au moment où les travaux ont été menés, et est fondé sur les renseignements obtenus par Stantec à ce moment. Aucune garantie n'est donnée quant à l'exactitude et à l'exhaustivité de ces renseignements. Stantec a présumé corrects tous les renseignements fournis par le client ou un tiers dans le cadre de la préparation du présent rapport. Stantec n'est aucunement responsable de toute lacune ou de toute inexactitude des renseignements reçus d'autres parties.

Les recommandations et les conclusions énoncées dans le présent rapport sont uniquement fiables lorsqu'elles sont liées aux conditions de la partie de la propriété désignée évaluée au moment où les travaux ont été effectués. Les activités menées sur la propriété après l'évaluation de Stantec pourraient avoir considérablement modifié l'état de la propriété. Stantec ne peut émettre aucun commentaire sur les autres zones de la propriété qui n'ont pas été évaluées.

Les conclusions formulées dans le présent rapport reflètent l'avis professionnel de Stantec au moment de sa rédaction et sont uniquement fondées sur la portée des travaux qui y sont décrits, sur la quantité restreinte de données disponibles et les résultats des travaux. Elles ne certifient pas les conditions environnementales de la propriété. Le présent rapport ne devrait pas être considéré comme un avis juridique.

Le présent rapport a été préparé pour l'utilisation exclusive du client qui y est désigné, et son utilisation par un tiers est interdite. Stantec n'est pas responsable des pertes, dommages, risques ou demandes de règlement découlant de quelque manière que ce soit de l'utilisation du présent rapport par un tiers.

L'emplacement de tout service public, de tout bâtiment et de toute structure et les limites de la propriété illustrées ou décrites dans le présent rapport, s'il y a lieu, y compris les files de poteaux, les canalisations, les conduites maîtresses, les égouts ou les autres services publics en surface ou sous la surface, ne sont pas garantis. L'emplacement de tels services publics ou de telles structures devrait être confirmé avant la réalisation de travaux, et Stantec n'est aucunement responsable des dommages qui peuvent y être causés.

Inventaire des matières dangereuses

Station radar de l'Île Charron

Les conclusions sont basées sur l'état du site observé par Stantec au moment où les travaux ont été réalisés aux emplacements particuliers de l'analyse ou de l'échantillonnage, et cet état peut différer selon l'emplacement. Des facteurs comme de possibles domaines de préoccupation déterminés dans des études précédentes, des conditions sur le site et le coût peuvent avoir limité les emplacements d'échantillonnage ayant servi à l'évaluation. De plus, les analyses ont seulement été faites pour un nombre limité de paramètres chimiques; on ne peut donc pas déduire que d'autres éléments chimiques ne sont pas présents. En raison de la nature de l'évaluation et de la quantité restreinte des données disponibles, Stantec ne peut offrir de garanties pour les risques environnementaux non identifiés ni garantir que les résultats de l'échantillonnage représentent l'état de l'ensemble du site. Comme le présent rapport vise à déterminer les conditions du site qui pourraient représenter un risque pour l'environnement, la portée de l'évaluation ne comprend pas la détermination des risques non environnementaux pour les structures ou les personnes sur le site.

Si des renseignements supplémentaires qui diffèrent considérablement de notre compréhension des conditions énoncées dans le présent rapport deviennent disponibles, Stantec se décharge de toute responsabilité quant à la mise à jour des conclusions du présent rapport.

ANNEXE A

Plans de localisation



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Note importante

Toutes les dimensions montrées sur cette figure sont approximatives et l'utilisateur est responsable de les vérifier. Stantec devrait être avisée de toute erreur ou omission dans les plus brefs délais.

Cliant/Projet

TPSGC
RAPPORT SUR L'INVENTAIRE DES MATIÈRES
DANGEREUSES POUR LA STATION RADAR
DE L'ÎLE CHARRON

Source

Base de données topographiques du Québec
Carte no. 31H11-200-0101

Titre de la figure

PLAN DE LOCALISATION

No. de projet

157102430

Date

2018-09-24

Dessiné par

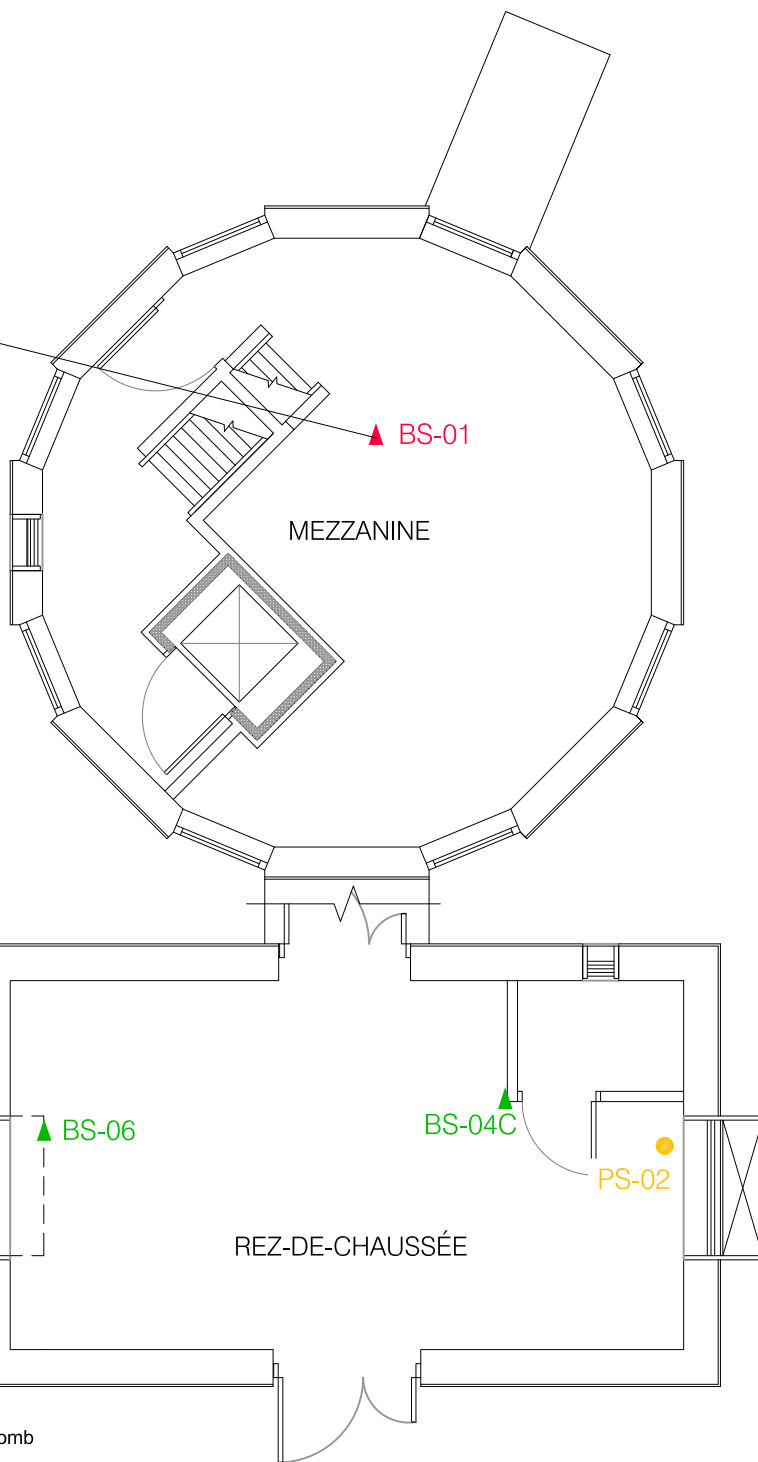
J.C.

Figure

Approuvé par

D.Q.

1



LÉGENDE

Amiante

- ▲ Échantillon de matériaux ne contenant pas d'amiante
- ▲ Échantillon de matériaux contenant de l'amiante
- ▲ Échantillon de matériaux présumé contenir de l'amiante

Plomb

- La peinture est considérée comme sans plomb (0 à 90 mg/kg)
- La peinture est considérée contenir une faible concentration de plomb (90 à 1000 mg/kg)
- La peinture est considérée comme contenant du plomb (1000 à 5000 mg/kg)
- La peinture est considérée contenir une concentration élevée de plomb (>5000 mg/kg)



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www.stantec.com

Note importante

Toutes les dimensions montrées sur cette figure sont approximatives et l'utilisateur est responsable de les vérifier. Stantec devrait être avisée de toute erreur ou omission dans les plus brefs délais.

Cliant/Projet

TPSGC
RAPPORT SUR L'INVENTAIRE DES MATIÈRES
DANGEREUSES POUR LA STATION RADAR
DE L'ÎLE CHARRON

Source

Base de données topographiques du Québec
Carte no. 31H11-200-0101

Titre de la figure

PLAN DE LOCALISATION DES ÉCHANTILLONS

No. de projet

157102430

Date

2018-09-24

Dessiné par

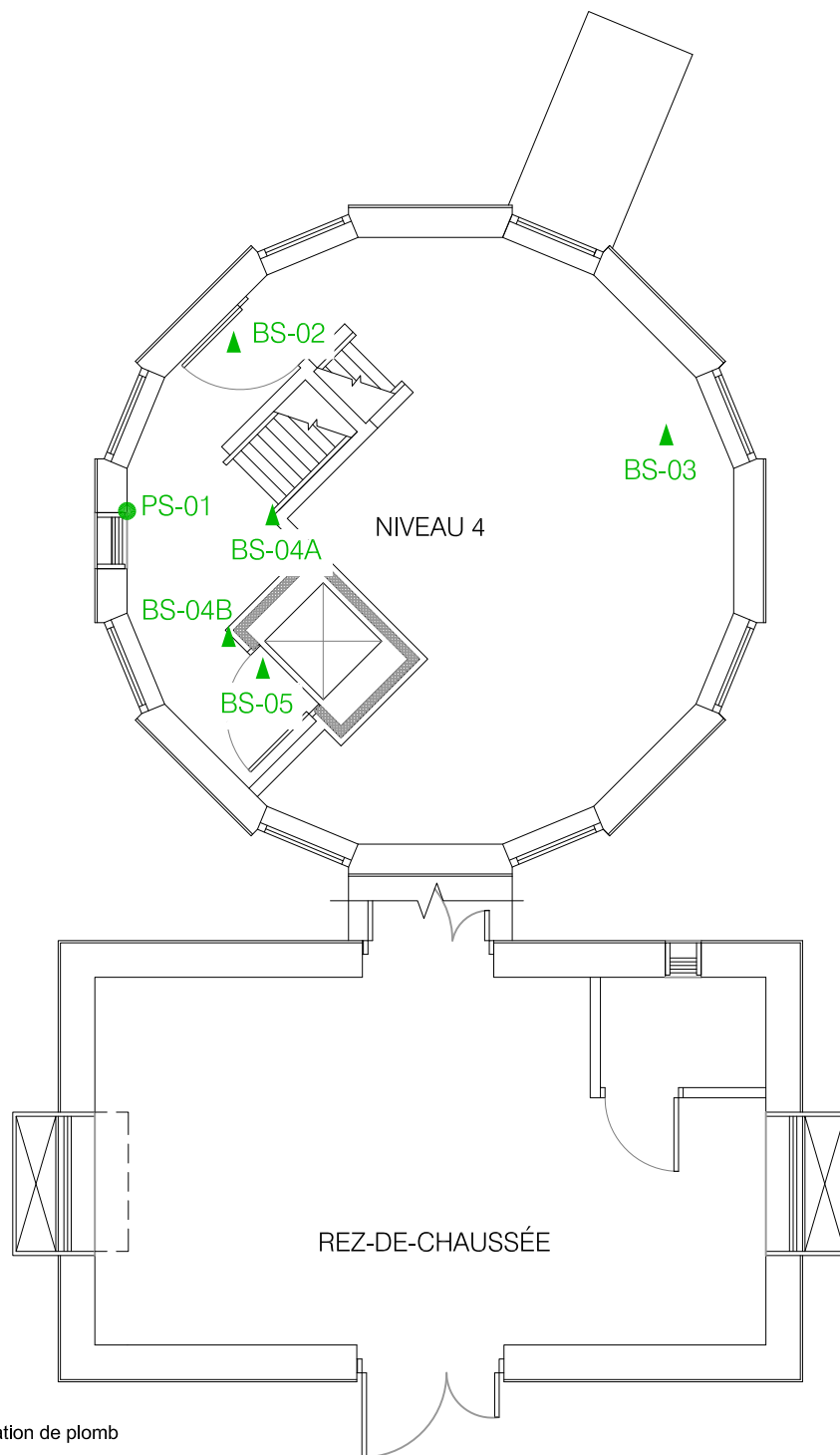
J.C.

Figure

Approuvé par

D.Q.

2



LÉGENDE

Amiante

- ▲ Échantillon de matériaux ne contenant pas d'amiante
- ▲ Échantillon de matériaux contenant de l'amiante
- ▲ Échantillon de matériaux présumé contenir de l'amiante

Plomb

- La peinture est considérée comme sans plomb (0 à 90 mg/kg)
- La peinture est considérée contenir une faible concentration de plomb (90 à 1000 mg/kg)
- La peinture est considérée comme contenant du plomb (1000 à 5000 mg/kg)
- La peinture est considérée contenir une concentration élevée de plomb (>5000 mg/kg)



Stantec Experts-conseils ltée
100, boulevard Alexis-Nihon, bureau 110
Saint-Laurent, Québec H4M 2N6
Tel: 514.739.0708
Fax: 514.739.8499
www.stantec.com

Note importante

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Cliant/Projet

TPSGC
RAPPORT SUR L'INVENTAIRE DES MATIÈRES
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Source

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Carte no. 31H11-200-0101

Titre de la figure

PLAN DE LOCALISATION DES ÉCHANTILLONS

No. de projet

157102430

Date

2018-09-24

Dessiné par

J.C.

Figure

Approuvé par

D.Q.

3

ANNEXE B

Document photographique

INVENTAIRE ET CARTOGRAPHIE DES CONTAMINANTS – RAPPORT PHOTOGRAPHIQUE

STATION RADAR DE L'ÎLE CHARRON


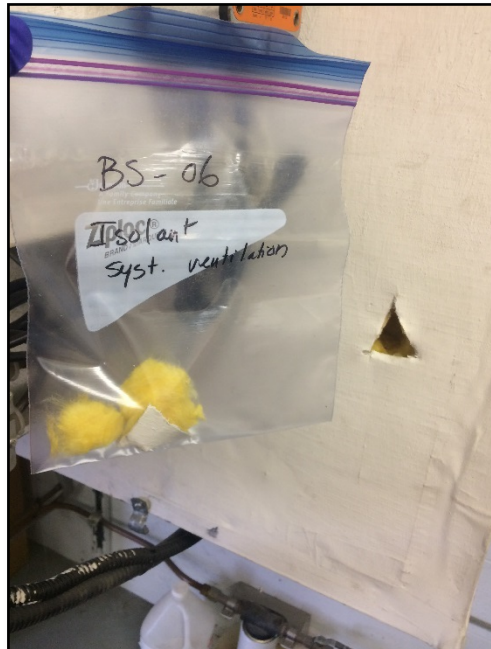

Photo	N°1	
Type de contaminant	Amiante	
Matériau	Bardeaux asphalte	
Localisation	Toit	
Observation	Selon les informations obtenues, les matériaux de toiture ont été installés en 2018.	
Résultat	Sans amiante	

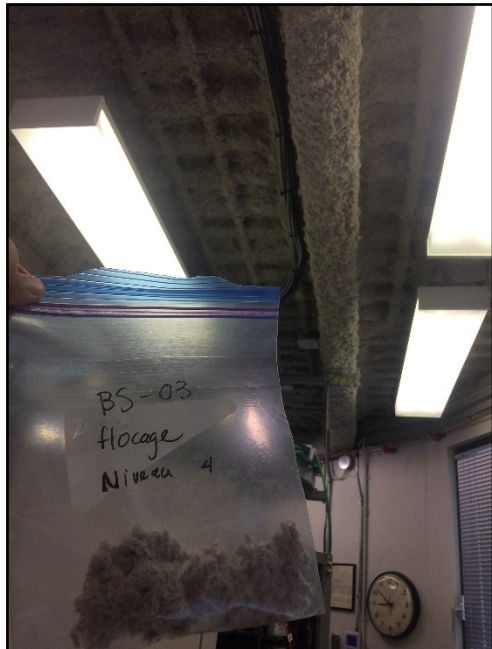
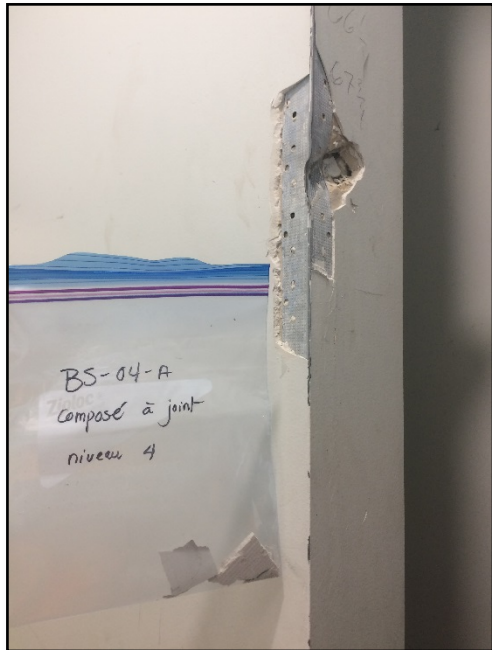
Photo	N°2	
Type de contaminant	Amiante	
Matériau	Isolant de type styromousse	
Localisation	Derrière les murs de gypse	
Observation	Matériau de type styromousse de 3 à 4 pouces d'épaisseur	
Résultat	Sans amiante	

INVENTAIRE ET CARTOGRAPHIE DES CONTAMINANTS – RAPPORT PHOTOGRAPHIQUE

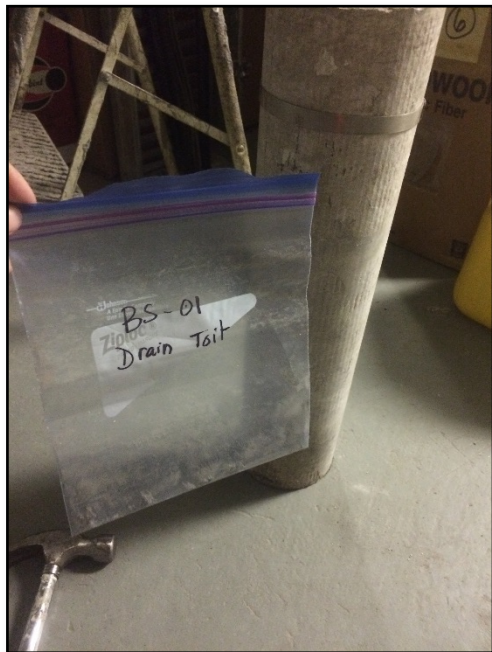
STATION RADAR DE L'ÎLE CHARRON

Photo	N°3	
Type de contaminant	Amiante	
Matériau	Isolant de calorifuge	
Localisation	Système de ventilation au rez-de-chaussée	
N° échantillon	BS-06	
Résultat	Sans amiante	
Photo	N°4	
Type de contaminant	Amiante	
Matériau	Tuiles de plancher en vinyle et colle	
Localisation	4 ^e étage	
N° échantillon	BS-02	
Résultat	Sans amiante	

INVENTAIRE ET CARTOGRAPHIE DES CONTAMINANTS – RAPPORT PHOTOGRAPHIQUE STATION RADAR DE L'ÎLE CHARRON

Photo	N°5	
Type de contaminant	Amiante	
Matériau	Isolant giclé (flocage)	
Localisation	Plafond au 4 ^e étage	
N° échantillon	BS-03	
Résultat	Sans amiante	
Photo	N°6	
Type de contaminant	Amiante	
Matériau	Composé à joint	
Localisation	Murs au 4 ^e étage	
N° échantillon	BS-04A, BS-04B, BS-04C	
Résultat	Sans amiante	

INVENTAIRE ET CARTOGRAPHIE DES CONTAMINANTS – RAPPORT PHOTOGRAPHIQUE STATION RADAR DE L'ÎLE CHARRON

Photo	N°7	
Type de contaminant	Amiante	
Matériau	Drain de toit	
Localisation	Du niveau 4 au rez-de-chaussée	
N° échantillon	BS-01	
Résultat	20% Chrysotile 15% Crocidolite	
Photo	N°8	
Type de contaminant	Amiante	
Matériau	Calfeutrant	
Localisation	Persienne extérieure	
N° échantillon	BS-07	
Résultat	Sans amiante	

INVENTAIRE ET CARTOGRAPHIE DES CONTAMINANTS – RAPPORT PHOTOGRAPHIQUE
STATION RADAR DE L'ÎLE CHARRON

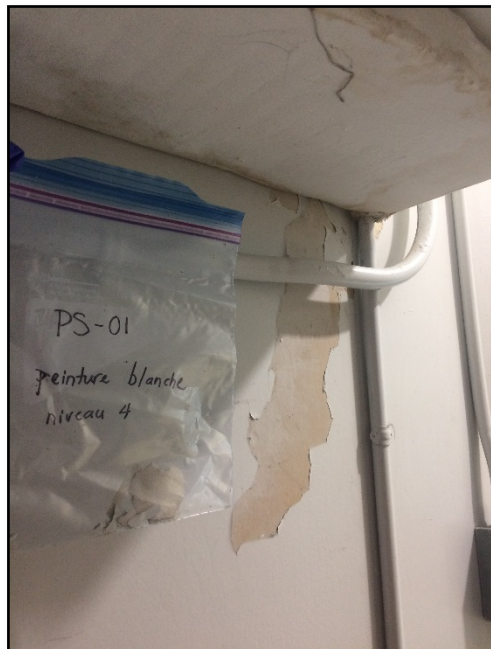
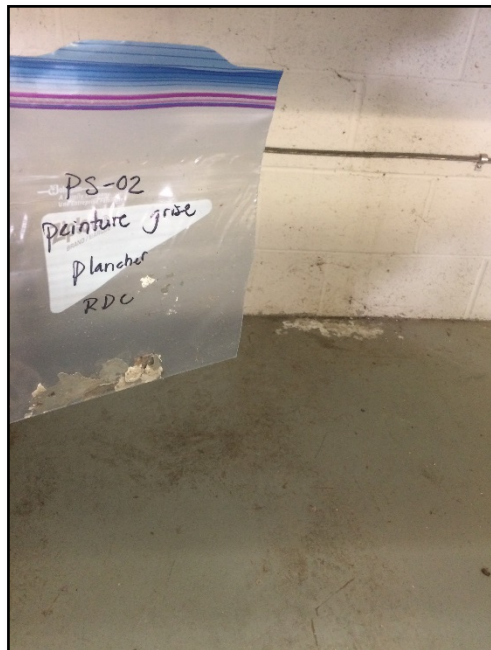
Photo	N°9	
Type de contaminant	Plomb	
Matériau	Peinture blanche	
Localisation	4 ^e étage	
N° échantillon	PS-01	
Résultat	Non détecté Pas une matière dangereuse	

Photo	N°10	
Type de contaminant	Plomb	
Matériau	Peinture grise au plancher	
Localisation	Rez-de-chaussée	
N° échantillon	PS-02	
Résultat	530 mg/kg de plomb Pas une matière dangereuse	

ANNEXE C

Certificats d'analyses



EMSL Canada Inc.

4200 rue Seré Ville Saint-Laurent, QC H4T 1A6

Tél/Fax (438) 338-9142 / (438) 338-9143

<http://www.EMSL.com> / MontrealLab@EMSL.com

Réf. Commande: 681803280

N° Client: 55JACQ30C

Bon de Commande:

N° Projet:

Attn: Dao Quach
Stantec Consulting Ltd.
100 Alexis Nihon
bureau 110
Montreal, QC H4M 2N6
Proj: 157102430

Téléphone: (514) 883-1629
Fax: (514) 739-8499
Date de Réception: 06/9/2018
Date du Prélèvement: 06/9/2018
Date de l'analyse: 13/9/2018 - 24/9/2018

Résumé du rapport d'analyse de l'amiante en utilisant la méthode analytique 244 de l'IRSST

Nom d'échantillon	Description d'échantillon	Couleur	ESSAI /	Partie non-amiante		Amiante
			Date d'analyse	Fibreux	Non Fibreux	
BS - 01 EMSL 681803280-0001	Drain de toit	Gris/Bleu	MLP	0%	65%	20% Chrysotile 15% Crocidolite
			13/9/2018			
BS- 02- Vinyl Floor Tile EMSL 681803280-0002	Tuile de vinyle + colle	Gris/Blanc	MLP	0%	100%	Non Détecté
			13/9/2018			
			MET	0.0%		Non Détecté
			24/9/2018			
BS- 02- Glue EMSL 681803280-0002A	Tuile de vinyle + colle	Noir	MLP	1%	99%	Non Détecté
			13/9/2018			
BS - 03 EMSL 681803280-0003	Flocage	Gris	MLP	95%	5%	Non Détecté
			13/9/2018			
BS - 04A EMSL 681803280-0004	Composé à joint	Blanc	MLP	<1%	100%	Non Détecté
			13/9/2018			
BS - 04B EMSL 681803280-0005	Composé à joint	Beige	MLP	<1%	100%	Non Détecté
			13/9/2018			
BS - 04C EMSL 681803280-0006	Composé à joint	Blanc	MLP	0%	100%	Non Détecté
			13/9/2018			
BS - 05 EMSL 681803280-0007	Calfeutrant blanc	Blanc	MLP	<1%	100%	Non Détecté
			13/9/2018			
BS - 06 EMSL 681803280-0008	Isolant de calorifuge/ systeme ventilation	Brun clair/Blanc/ Jaune	MLP	96%	4%	Non Détecté
			13/9/2018			
BS - 07- Caulk EMSL 681803280-0009	Calfeutrant gris	Gris	MLP	2%	98%	Non Détecté
			13/9/2018			
BS - 07- Base Coat EMSL 681803280-0009A	Calfeutrant gris	Brun clair	MLP	<1%	100%	Non Détecté
			13/9/2018			



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<http://www.EMSL.com> / MontrealLab@EMSL.com

Réf. Commande: 681803280

N° Client: 55JACQ30C

Bon de Commande:

N° Projet:

Résumé du rapport d'analyse de l'amiante en utilisant la méthode analytique 244 de l'IRSST

Nom d'échantillon	Description d'échantillon	Couleur	ESSAI /	Partie non-amiante		Amiante
			Date d'analyse	Fibreux	Non Fibreux	
Analyste(s):						
Giancarlo DiLalla	MLP(10)					
Lemma Mohammad	MLP(1)					
	MET(1)					

Examiné et approuvé par:

Lemma Mohammad, Directeur(trice) du Laboratoire ou
autre signataire autorisé

Les intervalles de concentration applicables à la méthode d'analyse de l' IRSST 244 sont les suivantes: ND (non détecté), Trace (4 fibres ou moins, contamination possible), <1, (1 à 5%), (entre 5 à 10%), (entre 10 à 25%), (entre 25 à 50%), (entre 50 à 75 %), (entre 75 à 90%), (> 90%). Les tuiles de plancher signalées comme "Non détecté" ou " Trace" par l'analyse de MLP doivent être analysés par MET (Méthode ELAP 198.4). La limite de détection pour les échantillons "Non détecté" est <0.1%. En raison des limites inhérentes à la méthode MLP, les fibres d'amiante de dimensions inférieures à la limite de la résolution ne seront pas détectées. Ce rapport d'essai ne concerne que les échantillons testés, et ne peut être reproduit sous aucune forme sans l'accord écrite d'EMSL. La responsabilité d' EMSL est limitée au coût de l'analyse. EMSL ne porte aucune responsabilité pour les activités de collecte d'échantillon ou des limites des méthodes analytiques. L'interprétation et l'utilisation des résultats des tests sont à la charge du client. Les échantillons ont été reçus en bon état, sauf indication contraire.

Analyses effectués par EMSL Canada Inc. Ville Saint-Laurent, QC PLM IRSST: NVLAP Lab Code 201052-0, TEM IRSST: NYS ELAP Lab Code 12043

La rapport modifié: 24/9/2018

Votre # du projet: 157102430
Adresse du site: ILE CHARRON
Votre # Bordereau: 961601

Attention: Dao Quach

STANTEC CONSULTING LTD
MONTREAL
100, boulevard Alexis-Nihon
Suite 110
Ville Saint-Laurent, QC
CANADA H4M 2N6

Date du rapport: 2018/09/24
Rapport: R2399289
Version: 2 - Révisé

CERTIFICAT D'ANALYSE – RÉVISÉ

DE DOSSIER MAXXAM: B839036

Reçu: 2018/09/06, 12:00

Matrice: PEINTURE
Nombre d'échantillons reçus: 2

Analyses	Quantité	Date de l' extraction	Date Analysé	Méthode de laboratoire	Référence Primaire
Métaux extractibles totaux	2	2018/09/10	2018/09/11	STL SOP-00006	MA.200–Mét. 1.2 R5 m
Métaux lixiviés	1	2018/09/21	2018/09/23	STL SOP-00006	MA.200–Mét. 1.2 R5 m
Lix.-espèces inorg.(TCLP, EPA 1311)	1	2018/09/20	2018/09/21	STL SOP-00024	MA100-Lixcom1.1 R1 m

Remarques:

Les laboratoires Maxxam sont certifiés ISO/IEC 17025:2005 pour certains paramètres précis des portées d'accréditation. Sauf indication contraire, les méthodes d'analyses utilisées par Maxxam s'inspirent des méthodes de référence d'organismes provinciaux, fédéraux et américains, tels que le CCME, le MDDELCC, l'EPA et l'APHA.

Toutes les analyses présentées ont été réalisées conformément aux procédures et aux pratiques relatives à la méthodologie, à l'assurance qualité et au contrôle de la qualité généralement appliqués par les employés de Maxxam (sauf s'il en a été convenu autrement par écrit entre le client et Maxxam). Toutes les données de laboratoire rencontrent les contrôles statistiques et respectent tous les critères de CQ et les critères de performance des méthodes, sauf s'il en a été signalé autrement. Tous les blancs de méthode sont rapportés, toutefois, les données des échantillons correspondants ne sont pas corrigées pour la valeur du blanc, sauf indication contraire. Le cas échéant, sauf indication contraire, l'incertitude de mesure n'a pas été prise en considération lors de la déclaration de la conformité à la norme de référence.

Les responsabilités de Maxxam sont restreintes au coût réel de l'analyse, sauf s'il en a été convenu autrement par écrit. Il n'existe aucune autre garantie, explicite ou implicite. Le client a fait appel à Maxxam pour l'analyse de ses échantillons conformément aux méthodes de référence mentionnées dans ce rapport. L'interprétation et l'utilisation des résultats sont sous l'entière responsabilité du client et ne font pas partie des services offerts par Maxxam, sauf si convenu autrement par écrit. Maxxam ne peut pas garantir l'exactitude des résultats qui dépendent des renseignements fournis par le client ou son représentant.

Les résultats des échantillons solides, sauf les biotes, sont rapportés en fonction de la masse sèche, sauf indication contraire. Les analyses organiques ne sont pas corrigées en fonction de la récupération, sauf pour les méthodes de dilution isotopique.

Les résultats s'appliquent seulement aux échantillons analysés. Si l'échantillonnage n'est pas effectué par Maxxam, les résultats se rapportent aux échantillons fournis pour analyse.

Le présent rapport ne doit pas être reproduit, sinon dans son intégralité, sans le consentement écrit du laboratoire.

Lorsque la méthode de référence comprend un suffixe « m », cela signifie que la méthode d'analyse du laboratoire contient des modifications validées et appliquées afin d'améliorer la performance de la méthode de référence.

Notez: Les données brutes sont utilisées pour le calcul du RPD (% d'écart relatif). L'arrondissement des résultats finaux peut expliquer la variation apparente.

Note : Les paramètres inclus dans le présent certificat sont accrédités par le MDDELCC, à moins d'indication contraire.

Votre # du projet: 157102430
Adresse du site: ILE CHARRON
Votre # Bordereau: 961601

Attention: Dao Quach

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MONTREAL
100, boulevard Alexis-Nihon
Suite 110
Ville Saint-Laurent, QC
CANADA H4M 2N6

Date du rapport: 2018/09/24
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Version: 2 - Révisé

CERTIFICAT D'ANALYSE – RÉVISÉ

DE DOSSIER MAXXAM: B839036

Reçu: 2018/09/06, 12:00

clé de cryptage

Veuillez adresser toute question concernant ce certificat d'analyse à votre chargé(e) de projets

Rodrigo Caffarengo,

Courriel: RCaffarengo@maxxam.ca

Téléphone (514)448-9001 Ext:7066336

=====

Maxxam a mis en place des procédures qui protègent contre l'utilisation non autorisée de la signature électronique et emploie les «signataires» requis, conformément à la section 5.10.2 de la norme ISO/CEI 17025:2005(E). Veuillez vous référer à la page des signatures de validation pour obtenir les détails des validations pour chaque division.

Dossier Maxxam: B839036
Date du rapport: 2018/09/24

STANTEC CONSULTING LTD
Votre # du projet: 157102430
Adresse du site: ILE CHARRON

MÉTAUX EXTRACTIBLES TOTAUX (PEINTURE)

ID Maxxam		FS4686	FS4687		
Date d'échantillonnage		2018/09/06 08:00	2018/09/06 08:00		
# Bordereau		961601	961601		
	Unités	PS-01	PS-02	LDR	Lot CQ
MÉTAUX					
Plomb (Pb) †	mg/kg	<5.0	530	5.0	1932837
LDR = Limite de détection rapportée					
Lot CQ = Lot contrôle qualité					
† Accréditation non existante pour ce paramètre					

Dossier Maxxam: B839036
Date du rapport: 2018/09/24

STANTEC CONSULTING LTD
Votre # du projet: 157102430
Adresse du site: ILE CHARRON

MÉTAUX LIXIVIÉS (PEINTURE)

ID Maxxam		FS4687		
Date d'échantillonnage		2018/09/06 08:00		
# Bordereau		961601		
	Unités	PS-02	LDR	Lot CQ
MÉTAUX				
Plomb (Pb) †	ug/L	100	10	1936930
LDR = Limite de détection rapportée				
Lot CQ = Lot contrôle qualité				
† Accréditation non existante pour ce paramètre				

Dossier Maxxam: B839036
Date du rapport: 2018/09/24

STANTEC CONSULTING LTD
Votre # du projet: 157102430
Adresse du site: ILE CHARRON

TCLP-EPA 1311 (PEINTURE)

ID Maxxam		FS4687	
Date d'échantillonnage		2018/09/06 08:00	
# Bordereau		961601	
	Unités	PS-02	Lot CQ
Lixiviat			
Poids de l'échantillon (g) †	n/a	2.32	1936512
pH de l'eau déionisée †	n/a	5.80	1936512
pH final du lixiviat †	n/a	5.39	1936512
Volume fluide d'extraction 1 (ml) †	n/a	46.4	1936512
Lot CQ = Lot contrôle qualité			
† Accréditation non existante pour ce paramètre			

Dossier Maxxam: B839036
Date du rapport: 2018/09/24

STANTEC CONSULTING LTD
Votre # du projet: 157102430
Adresse du site: ILE CHARRON

REMARQUES GÉNÉRALES

Version 2 - essai de lixiviation pour le plomb pour l'échantillon PS-02.

TCLP-EPA 1311 (PEINTURE)

Veillez noter la déviation à notre procédure d'opération normalisée concernant la matrice pour la lixiviation de l'échantillon FS4687, composé de morceaux de peinture avec une granulométrie supérieure à 9.5 mm. Le pre-test n'a pas été fait car il n'y avait pas assez d'échantillon mais le ration 1 :20 a été respecté. Noter aussi que le fluide d'extraction 1 a été utilisé.

Les résultats ne se rapportent qu'aux échantillons soumis pour analyse

Dossier Maxxam: B839036
Date du rapport: 2018/09/24

STANTEC CONSULTING LTD
Votre # du projet: 157102430
Adresse du site: ILE CHARRON

RAPPORT ASSURANCE QUALITÉ

Lot AQ/CQ	Init	Type CQ	Groupe	Date Analysé	Valeur	Réc	Unités
1932837	EHA	MRC	Plomb (Pb)	2018/09/11		97	%
1932837	EHA	Blanc fortifié	Plomb (Pb)	2018/09/11		107	%
1932837	EHA	Blanc de méthode	Plomb (Pb)	2018/09/11	<5.0		mg/kg
1936512	SRA	Blanc de méthode	pH de l'eau déionisée	2018/09/21	5.80		n/a
			pH final du lixiviat	2018/09/21	4.91		n/a
			Volume fluide d'extraction 1 (ml)	2018/09/21	400		n/a
1936930	FS	BL. LIXIVIAT	Plomb (Pb)	2018/09/23	<10		ug/L
1936930	FS	Blanc fortifié	Plomb (Pb)	2018/09/23		90	%

Blanc de lixiviat: Blanc contenant les réactifs utilisés dans le processus de lixiviation. Sert à évaluer toutes contaminations de procédure.

MRC: Un échantillon de concentration connue préparé dans des conditions rigoureuses par un organisme externe. Utilisé pour vérifier la justesse de la méthode.

Blanc fortifié: Un blanc, d'une matrice exempte de contaminants, auquel a été ajouté une quantité connue d'analyte provenant généralement d'une deuxième source. Utilisé pour évaluer la précision de la méthode.

Blanc de méthode: Une partie aliquote de matrice pure soumise au même processus analytique que les échantillons, du prétraitement au dosage. Sert à évaluer toutes contaminations du laboratoire.

Réc = Récupération

Dossier Maxxam: B839036
Date du rapport: 2018/09/24

STANTEC CONSULTING LTD
Votre # du projet: 157102430
Adresse du site: ILE CHARRON

PAGE DES SIGNATURES DE VALIDATION

Les résultats analytiques ainsi que les données de contrôle-qualité contenus dans ce rapport furent vérifiés et validés par les personnes suivantes:



Caroline Bougie

Caroline Bougie, B.Sc. Chimiste

Faouzi Sarsi



Faouzi Sarsi, B. Sc. Chimiste



Jonathan Fauvel

Jonathan Fauvel, B.Sc, Chimiste

Maxxam a mis en place des procédures qui protègent contre l'utilisation non autorisée de la signature électronique et emploie les «signataires» requis, conformément à la section 5.10.2 de la norme ISO/CEI 17025:2005(E). Veuillez vous référer à la page des signatures de validation pour obtenir les détails des validations pour chaque division.



☐ 889 Montée de Liesse, Ville St-Laurent (Québec) H4T 1P5 Téléphone (514) 448-9001 Télécopieur (514) 448-9199
☐ 2690 Avenue Dalton, Québec (Québec) G1P 3S4 Téléphone (418) 658-5784 Télécopieur (418) 658-6594
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CHAÎNE DE RESPONSABILITÉ 961601

#CdR:

Page 1 de 1

Information facturation				Information rapport				Information projet				Délai d'analyse requis			
Client: Stantec				Compagnie: IDEM				# soumission: -				<input checked="" type="checkbox"/> 5 jours régulier			
Contact: Dao Quach				Attention de: IDEM				# bon de Commande: -				SVP aviser votre chargé de projets de toutes demandes de délais rapide			
Adresse: 100 Alexis - Nihon				Adresse: -				# projet: 157102430				Délai rapide (Surcharges applicables)			
# 110, St-Laurent, H4M 2N6				-				Localisation du site: île charbon				<input type="checkbox"/> 8h (même jour) <input type="checkbox"/> 48h			
Tél: 514-739-0708				Tél: -				# site: -				<input type="checkbox"/> 24h <input type="checkbox"/> 72h			
Courriel: Dao.quach@stantec.com				Courriel: -				Échantillonneur: Dao Quach				Date requise: -			
Critères/Règlement applicable				Analyses requises				# confirmation-délai rapide:							
<input type="checkbox"/> Guide d'intervention (PSRTC) <input type="checkbox"/> RQEP - formulaire MDELCC requis <input type="checkbox"/> RMD (Mat. lixiviable) <input type="checkbox"/> CMM 2008-47 <input type="checkbox"/> Qualité de l'eau de surface <input type="checkbox"/> CCME <input type="checkbox"/> Dir. 019 (Minier) <input type="checkbox"/> Autre (spécifier) -				Filtration au labo. requise <input type="checkbox"/> O <input type="checkbox"/> N BTEX <input type="checkbox"/> COV <input type="checkbox"/> FIBTEX <input type="checkbox"/> C10-C50 <input type="checkbox"/> F2-F4 <input type="checkbox"/> H&G min <input type="checkbox"/> H&G totales <input type="checkbox"/> HAP <input type="checkbox"/> Phénols 4AAP <input type="checkbox"/> GCMS <input type="checkbox"/> NO2 <input type="checkbox"/> NO3 <input type="checkbox"/> NO2+NO3 <input type="checkbox"/> Cl <input type="checkbox"/> SO4 <input type="checkbox"/> F <input type="checkbox"/> pH <input type="checkbox"/> Conductivité <input type="checkbox"/> Turbidité <input type="checkbox"/> Métaux extractibles (PSRTC) - sols Ag, As, Ba, Cd, Co, Cr, Cu, Mn, Mo, Ni, Pb, Zn, Se Hg <input type="checkbox"/> P-total <input type="checkbox"/> Métaux dissous (PSRTC) - eaux souterraines Al, SO4, Ag, As, Ba, Cd, Co, Cr, Cu, Mn, Mo, Ni, Pb, Se, Zn				Réservé au laboratoire Scelle légale <input type="checkbox"/> O <input type="checkbox"/> N <input type="checkbox"/> Températures des glacières Présent <input type="checkbox"/> Intact <input type="checkbox"/> Réfrigérant présent <input type="checkbox"/> O <input checked="" type="checkbox"/> N							
Matrice				# contenants				Plomb / peinture				Instructions spéciales			
Eau: Souterraine (S) Surface (Sur) Usée (EU) Potable (P) Captage (C) Lixiviât naturel (LN) Déchet liquide (DL) Sol (Sol) Boue (B) Sédiment (Sed) Solide (SL) Ciment (Cim) Huile (H) Frottis (F) Matière résiduelle (MR) Autre: -															
Identification de l'échantillon		Date prélevement (AAAA/MM/JJ)	Heure prélevement (HH:MM)	Matrice											
1	PS-01	2018/09/06	8:00	peint											
2	PS-02	2018/09/06	8:01	peint											
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DAO QUACH / QLE		2018/09/06		12:00		Gabriella Benedetti		2018-09-06		12:00					

Sauf accord contraire passé par écrit, les services compris dans cette chaîne de responsabilités sont soumis aux conditions générales standard de Maxxam. Par la signature de cette chaîne de responsabilités, vous confirmez que vous avez pris connaissance des conditions générales et que vous les acceptez telles qu'elles se présentent au <http://maxxam.ca/fr/terms>

COC-1023 (11/2017)

client.

DIVISION 07

Thermal and Moisture Protection

Part 1 General**1.1 RELATED REQUIREMENTS**

- .1 Section 21 05 00 - Common Work Results for Fire Suppression.
- .2 Section 22 05 00 - Common Work Results for Plumbing
- .3 Section 23 05 00 - Common Work Results for HVAC.
- .4 Section 25 05 01 - EMCS: General Requirements.

1.2 REFERENCE STANDARDS

- .1 Health Canada/Workplace Hazardous Materials Information System (WHMIS).
 - .1 Safety Data Sheets (SDS).
- .2 National Research Council Canada (NRC).
 - .1 National Building Code of Canada - 2015 (NBC).
- .3 Underwriter s Laboratories of Canada (ULC).
 - .1 ULC-S115-1995, Fire Tests of Fire Stop Systems.

1.3 DEFINITIONS

- .1 Fire Stop Material: Devices intended to close off openings or penetrations during fire, or materials that fill openings in wall or floor assembly where penetration is by cables, cable trays, conduits, ducts and pipes, and poke-through termination devices, including electrical outlet boxes along with their means of support through wall or floor openings.
- .2 Single Component Fire Stop System: Fire stop materials that has Listed Systems Design, used individually, without use of high-temperature insulation or other materials to create fire stop system.
- .3 Multiple Component Fire Stop System: Exact group of fire stop materials that are identified within Listed Systems Design to create onsite fire stop systems.
- .4 Tightly Fitted (Ref: NBC Part 3.1.9.1(1) and 9.10.9.6(1)): Penetrating items that are embedded in concrete in buildings of noncombustible construction or have no annular space in case of buildings of combustible construction.
 - .1 Penetrations are "perfectly sealed" when they ensure integrity of fire separation which can then prevent passage of smoke and hot gases on its unexposed face.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

- .1 Submit manufacturer's printed product literature, specifications, and data sheets, and include product characteristics, performance criteria, physical size, finish, and limitations.

.3 Shop Drawings:

- .1 Submit shop drawings to show proposed material, reinforcement, anchorage, fastenings, and method of installation.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Packing, shipping, handling, and unloading:

- .1 Deliver, store, and handle materials in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Deliver, store, and handle materials in accordance with manufacturer's written instructions.
- .3 Deliver materials to the site in undamaged condition and in original unopened containers, marked to indicate brand name, manufacturer, ULC approval.

.2 Storage and Protection:

- .1 Store materials indoors, in dry location, and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
- .2 Replace defective or damaged materials with new.

1.6 DESCRIPTION OF WORK

- .1 Provide the personnel, materials, equipment, and services required to install fire stops and smoke controls around mechanical services that pass through fire-resistant building components.

1.7 QUALITY ASSURANCE

- .1 The works in this Section must be carried out by a qualified person, approved by the manufacturer of the fire stop, employing qualified and certified personnel with experience in the installation/application of fire stops and smoke controls.
- .2 All works must be of superior quality and performed in accordance with the industry's best practices and in strict accordance with manufacturers' written specifications.
- .3 In the case of fire-rated elements for which the manufacturer does not provide any ULC or CUL approved assembly, derived from similar UL listed or otherwise tested, drawings of such elements produced by the manufacturer's engineer must then be presented to local Authorities Having Jurisdiction, who will review and approve them before they are installed.

- .4 Site Meetings: Onsite inspections by the manufacturer, as prescribed in PART 3 ON-SITE QUALITY CONTROL, must include site visits at the following stages:
 - .1 Once the products have been delivered and stored on the site, and the preparatory work and other preliminary work has been completed, but before the work begins;
 - .2 Two times during work, the first when completed to 25% and the second at 60%;
 - .3 After completion of work and cleaning.

Part 2 Products

2.1 GENERAL

- .1 All products used in the fire protection system must be cUL, ULC, and FM certified, and must be labeled as such.

2.2 MATERIAL

- .1 Fire stop and smoke barrier assemblies:
 - .1 Asbestos-free materials and assemblies, providing an effective barrier against flame, smoke, and gases, in accordance with CAN/ULC S115, having dimensions not exceeding those of the traverse or access point for which they are intended.
 - .2 Installation of fire stop and smoke control assemblies: Certified by ULC, in accordance with CAN/ULC S115 requirements.
 - .3 The fire-resistance rating of all installed fire stops must not be less than the fire rating of the surrounding floors and walls as specified in the Architectural drawings.
- .2 Fire stop assemblies for utility and service traverses: Tested using CAN/ULC S115 tests.
- .3 Components of fire-stop assemblies for utility and service traverses: Certified by a testing laboratory in accordance with CAN/ULC S115.
- .4 The degree of fire resistance of installed fire-stop assemblies must comply with the requirements of the NBC.
- .5 Fire and smoke control assemblies installed at access points to concealed installations, or cables, e.g. Elastomeric joints.
- .6 Fire and smoke protection assemblies installed on pipes, air ducts, and other mechanical equipment requiring acoustic and vibration insulation: Elastomeric joints.
- .7 Fire stop devices:
 - .1 High-speed fire protection devices for plastic pipe, made of an intumescent material expanding when exposed to temperatures of 300°F (149°C) or more. The material can expand up to 25 times its original volume to seal the opening created by the plastic pipe.

- .2 Devices certified to CAN/ULC S115 in accordance with a test conducted at 50 Pa (0.2 in Water) differential pressure and providing one- or two-hour of fire resistance.
- .8 Primers: In accordance with manufacturer's recommendations for material, substrate, and intended use.
- .9 Water (if applicable): Potable, clean, and free from excessive amounts of harmful substances.
- .10 Mineral Wool: Rock and slag fibers glued with heat resistant binder. Maximum operating temperature 1,035°C (1,895°F). Materials with practically neutral pH.
- .11 Restraining, supporting, and anchoring devices: As recommended by the manufacturer and compatible with assemblies used, proven, and deemed acceptable by the authority having jurisdiction.
- .12 Sealants for Vertical Joints: Non-sagging products, in accordance with ULC test assemblies.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

- .1 Comply with manufacturer's requirements, recommendations, and written specifications, including any technical bulletins available, instructions for handling, storing and processing products, and specifications.

3.2 PREPARATORY WORK

- .1 Examine dimensions and condition of the voids to be filled to determine the thickness of material required and the method of application to be used.
 - .1 Ensure surfaces are clean, dry, and unfrozen.
- .2 Prepare surfaces in contact with fire and smoke control materials, as directed by the manufacturer.
- .3 Ensure integrity of insulation around pipes and ducts through fire walls, including vapor barrier.
- .4 If necessary, cover contiguous surfaces to protect them from dripping and splashing and, after completion of work, remove unwanted stains or deposits.

3.3 INSTALLATION

- .1 Install fire stop and smoke assemblies and their component parts in accordance with manufacturer's instructions for tested and certified assemblies.
- .2 Seal gaps and clearances around pipes or devices crossing wholly or partly the fire walls, and seal openings reserved for later use and the joints around them to ensure the continuity and integrity of the fire protection provided.

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- .3 If necessary, install temporary retainers and do not remove them until the initial cure is complete and the materials have attained enough strength.
- .4 Shape exposed surfaces or trowel smooth to neat finish.
- .5 Remove excess surplus product as work is advanced and as soon as work is completed.

3.4 WORK SCHEDULING

- .1 Proceed with installation only after documents/samples to be submitted have been reviewed by the Departmental Representative.
- .2 Install fire protection for floors before installing interior walls.
- .3 Connection to a metal support: Fire protection must be carried out before the application of any fire-retardant coating, to ensure the required connection.
- .4 Mechanical System Pipe Insulation: Component of an approved fire protection assembly.
 - .1 Ensure piping insulation is installed before fire protection.

3.5 ONSITE QUALITY CONTROL

- .1 Inspections: Before concealing or covering materials or fire stop systems, inform the Departmental Representative that work is ready for inspection.
- .2 Manufacturer's Field Services:
 - .1 Obtain manufacturer's written report confirming that work complies with specified criteria regarding product handling, installation, and application as well as protection and cleaning of work, and submit report in accordance with SUBMITTALS, as stated in PART 1.
 - .2 Manufacturer must provide recommendations regarding use of products and conduct periodic visits to verify if implementation is such as recommended.
 - .3 Site visits must be in accordance with QUALITY ASSURANCE, of PART 1.

3.6 SITE CONDITIONS

- .1 Application and drying of fire stop and smoke barrier materials must be in accordance with manufacturer's recommendations regarding temperature, relative humidity, and moisture content of basecoats.
- .2 Protect all work against potential damage and deterioration caused by other trades, and protect other trade installations against dirt and potential damage originating from this work.
- .3 Once completed, correct all imperfections, and leave workplace in impeccable condition.

3.7 VERIFICATION

- .1 Check the surfaces of all fire stops to be sealed. Provide a written report stating conditions that are non-compliant or deemed unacceptable by the Contractor before starting work.
- .2 Delay work until surface conditions are acceptable.

3.8 MIXING

- .1 Mix materials in strict compliance with manufacturer's instructions.
- .2 Components must be well prepared and mixed by qualified personnel.

3.9 COATING MATURATION

- .1 Allow coatings to mature according to manufacturer's recommendations.
- .2 Do not cover materials before maturation is completed.

3.10 INSPECTION OF WORK

- .1 Inform the Departmental Representative when work is ready for inspection. Work must not yet be covered by fireproofing, control materials, or any other services traversing fire resistant partitions.
- .2 Inspect penetrations in fire stop systems in accordance with ASTM E2174.

3.11 CLEANING

- .1 Once installation and performance monitoring are finished, remove extra materials, rubbish, and tools from site.
- .2 Take off temporary safety restraints, once initial setting of fire stop and smoke barrier materials is completed.

3.12 TESTS

- .1 Perform smoke penetration simulation tests.
- .2 If joint finishing, gaps, or openings described in this Section clearly show smoke emission during tests, correct all defects and start smoke test again, and this, at no additional costs to the Owner.
- .3 Smoke simulation product must not be toxic nor staining and must provide fog density of 80 mg/m³ (0.00008 oz/in³) with acceptable air concentration levels of 50 ppm.
- .4 Create smoke at a rate of 4 seconds/2.8 m³ (4 seconds/100 in³) and maintain fog density until inspection is completed.

3.13 FIRE STOP SYSTEM LOCATION

- .1 Ensure fire stop and smoke barrier protection to building elements that are fire resistant, including the following locations:
 - .1 Penetrations through partitions, masonry walls, concrete, and gypsum that are fire resistant;
 - .2 Penetrations through floor slabs, ceilings, and roofs that are fire resistant;
 - .3 Access openings and penetrations made in fire-resistant partitions for further use;
 - .4 Around piping and other mechanical and electrical material penetrating fire-resistant partitions;
 - .5 Rigid conduits with section above 129 cm²: Fire protection by means of a fire-resistant joint located between angle bracket and fire-resistant partition, as well as between angle bracket and conduit on each side of the fire-resistant partition.

END OF SECTION

DIVISION 21

Fire Suppression

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Part 1 General**1.1 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
 - .1 Indicate on drawings:
 - .1 Mounting arrangements.
 - .2 Operating and Maintenance (O&M) clearances.
 - .2 Shop drawings and product data accompanied by:
 - .1 Detailed drawings of bases, supports, and anchor bolts.
 - .2 Acoustical sound power data of systems and devices, where applicable.
 - .3 Points of operation on performance curves.
 - .4 Manufacturer to certify current model production.
 - .5 Certification of compliance to applicable Codes.

1.2 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
 - .1 Operation and Maintenance (O&M) Manual approved by, and final copies deposited with, Departmental Representative before final inspection.
 - .2 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 each system and its component.
 - .5 Description of actions to be taken in event of equipment failure.
 - .6 Valves schedule and flow diagram.
 - .7 Colour coding chart.
 - .3 Maintenance data to include:
 - .1 Servicing, maintenance, operation, and troubleshooting instructions for each item of equipment.
 - .2 Data to include schedules of tasks, frequency, tools required, and task time.
 - .4 Performance data to include:
 - .1 Equipment manufacturer's performance data sheets with point of operation as left after commissioning is completed.
 - .2 Equipment performance verification test results.

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- .3 Special performance data as specified elsewhere in Contract Documents.
- .4 Testing, adjusting, and balancing reports as specified in Section 23 05 93 - Testing, Adjusting and Balancing for HVAC.
- .5 Approvals:
 - .1 Submit two copies of draft (O&M) Manual to Departmental Representative for approval. Submission of individual data will not be accepted, unless otherwise directed by Departmental Representative.
 - .2 Make changes as required and re-submit to Departmental Representative.
- .6 Additional data:
 - .1 Prepare and insert into (O&M) Manual additional data when need for it becomes apparent during specified demonstrations and instructions.
 - .2 Transfer information weekly to reproducibles, revising reproducibles to show work as actually installed.
 - .3 Use different colour waterproof ink for each network.
 - .4 Make available for reference purposes and inspection.
- .7 "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 drawings to Departmental Representative 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 O&M Manuals.
- .8 Submit copies of "As-Built" drawings for inclusion in final TAB report.

1.3 DELIVERY, STORAGE, AND HANDLING

- .1 Deliver, store, and handle materials in accordance with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: Deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials indoors, in dry location, off ground and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

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Part 2 Products**2.1 NOT USED**

- .1 Not used.

Part 3 Execution**3.1 EXAMINATION**

- .1 Verification of Conditions: Prior to proceed with installation:
 - .1 Visually inspect substrate in presence of Departmental Representative.
 - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
 - .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 PAINTING REPAIRS AND RESTORATION

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

3.3 SYSTEM CLEANING

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

3.4 DEMONSTRATION

- .1 Departmental Representative will use equipment and systems for test purposes prior to acceptance. Supply labour, material, and instruments required for testing.
- .2 Supply tools, equipment, and personnel to demonstrate and instruct operating and maintenance personnel in operating, controlling, adjusting, troubleshooting, and servicing of all systems and equipment during regular work hours, prior to acceptance.
- .3 Use O&M Manual, "As-Built" drawings, and audiovisual aids as part of instruction materials.
- .4 Instruction duration time requirements as specified in appropriate Sections.

3.5 CLEANING

- .1 Progress Cleaning: Clean in accordance with Section 01 74 00 - Cleaning.
 - .1 Leave Work area clean at end of each day.

- .2 Final Cleaning: Upon completion remove surplus materials, rubbish, tools, and equipment in accordance with Section 01 74 00 - Cleaning.

3.6 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 RELATED REQUIREMENTS**

- .1 Section 21 05 00 - Common Work Results for Fire Suppression.

1.2 REFERENCE STANDARDS

- .1 American National Standards Institute (ANSI).
 - .1 ANSI/ASME B1.20.1-83 (R2001), Standard for Pipe Threads, General Purpose.
 - .2 ANSI/ASME B16.3-2006, Malleable Iron Threaded Fittings Classes 150 and 300.
 - .3 ANSI/ASME B16.9-01, Factory Made Wrought Buttwelding Fittings.
 - .4 ANSI/ASME 2004 Boiler and Pressure Vessel Code - Section IX, Welding and Brazing Qualifications.
- .2 American Society of Mechanical Engineers (ASME).
 - .1 ASME B31.1-04, Power Piping.
- .3 ASTM International (ASTM).
 - .1 ASTM A53/A53M-07, Standard Specification for Pipe, Steel, Black and Hot-Dipped Zinc Coated, Welded and Seamless.
 - .2 ASTM A106/A106M-06a, Standard Specification for Seamless Carbon Steel Pipe for High-Temperature Service.
 - .3 ASTM A197/A197M-00 (R2006), Standard Specification for Cupola Malleable Iron.
 - .4 ASTM A234/A234M-07, Standard Specification for Pipe Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service.
- .4 National Fire Protection Association (NFPA).
 - .1 NFPA 2001-2008, Standard on Clean Agent Fire Extinguishing Systems.
 - .2 NFPA 70-2008, National Electrical Code.
- .5 Underwriters' Laboratories Inc. (UL) - Fire Protection Equipment Directory-2002.
 - .1 UL 1058-2006, Standard for Halogenated Agent Extinguishing System Units.
 - .2 UL 2166-99, Standard for Halocarbon Clean Agent Extinguishing Systems Units.
- .6 U.S. Department of Transportation (DOT) - Title 49 Code of Federal Regulations Parts 100 to 199, Transportation of Hazardous Material.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Shop drawings must indicate, show, or include the following:
 - .1 Detailed diagram of the system;
 - .2 Description and location of component elements;

- .3 Written description of the sequence of operations;
- .4 Details of the various devices;
- .5 Details of gas discharge calculations (Novec 1230);
- .6 Submit fire system piping diagrams.
- .3 Submit two copies of the Workplace Hazardous Materials Information System (WHMIS) Material Safety Data Sheets.
- .4 Submit the following test reports:
 - .1 Leak testing of protected rooms before and after work;
 - .2 Pressure test;
 - .3 Flow test.
- .5 Submit hydraulic calculation sheets and installation drawings, in accordance with working drawings and calculation criteria prescribed in NFPA 2001. Provide hydraulic calculations for all zones.
- .6 Hydraulic calculations and installation drawings must be signed and sealed by an engineer member of the "Ordre des ingénieurs du Québec".

1.4 DOCUMENTS / ELEMENTS TO BE SUBMITTED ON COMPLETION OF THE WORK

- .1 Provide all documents and items to be submitted upon completion of required work and attach them to the "Operations Manual in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Maintenance Sheets:
 - .1 The maintenance sheets must include the following:
 - .1 Technical data from manufacturers' catalogs and documentation, including model number, type, and dimensions for the items listed below:
 - .1 Storage bottles;
 - .2 Valves and other pilot control devices;
 - .3 Projection nozzles.
- .3 Written description of the system and its design characteristics.
- .4 Drawings illustrating the control logic and showing the location of the equipment.
- .5 Written documentation for the following:
 - .1 Procedures to be observed in case of emergency;
 - .2 Troubleshooting procedures;
 - .3 Security requirements.
- .6 Relevant details regarding operation, care, and maintenance.
- .7 A list of recommended replacement parts.

1.5 DESIGN CRITERIA

- .1 The system must be designed in accordance with NFPA 2001, according to the following parameters:
 - .1 Risk 1: Generator room:
 - .1 Gross room volume: 74 m³ (2,615 ft³).
 - .2 Minimum temperature: 15°C (59°F).
 - .3 Maximum temperature: 32.2°C (90°F).
- .2 Submit calculations relating to the following parameters:
 - .1 Pressure at the most distant nozzles;
 - .2 Flow at projection nozzles;
 - .3 Port code number;
 - .4 Pressure losses in piping;
 - .5 Flow characteristics of the component elements;
 - .6 Diameter of pipes;
 - .7 Minimum design concentration;
 - .8 Minimum quantity of extinguishing agent calculation;
 - .9 Actual quantity of extinguishing agent;
 - .10 Maximum expected actual quantity;
 - .11 Discharge time;
 - .12 Time to maintain concentration;
 - .13 Venting of the enclosure.

1.6 SYSTEM DESCRIPTION

- .1 The Novec 1230 total immersion extinguishing system with a minimum concentration of 4.2% at 21°C (70°F) is activated by the release panel supplied with the system under division 21.
- .2 The system includes the following:
 - .1 A Novec cylinder, capacity according to the volume of the room;
 - .2 One retaining strip per cylinder;
 - .3 A discharge nozzle;
 - .4 A 24 VDC electrical control head;
 - .5 A low pressure switch;
 - .6 A pressure switch.

Part 2 Products**2.1 GENERAL**

- .1 All products used in fire-fighting installations must be officially approved "ULC", "ULC", or "FM", and must be labeled as such.

2.2 SUPPRESSION AGENT

.1 Suppression Agent:

- .1 NFPA 2001 designation: FK-5-1-12.
- .2 Composition/Chemical name: Novec 1230; chemical formula $\text{CF}_3\text{CF}_2\text{C}(\text{O})\text{CF}(\text{CF}_3)_2$.

2.3 AGENT STORAGE

.1 Cylinders.

- .1 Cylinders must be of permanent pressure welded steel and manufactured, tested, and marked to D.O.T. 4BW450. Provide format cylinders meeting the needs of each application without exceeding a capacity of 408 kg (900 lbs) per cylinder.
- .2 Cylinders must be filled with Novec 1230 extinguishing agent and pressurized with nitrogen to a total pressure of 24.84 bar (360 psi) at 21.1°C (70°F) to ensure quick discharge. Operation will be possible at temperatures as low as 0°C (32°F). Cylinders with a capacity greater than 250 lbs. Must have welded-on lifting clips for easy handling. Each cylinder must have a wall clip for secure attachment.
- .3 Each cylinder must be equipped with a pressure monitoring switch, which will cause a monitoring signal to the control panel if the cylinder pressure drops to approximately 320 psi.
- .4 Cylinders of capacity 150 lbs or more must be provided with a liquid level indicator to allow the weight of the extinguishing agent to be determined without dismantling or weighing the cylinder during inspections. The device will consist of a brass tube with a stainless steel float on the outside and a graduated magnetic tape on the inside. When the two magnets are aligned, the reading on the ribbon makes it possible to refer to the agent's weight on a chart.

.2 Cylinder Valves.

- .1 Cylinder valves must be made of brass. They must include a brass piston with seals held in place by cylinder pressure, an electric solenoid activation valve to release the agent, a burst disc, an outlet for activation of a slave cylinder, and a pressure indicator dial. The solenoid valve coil should be easily removed from the cylinder to facilitate service. Explosive type limited life activation devices are not acceptable.
- .2 Cylinder valves must be provided with a back-up plug to prevent dangerous cylinder movement during accidental discharge when not securely secured in place.

.3 Control Head.

- .1 24 VDC electrical control head, solenoid type, with manual activation lever.

2.4 OPERATING SEQUENCES

- .1 The system will operate upon activation by the release panel, such as the sequence of the existing system to be replaced.

2.5 PROJECTION NOZZLES

- .1 Nozzles must be made of aluminum and ULC and FM approved. They must be marked with the manufacturer's identification number with reference to the size of the orifices.
- .2 The nozzles will be of female type with standard threads to be directly screwed onto the discharge piping.
- .3 Nozzles will be spaced and installed in accordance with the manufacturer's instructions and within the limits approved by ULC and FM Standards.
- .4 Nozzles will be 360° type with maximum coverage of 32 ft by 32 ft and installed at a maximum height of 12 ft for a total immersion application.

2.6 DISTRIBUTION PIPING AND ASSOCIATED FITTINGS

- .1 The piping must be in black or galvanized 40-gauge steel, according to ASTM A-53 or A 106, ANSI 36.10. The thickness of the pipe must be in accordance with ANSI B-31.1 "Power Piping Code". All couplings must be 300 lbs or 600 lbs class according to NFPA 2001.
- .2 All ends of piping must be cleaned after cutting and threading to remove any metal particles or cutting oil. Dry air or nitrogen should be blown through the lines to remove all debris and oil before installing the discharge nozzles.
- .3 All piping must be securely anchored between each coupling with special attention near the nozzles to prevent movement due to the reaction during discharge, in accordance with NFPA 2001 Standard.
- .4 Reducers will be of concentric type only.

2.7 SUPPORTS AND SUSPENSIONS FOR PIPING

- .1 Suspensions intended for use in a fire protection system and in compliance with the prescriptions and requirements of NFPA 2001 Standard.
- .2 Refer to Section 23 05 29 – Hangers and Supports for HVAC Piping and Equipment and Section 23 05 48.16 – Seismic Restraint Systems (SRS).

2.8 LAMICOID TYPE SIGNS

- .1 Lamicoid type signs in white letters on a red background to indicate the safety instructions for the extinguishing system.

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 INSTALLERS

- .1 The Contractor must have followed the training required by the supplier to develop, calculate, install, test, and maintain the Novec 1230 system that he proposes to supply.

- .2 The Contractor must be an experienced office, regularly engaged in projects to install automatic fire suppression systems with own agent in strict accordance with the applicable Codes and Standards.
- .3 The Contractor must be able to provide emergency service 24 hours a day, seven days a week.

3.3 INSTALLATION

- .1 Install component parts and accessories of the extinguishing system, and inspect and test them in accordance with NFPA 2001.
- .2 Install extinguishing system in accordance with written instructions from the manufacturer of the clean extinguishing agent (Novec 1230).

3.4 PIPING

- .1 Ream pipe after cutting to remove burrs and sharp edges.
- .2 Clean pipe before installation to remove foreign matter and oil from pipe.
 - .1 Pull wire brush through pipe lengths several times.
 - .2 Follow with clean cloth rags treated with a noncombustible metal cleaner designed for purpose.
- .3 Blow dry air through piping prior to installation of nozzles.
- .4 Install piping in accordance with layout design to provide maximum flow and to avoid possible mechanical, chemical or other damage.
- .5 Pipe reductions: install reductions to permit full flow. Entrance holes from main pipe run to fitting to be of proper size and free of sharp edges, ridges or burrs.

3.5 PIPE HANGERS AND SUPPORTS

- .1 Fasten piping near nozzles to prevent pipe movement due to reaction force during discharge.
- .2 Install piping supports to prevent disengagement of supports by movement of supported pipe.
- .3 Solidly anchor pipe to structural members where longitudinal or lateral movements is possible.
- .4 Install rigid hangers wherever change in direction or change in elevation in piping system occurs.
- .5 Every other hanger: rigid on long straight runs.
- .6 Attach piping to rigid hangers by means of U-bolts locked with double nuts, one on each side of hanger.
- .7 Allow for longitudinal movement of pipe within U-bolt except where piping design requires pipe to be anchored.
- .8 Do not support pipe using other pipeline.
- .9 Arrange piping supports to prevent bending stresses from concentrated loads between supports.

3.6 FIELD QUALITY CONTROL

- .1 Site Tests:
 - .1 Test installation for correct operation and function.
 - .2 Provide requisite equipment, personnel, to complete tests and provide written reports of results.
 - .3 Room Integrity:
 - .1 Standard: to NFPA 2001.
 - .2 Test room integrity by pressurizing it in accordance with the written instructions of the manufacturer of the extinguishing agent. The test must demonstrate sufficient tightness to maintain a 4.2% concentration of extinguishing agent in all sections of the room.
 - .3 Provide written test report to Departmental Representative of results.
 - .4 Correct deficiencies and retest.
 - .4 Pressure Test:
 - .1 Pneumatically test system discharge piping in closed circuit for period of ten minutes at 2750 kPa.
 - .2 Pressure drop not exceed 20% of test pressure.
 - .5 Flow Test:
 - .1 Perform flow test using nitrogen on the pipe network to verify that flow is continuous and that piping and nozzles are unobstructed.
 - .2 Install 'telltales' styrofoam cups over each nozzle that will easily blow off when nitrogen pressure reaches nozzle.
- .2 Manufacturer's Field Services:
 - .1 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 All calculations for calculated extinguishing systems must be done with software approved and accepted by the Authorities having jurisdiction, NFPA-2001, UL, ULC, and the manufacturer of the system.
- .4 A final copy of the reports generated by the calculation software must be submitted.

3.7 DEMONSTRATION

- .1 Upon completion of installation provide 'hand-on' site review of system components and operation.
- .2 Functionally test system to demonstrate system components, system functions and recommended procedures for building maintenance personnel.

3.8 CERTIFICATE

- .1 An installation certificate in accordance with NFPA-2001 Standard must be issued to the Owner.

3.9 RESPONSIBILITY

- .1 The installer remains responsible for the final design of the system. Consequently, any variation in site conditions in relation to drawing and specifications must be brought to the attention of the Departmental Representative.

3.10 TRAINING

- .1 The Contractor must plan and organize a four-hour training session for building operations and maintenance personnel.
- .2 Training will include normal operation, emergency directions, and system maintenance.

END OF SECTION

DIVISION 22

Plumbing

Part 1 General**1.1 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature, and data sheets.
- .3 Shop Drawings:
 - .1 Indicate on drawings:
 - .1 Mounting arrangements.
 - .2 Operating and Maintenance (O&M) clearances.
 - .2 Shop drawings and product data accompanied by:
 - .1 Detailed drawings of bases, supports, and anchor bolts.
 - .2 Certification of compliance to applicable Codes.
 - .3 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.
- .4 Fabrication Drawings:
 - .1 Prepare and submit fabrication drawings to coordinate the work of the various construction sub-trades. Construction drawings are required for the following work:
 - .1 Ventilation work.
 - .2 Plumbing (Fuel and oil facility and drainage).
 - .3 Fire protection work.
 - .2 All fabrication drawings must be prepared with the latest AutoCAD version, presented as DWG and PDF files. Drawings must be at an appropriate scale, but no smaller than 1:50.
 - .3 The fabrication drawings must consist of drawings to scale, indicating the position of equipment, ducts, piping, valves, and other fittings, with required sections and details, including the dimensions of piping and ducts, openings, anchors, and supports, relative positions with framework, architectural works, and other mechanical and electrical works.
 - .4 Preparation:
 - .1 Each sub-trade must do its own fabrication drawing and coordinate it with other sub-trades.
 - .2 The General Contractor is responsible for the coordination of all fabrication drawings of all mechanical and electrical sub-trades, which must provide all the data, drawings, and diagrams necessary for this coordination work.

- .3 The Ventilation Contractor must prepare a design of its own work with all necessary data and dimensions, and incorporate all information provided by the other trades.
- .4 All fabrication drawings must be submitted for review simultaneously.
- .5 Mechanical and electrical contractors must work in close collaboration to determine the location of their respective works and to avoid clashes.
- .5 Responsibilities:
 - .1 Each subcontractor is directly responsible for the location and exact dimensions of the openings, bases, the location of its equipment, piping and ducts, whether dimensions figure in the structural, architectural, or engineering drawings or not.
 - .2 The Ventilation Contractor must ensure that no clashes are present in the fabrication drawings.
 - .3 No compensation will be awarded for modifications to the work, for coordination and integration of mechanical and electrical systems with each other.
 - .4 The Departmental Representative's verification of the fabrication drawings is limited to ensuring that the technical requirements appear to be met (FD, grilles, insulation, duct sizing, etc.) The Departmental Representative does not verify the quality of the coordination carried out by contractors.
- .6 Work in existing conditions:
 - .1 The fabricating drawings must include the existing mechanical, electrical, structural, and architectural facilities, as well as planned work.

1.2 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
 - .1 Operation data to include:
 - .1 Control schematics for systems including environmental controls.
 - .2 Description of systems and their controls.

1.3 DELIVERY, STORAGE, AND HANDLING

- .1 Deliver, store, and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: Deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials indoors, off ground, in dry location, and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Replace defective or damaged materials with new.

Part 2 Products**2.1 NOT USED**

- .1 Not used.

Part 3 Execution**3.1 SYSTEM CLEANING**

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

3.2 FIELD QUALITY CONTROL

- .1 Site Tests: Conduct following tests in accordance with Section 01 45 00 - Quality Control and submit report as described in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS.

3.3 CLEANING

- .1 Progress Cleaning: Clean in accordance with Section 01 74 00 - Cleaning.
 - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: Upon completion remove surplus materials, rubbish, tools, and equipment in accordance with Section 01 74 00 - Cleaning.

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 REFERENCE STANDARDS**

- .1 CSA Group (CSA).
 - .1 CSA S350 M1980 (R2003), Code of Practice for Safety in Demolition of Structures.

1.2 DEFINITIONS

- .1 Demolish: Dismantle items from existing construction and legally dispose of items off site, unless indicated as removed and salvaged, or removed and reinstalled.
- .2 Remove: Planned deconstruction and disassembly of electrical items from existing construction including removal of conduit, junction boxes, cabling, and wiring from electrical component to panel taking care not to damage adjacent assemblies designated to remain; legally dispose of items off site, unless indicated as removed and salvaged, or removed and reinstalled.
- .3 Remove and Salvage: Dismantle items from existing construction and deliver them to Departmental Representative ready for reuse.
- .4 Remove and Reinstall: Dismantle items from existing construction, prepare them for reuse, and reinstall them where indicated.
- .5 Existing to Remain: Existing items of construction that are not removed and that are not otherwise indicated as being removed and salvaged, or removed and reinstalled.
- .6 Hazardous Substances: Dangerous substances, dangerous goods, hazardous commodities and hazardous products may include asbestos, mercury and lead, PCBs, poisons, corrosive agents, flammable substances, radioactive substances, or other material that can endanger human health, well-being, or environment if handled improperly as defined by the Federal Hazardous Products Act (RSC 1985), including latest amendments.

1.3 ADMINISTRATIVE REQUIREMENTS

- .1 Coordination: Coordinate work of this Section to avoid interference with work by other Sections.

1.4 SITE CONDITIONS

- .1 Existing Conditions: Condition of materials identified as being salvaged or demolished are based on their observed condition at time of site examination before tendering.
- .2 Existing Hazardous Substances: Departmental Representative has performed a hazardous substances assessment and identified materials requiring abatement as follows:
 - .1 Hazardous substances are as defined in the Hazardous Products Act;

- .2 Hazardous substances will be removed by the Contractor as a part of the Contract.

Part 2 Products

2.1 MATERIALS

- .1 Plumbing Repair Materials: Use only new materials required for completion or repair matching materials damaged during performance of work of this Section; new materials are required to meet assembly or system characteristics as existing systems indicated to remain and carry CSA approval labels required by the Authority Having Jurisdiction.
- .2 Fire Stopping Repair Materials: Use fire stopping materials compatible with existing fire stopping systems where removal or demolition work affects rated assemblies, restore to match existing fire-rated performance.

Part 3 Execution

3.1 EXAMINATION

- .1 Verification of Existing Conditions: Visit site, thoroughly examine and become familiar with conditions that may affect the work of this Section before tendering the Bid; Departmental Representative will not consider claims for extras for work or materials necessary for proper execution and completion of the Contract that could have been determined by a site visit.

3.2 PREPARATION

- .1 Protection of Existing Systems to Remain: Protect systems and components indicated to remain in place during selective demolition operations, and as follows:
 - .1 Prevent movement and install bracing to prevent settlement or damage of adjacent services and parts of existing buildings scheduled to remain;
 - .2 Notify Departmental Representative and cease operations where safety of buildings being demolished, adjacent structures or services appears to be endangered and await additional instructions before resuming demolition work specified in this Section;
 - .3 Prevent debris from blocking drainage inlets;
 - .4 Protect mechanical systems that must remain in operation.
- .2 Protection of Building Occupants: Sequence demolition work so that interference with the use of the building by the Departmental Representative and users is minimized:
 - .1 Prevent debris from endangering the safe access to and egress from occupied buildings.

- .2 Notify Departmental Representative and cease operations where safety of occupants appears to be endangered and await additional instructions before resuming demolition work specified in this Section.

3.3**EXECUTION**

- .1 Demolition and Removal:
 - .1 Disconnect and cap mechanical services in accordance with requirements of local Authority Having Jurisdiction.
 - .2 Do not disrupt active or energized utilities without approval of the Departmental Representative.
 - .3 Erect and maintain dust proof and weather tight partitions to prevent the spread of dust and fumes to occupied building areas; remove partitions when work is completed.
 - .4 Demolish parts of existing building to accommodate new construction and remedial work, as indicated.
 - .5 At end of each day of work, leave worksite in safe condition.
 - .6 Perform demolition work in a neat and workmanlike manner:
 - .1 Remove any tools or equipment after completion of work, and clean site for subsequent renovation work.
 - .2 Repair and restore damages caused as a result of work of this Section to match existing materials and finishes.

END OF SECTION

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Part 1 General**1.1 RELATED REQUIREMENTS**

- .1 Section 22 05 00 - Common Work Results for Plumbing.
- .2 Section 23 05 48 - Vibration and Seismic Controls for HVAC.

1.2 REFERENCE STANDARDS

- .1 ASTM International (ASTM).
 - .1 ASTM B32-08, Standard Specification for Solder Metal.
 - .2 ASTM B306-02, Standard Specification for Copper Drainage Tube (DWV).
 - .3 ASTM C564-03a, Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings.
- .2 CSA Group (CSA).
 - .1 CSA B67-1972(R1996), Lead Service Pipe, Waste Pipe, Traps, Bends and Accessories.
 - .2 CAN/CSA-B70-06, Cast Iron Soil Pipe, Fittings and Means of Joining.
 - .3 CAN/CSA-B125.3-05, Plumbing Fittings.
- .3 Green Seal Environmental Standards (GSES).
 - .1 Standard GS-36-00, Commercial Adhesives.
- .4 National Research Council Canada (NRC).
 - .1 National Plumbing Code of Canada 2015 (NPC).
- .5 South Coast Air Quality Management District (SCAQMD), California State.
 - .1 SCAQMD Rule 1168-A2005, Adhesive and Sealant Applications.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Provide manufacturer's printed product literature, and data sheets for adhesives, and include product characteristics, performance criteria, physical size, finish, and limitations.

1.4 DELIVERY, STORAGE, AND HANDLING

- .1 Deliver, store, and handle materials in accordance with manufacturer's written instructions.

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- .2 Delivery and Acceptance Requirements: Deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

1.5 QUALITY CONTROL

- .1 An ISO 9000 Quality Control Certificate for gray cast-iron parts must be provided on demand.
- .2 An ISO 140001 Environmental Management Certificate for gray cast-iron parts must be provided on demand.
- .3 Ferrous materials used in the production of the gray cast-iron parts to be installed must be subjected to a radiation detection test in accordance with CSA B70, Clause 4.1.1. The documentation stipulated in this Clause must be provided on demand.
- .4 All certificates and approvals must be kept by the parts manufacturer to substantiate both their exact origin and their certification.
- .5 All assembled parts, such as gray cast-iron piping and fittings, must come from the same manufacturer to simplify liability and warranty requirements.
- .6 All products or materials to be installed, such as stainless-steel sheath couplings (MJ joint), must come from the same manufacturer to simplify liability and warranty requirements.

Part 2 Products

2.1 CAST-IRON PIPING AND FITTINGS

- .1 Sanitary, vent piping, and storm of the building for above-ground installation, NPS 3 and above, as well as their fittings, must be Class 4000 gray cast iron, to CAN/CSA B70 and have a bituminous coating.
- .2 The trademark, diameter, and CSA and ASTM acronyms must be stamped, throughout the entire length of the pipes, to CAN/CSA B70.
- .3 The fittings must be notched to indicate the position of the couplings.
- .4 Couplings:
 - .1 Standard couplings for gray cast-iron fittings with plain ends (MJ), both under- and above-ground, and piping NPS 6 and under.
 - .1 Mechanical joints with neoprene gaskets, reinforced with stainless steel sheaths 0.2 mm thick (0.008 in.) and fitted with T-304 stainless steel clamps. Joints in accordance with CAN/CSA B70-M, CSA B602, and CAN/ULC S102 or CAN/ULC S102.2. Mechanical joints must be Warnock Hersey-certified in the "Listed Pipe Coupling" category.
- .5 Fasteners:
 - .1 Carbon steel clamps.

2.2 SUSPENSION

- .1 Refer to Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment.

Part 3 Execution**3.1 INSTALLATION**

- .1 Unless otherwise indicated, install piping and accessories in accordance with National Plumbing Code of Canada and local Authority Having Jurisdiction.
- .2 Install the above-ground piping parallel with and close to walls and ceilings in order to conserve headroom and space. Follow the slope and levels indicated.
- .3 Perform tests in accordance with both the National plumbing Code of Canada and the local Authority Having Jurisdiction.

3.2 VENT

- .1 Extend vents without decreasing size to minimum 450 mm (18 in.) under roof and increase the diameter at that point to minimum NPS 4 and above. Use a tapered reducing pipe fitting to change diameter size.

3.3 TESTS

- .1 All openings of the storm and sanitary piping must be completely plugged, including connections, mains, vent upflows, and horizontal drains. The piping must be filled with water to the highest level possible. The water must be maintained at this level for minimum two hours. If it is not possible to test the entire installation in a single operation, the testing can be divided up into several sections with each section tested as described above. However, the water column must be at least 3 m higher than the tested part of the system.
- .2 The piping must be tested up to roof level.
- .3 These tests, which are in accordance with or are more demanding than the National plumbing Code of Canada, must be performed in the presence of plumbing inspectors or the Departmental Representative.

3.4 PERFORMANCE VERIFICATION

- .1 Cleanouts:
 - .1 Ensure accessibility and that access doors are correctly located.
 - .2 Open, cover with linseed oil, and tightly re-seal.
 - .3 Verify that cleanout rods can probe at least as far as the next cleanout.
- .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 identification label (storm) c/w directional arrows every floor or 4.5 m (whichever is less).

END OF SECTION

DIVISION 23

Heating, Ventilation and Air-Conditioning (HVAC)

Part 1 General**1.1 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature, and data sheets.
- .3 Shop Drawings:
 - .1 Indicate on drawings:
 - .1 Mounting arrangements.
 - .2 Operating and maintenance (O&M) clearances.
 - .2 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.
- .4 Fabrication drawings:
 - .1 Prepare and submit fabrication drawings to coordinate the work of the various construction sub-trades. Construction drawings are required for the following work:
 - .1 All ventilation working.
 - .2 Plumbing (Petroleum products and drainage).
 - .3 Fire protection work.
 - .2 All fabrication drawings must be prepared with the latest AutoCAD version, presented as DWG and PDF files. Drawings must be of an appropriate scale, but no smaller than 1:50.
 - .3 The fabrication drawings must consist of drawings to scale, indicating the position of equipment, ducts, piping, valves, and other fittings with required sections and details, including the dimensions of piping and ducts, openings, anchors, and supports, relative positions with framework, architectural works, and other mechanical and electrical works.
 - .4 Preparation:
 - .1 Each sub-trade must do its own fabrication drawing and coordinate it with other sub-trades.
 - .2 The General Contractor must be responsible for the coordination of all fabrication drawings of all mechanical and electrical sub-trades which

- must provide all data, drawings, and diagrams necessary for this coordination work.
- .3 The Ventilation Contractor must prepare a design of its own work with all necessary data and dimensions, and incorporate all information provided by the other trades.
- .4 All fabrication drawings must be submitted for review simultaneously.
- .5 Mechanical and Electrical Contractors must work in close collaboration to determine the location of their respective works and to avoid clashes.
- .5 Responsibilities:
 - .1 Each subcontractor is directly responsible for the location and exact dimensions of the openings, bases, the location of its equipment, piping and ducts, whether dimensions figure in the structural, architectural or engineering drawings or not.
 - .2 The Ventilation Contractor must ensure that no clashes are present in the fabrication drawings.
 - .3 No compensation must be awarded for modifications to the work, for coordination and integration of mechanical and electrical systems with each other.
 - .4 The Departmental Representative's verification of the fabrication drawings is limited to ensuring that the technical requirements appear to be met (FD, grilles, insulation, duct sizing, etc.). The Departmental Representative does not verify the quality of the coordination carried out by the contractors.
- .6 Work in existing conditions:
 - .1 The fabricating drawings must include the existing mechanical, electrical, structural, and architectural facilities, as well as planned work.

1.2 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Operation and Maintenance Data: Submit Operation and Maintenance (O&M) data of units and dampers:
 - .1 Operation and Maintenance (O&M) Manual approved by and final copies deposited with Departmental Representative, before final inspection.
 - .2 Operation data to include:
 - .1 Control schematics for systems, including environmental controls.
 - .2 Description of each system and its control devices.
 - .3 Description of operation of systems at various loads together with reset schedules and seasonal variances.
 - .4 Operation instruction for each system and of each component.
 - .5 Description of actions to be taken in event of equipment failure.
 - .6 Valves schedule and flow diagram.

- .7 Colour coding chart.
- .3 Maintenance data to include:
 - .1 Servicing, maintenance, operation, and troubleshooting instructions for each item of equipment.
 - .2 Data to include schedules of tasks, frequency, tools required, and task time.
- .4 Performance data to include:
 - .1 Equipment manufacturer's performance data sheets with point of operation as left after commissioning is completed.
 - .2 Equipment performance verification test results.
 - .3 Special performance data as specified, elsewhere in Contract Documents.
- .5 Approvals:
 - .1 Submit one copy of draft O&M Manual to Departmental Representative for approval. Submission of individual data will not be accepted unless directed by Departmental Representative.
 - .2 Make changes in O&M Manual as required and re-submit to Departmental Representative.
- .6 Additional data:
 - .1 Prepare and insert into O&M Manual additional data when need becomes apparent during specified demonstrations and instructions.
- .7 Site records:
 - .1 Transfer information weekly to reproducibles, revising reproducibles to show work as actually installed.
 - .2 Use different colour waterproof ink for each service.
 - .3 Make available for reference purposes and inspection.
- .8 "As-Built" drawings:
 - .1 Prior to start of Testing, Adjusting and Balancing (TAB) 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 Departmental Representative 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 O&M Manuals.
- .9 Submit copies of "As-Built" drawings for inclusion in final TAB report.

1.3 DELIVERY, STORAGE, AND HANDLING

- .1 Deliver, store, and handle materials in accordance with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: Deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials indoors, off ground, in dry location, and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Replace defective or damaged materials with new.

Part 2 Products**2.1 NOT USED**

- .1 Not used.

Part 3 Execution**3.1 EXAMINATION**

- .1 Verification of Conditions: Prior to proceed with installation:
 - .1 Visually inspect substrate in presence of Departmental Representative.
 - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
 - .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval from Departmental Representative.

3.2 PAINTING REPAIRS AND RESTORATION

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

3.3 SYSTEM CLEANING

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

3.4 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 - ACTION AND INFORMATIONAL 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.

3.5 DEMONSTRATION

- .1 Departmental Representative will use certain material, equipment, and systems, for test purposes, prior to acceptance. Supply labour, material, and instruments required for testing.
- .2 Supply tools, equipment, and personnel to demonstrate and instruct operating and maintenance personnel in operating, controlling, adjusting, troubleshooting, and servicing of all systems and equipment during regular work hours, prior to acceptance.
- .3 Use O&M Manual, "As-Built" drawings, and audiovisual aids as part of instruction materials.
- .4 Instruction duration time requirements as specified in each appropriate section.

3.6 CLEANING

- .1 Progress Cleaning: Clean in accordance with Section 01 74 00 - Cleaning.
 - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: Upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00 - Cleaning.

3.7 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 REFERENCE STANDARDS**

- .1 CSA Group (CSA).
 - .1 CSA S350-M1980 (R2003), Code of Practice for Safety in Demolition of Structures.

1.2 DEFINITIONS

- .1 Demolish: Dismantle items from existing construction and legally dispose of items off site, unless indicated as removed and salvaged, or removed and reinstalled.
- .2 Remove: Planned deconstruction and disassembly of electrical items from existing construction, including removal of conduit, junction boxes, cabling and wiring from electrical component to panel taking care not to damage adjacent assemblies designated to remain; legally dispose of items off site, unless indicated as removed and salvaged, or removed and reinstalled.
- .3 Remove and Salvage: Dismantle items from existing construction and deliver them to Departmental Representative ready for reuse.
- .4 Remove and Reinstall: Dismantle items from existing construction, prepare them for reuse, and reinstall them where indicated.
- .5 Existing to Remain: Existing items of construction that are not removed and that are not otherwise indicated as being removed and salvaged, or removed and reinstalled.
- .6 Hazardous Substances: Dangerous substances, dangerous goods, hazardous commodities and hazardous products may include asbestos, mercury and lead, PCBs, poisons, corrosive agents, flammable substances, radioactive substances, or other material that can endanger human health and wellbeing, or environment if handled improperly as defined by the Federal Hazardous Products Act (RSC 1985), including latest amendments.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Action Submittals: Provide the following in accordance with Section 01 33 00 - Submittal Procedures before starting work of this Section.

1.4 SITE CONDITIONS

- .1 Existing Conditions: Condition of materials identified as being salvaged or demolished are based on their observed condition at time of site examination, before tendering.

- .2 Existing Hazardous Substances: Departmental Representative has performed a hazardous substances assessment and identified materials requiring abatement as follows:
 - .1 Existing Hazardous Substances: Departmental Representative has performed a hazardous substances assessment and determined that identified materials must be eliminated as follows:
 - .1 Hazardous substances will be removed by the Contractor as a part of the Contract.

Part 2 Products**2.1 NOT USED**

- .1 Not used.

Part 3 Execution**3.1 EXAMINATION**

- .1 Verification of Existing Conditions: Visit site, thoroughly examine and become familiar with conditions that may affect the work of this Section before tendering the Bid; Departmental Representative will not consider claims for extras for work or materials necessary for proper execution and completion of the contract that could have been determined by a site visit.

3.2 PREPARATION

- .1 Protection of Existing Systems to Remain: Protect systems and components indicated to remain in place during selective demolition operations and as follows:
 - .1 Prevent movement and install bracing to prevent settlement or damage of adjacent services and parts of existing buildings scheduled to remain;
 - .2 Notify Departmental Representative and cease operations where safety of buildings being demolished, adjacent structures or services appears to be endangered and await additional instructions before resuming demolition work specified in this Section;
 - .3 Prevent debris from blocking drainage inlets;
 - .4 Protect mechanical systems that must remain in operation.

3.3 EXECUTION

- .1 Disconnect and cap gas supply and electrical services in accordance with requirements of local Authority Having Jurisdiction.
- .2 Do not disrupt active or energized utilities without approval of the Departmental Representative.
- .3 Erect and maintain dust proof and weather tight partitions to prevent the spread of dust and fumes to occupied building areas; remove partitions when work completed.

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- .4 Demolish parts of existing building to accommodate new construction and remedial work, as indicated.
- .5 At end of each day of work, leave work site in safe condition.
- .6 Perform demolition work in a neat and workmanlike manner:
 - .1 Remove any tools and equipment after completion of work and leave site ready for subsequent renovation work.
 - .2 Repair and restore damages caused as a result of work of this Section to match existing materials and finishes.

END OF SECTION

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Part 1 General**1.1 REFERENCE STANDARDS**

- .1 Green Seal Environmental Standards (GSES).
 - .1 Standard GS-11-2008, 2nd Edition, Environmental Standard for Paints and Coatings.
- .2 National Research Council Canada (NRC).
 - .1 National Fire Code of Canada, 2015 (NFC).
- .3 South Coast Air Quality Management District (SCAQMD), California State, Regulation XI. Source Specific Standards.
 - .1 SCAQMD Rule 1113-A2007, Architectural Coatings.
 - .2 SCAQMD Rule 1168-A2005, Adhesive and Sealant Applications.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Provide manufacturer s printed product literature, specifications, and data sheets for piping and equipment, and include product characteristics, performance criteria, physical size, finish, and limitations.

1.3 DELIVERY, STORAGE, AND HANDLING

- .1 Deliver, store, and handle materials in accordance with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements:
 - .1 Deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

Part 2 Products**2.1 NOT USED**

- .1 Not used.

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Part 3 Execution**3.1 CONNECTIONS TO EQUIPMENT**

- .1 Connect piping in accordance with manufacturer's instructions, unless otherwise indicated.
- .2 Use valves and either unions or flanges for isolation and to 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 equipment for observation of operation, inspection, servicing, maintenance, and as recommended by manufacturer.
- .2 Provide space for disassembly, removal of equipment and components without interrupting operation of other system, equipment, components. The dimension of the space must comply to that shown in the drawings or must be consistent with the manufacturer's recommendation, whichever is greater.

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 isolating valves.
- .3 Pipe each drain valve discharge separately to above floor drain. The discharge must be visible.
- .4 Drain valves: NPS $\frac{3}{4}$ gate or globe valves unless indicated otherwise, with hose end male thread, cap and chain.

3.4 DIELECTRIC COUPLINGS

- .1 Use appropriate dielectric couplings compatible with pipework, to suit pressure rating of system.
- .2 Locations of dielectric couplings: Where dissimilar metals are joined.
- .3 NPS 2 and under: Isolating unions or bronze valves.
- .4 Over NPS 2: Flanges.

3.5 PIPEWORK INSTALLATION

- .1 Screwed fittings covered and 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.

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- .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 size of main.
 - .1 Hole saw (or drill) and ream main to maintain full inside diameter of branch line prior to welding saddle, and deburr edges.
- .6 Install exposed piping, equipment, rectangular cleanouts, and similar items parallel or perpendicular to building lines.
- .7 Install concealed pipework to minimize furring space, to maximize headroom, and to 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 piping.
- .10 Group piping wherever possible and as indicated.
- .11 Ream pipes, remove scale, and other foreign material before assembly. Clean also after completion of installation work.
- .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 or vertical upward, unless otherwise indicated.
 - .4 Valves accessible for maintenance without removing adjacent piping.
 - .5 Install globe valves in bypass around control valves.
 - .6 Use butterfly or ball valves at branch take-offs for isolating purposes of certain parts of the network, except where specified.
 - .7 Install butterfly valves between weld neck flanges to ensure full compression of liner.
 - .8 Use chain operators on valves NPS 2½ and larger where installed more than 2,400 mm (95 in) above floor in mechanical rooms.

3.6 SLEEVES

- .1 General: Install where pipes pass through masonry, concrete structures, fire rated assemblies, and as indicated.
- .2 Material: Schedule 40 black steel pipe.
- .3 Construction: Use annular fins continuously welded at mid-point at foundation walls and where sleeves extend above finished floors.

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- .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 (1 in.) 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 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 FIRE STOPPING

- .1 Install fire stopping within annular space between pipes, ducts, insulation, and adjacent fire separation, in accordance with Section 07 84 00 - Fire Stopping.
- .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 the Departmental Representative 48 hours minimum prior to performance of pressure tests.
- .2 Pipework: Test as specified in relevant Sections of Division 23.
- .3 Maintain specified test pressure without loss for 4 hours minimum, unless specified for longer period in relevant Sections of Division 23.
- .4 Prior to tests, isolate equipment and other parts which are not designed to withstand test pressure or media.

- .5 Conduct tests in presence of the Departmental Representative.
- .6 Pay costs for repairs or replacement, retesting, and making good.
- .7 Whether repair or replacement is appropriate is to be determined by the Departmental Representative.
- .8 Insulate or conceal work only after approval and certification of tests by the Departmental Representative.

END OF SECTION

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Part 1 General**1.1 RELATED REQUIREMENTS**

- .1 Section 23 05 48 - Vibration and Seismic Controls for HVAC.

1.2 REFERENCE STANDARDS

- .1 American Society of Mechanical Engineers (ASME).
 - .1 ASME B31.1-07, Power Piping.
- .2 ASTM International (ASTM).
 - .1 ASTM A125-1996 (2007), Standard Specification for Steel Springs, Helical, Heat-Treated.
 - .2 ASTM A307-07b, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
 - .3 ASTM A563-07a, Standard Specification for Carbon and Alloy Steel Nuts.
- .3 Factory Mutual (FM).
- .4 Manufacturer's Standardization Society of the Valves and Fittings Industry (MSS).
 - .1 MSS SP58-2002, Pipe Hangers and Supports - Materials, Design and Manufacture.
 - .2 MSS SP69-2003, Pipe Hangers and Supports - Selection and Application.
 - .3 MSS SP89-2003, Pipe Hangers and Supports - Fabrication and Installation Practices.
- .5 National Research Council Canada (NRC).
 - .1 National Plumbing Code of Canada, 2015 (NPC).
- .6 Underwriters Laboratories of Canada (ULC).

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Provide manufacturer's printed product literature and data sheets for hangers and supports, and include product characteristics, performance criteria, physical size, finish, and limitations.
- .3 Shop Drawings:
 - .1 Submit shop drawings for:
 - .1 Bases, hangers, and supports.
 - .2 Connections to equipment and structure.

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- .3 Structural assemblies.
- .4 Certificates:
 - .1 Submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
- .5 Manufacturer's Instructions:
 - .1 Provide manufacturer's installation instructions.
 - .1 Departmental Representative will make available a copy of systems supplier's installation instructions.
- 1.4 CLOSEOUT SUBMITTALS**
 - .1 Provide maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.
- 1.5 DELIVERY, STORAGE, AND HANDLING**
 - .1 Deliver, store, and handle materials in accordance with manufacturer's written instructions.
 - .2 Delivery and Acceptance Requirements:
 - .1 Deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- Part 2 Products**
- 2.1 DESCRIPTION OF SYSTEM**
 - .1 Design requirements:
 - .1 Construct pipe hangers and supports to manufacturer's recommendations utilizing manufacturer's regular production components, parts, and assemblies.
 - .2 Base maximum load ratings on allowable stresses prescribed by ASME B31.1 or MSS SP58.
 - .3 Ensure that supports, guides, and anchors do not transmit adverse quantities of heat or stress 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, and hangers to withstand seismic events.

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2.2 GENERAL

- .1 Fabricate hangers, supports, and sway braces in accordance with ANSI B31.1 and MSS-SP-58 Standards.
- .2 Use components for intended design purpose only. Do not use for rigging or erection purposes.
- .3 Perforated metal straps are forbidden.
- .4 "Ramset" percussion and drop-in anchors are forbidden.

2.3 HANGERS

- .1 Finish:
 - .1 Hangers and supports: Galvanized after manufacture.
 - .2 Use electro-plating galvanizing process.
 - .3 Ensure steel hangers in contact with copper piping are copper plated epoxy coated.
 - .4 Stainless-steel hangers for all stainless-steel pipework.
- .2 Suspension equipment from bottom flange of I-Beam:
 - .1 Piping NPS 2 or less and HVAC equipment: Malleable cast-iron C-clamp, with hardened steel cup point, set screw, and locknut, UL, ULC, and FM approved, to MSS-SP-69.
 - .2 Piping NPS 2½ or greater: Malleable cast-iron beam clamp, eye rod, jaws, and extension with carbon-steel retaining clip, tie rod, nuts and washers, UL, ULC and FM approved, to MSS-SP-69.
- .3 Suspension equipment from top flange of I-Beam:
 - .1 Ductile cast-iron top-of-beam C-clamp, with hardened steel cup point set screw, carbon-steel locknut, and retaining clip, UL, ULC, and FM approved, to MSS-SP-69.
 - .2 Malleable cast-iron jaw, hook rod with nut, lock washer, and plain washer, UL and FM approved, to MSS-SP-69.
- .4 Steel Joists:
 - .1 Pipes NPS 2 or less and HVAC equipment: Steel bearing plates with two locknuts.
 - .2 Pipes NPS 2½ or greater and HVAC equipment: Steel bearing plates with two locknuts, carbon steel welded attachment with malleable cast-iron eye nut.
 - .3 Carbon steel welded attachment with two locknuts in accordance with MSS-SP-69, type 22.

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- .5 Steel angles or channels (bottom flange):
 - .1 Ductile cast-iron top-of-beam C-clamp, with hardened steel cup point set screw, locknut, and carbon-steel retaining clip, UL, ULC and FM approved, to MSS-SP-69.
- .6 Steel angles or channels (top flange):
 - .1 Malleable cast-iron jaw, hook rod with nut, lock washer, and plain washer, UL and FM approved, to MSS-SP-69.
- .7 Suspension to concrete:
 - .1 Structural attachment to ceiling: Carbon steel clevis plate, clevis pin, and welded eye rod, or forged steel weldless eye nut. The eye must have a diameter at least 6 mm (0.236 in.) greater than rod.
 - .2 Zinc-coated steel screw anchor with hex washer head, internally threaded, for ¼ in. ⅜ in., and ½ in. diameter threaded rod:
 - .3 Zinc-plated expansion anchor (¼ in diameter to 1 in. diameter):
 - .4 Wedge type concrete insert with knockout protector plate, UL, ULC, and FM approved, to MSS-SP-69.
- .8 Shop and field-fabricated assemblies:
 - .1 Roller supports.
 - .2 Steel brackets.
 - .3 Sway braces for seismic restraint systems: In accordance with Section 23 05 48.16 - Seismic Restraint Systems (SRS).
- .9 Hanger Rods: Threaded rod material to MSS-SP-58:
 - .1 Ensure that hanger rods are subject to tensile loading only.
 - .2 Provide linkages where vertical or horizontal movement of pipework is anticipated.
- .10 Supports and hangers installed on insulation (all diameters):
 - .1 Steel or copper piping, with longitudinal movement of less than 25 mm (1 in.): Adjustable clevis fastener, UL, ULC, and FM approved, in accordance with MSS-SP-69.
 - .2 Steel piping, with longitudinal movement of less than 25 mm (1 in.): Pipe roll in accordance with MSS-SP-69, type 43.
 - .3 Steel or copper, hot piping, supported by the underside: Pipe roll stand in accordance with MSS-SP-69, type 44.
- .11 Supports and hangers installed directly on pipe (all diameters - Hot or temperate network only):
 - .1 Steel or plastic piping, with longitudinal movement of less than 25 mm (1 in.): Adjustable swivel ring, to MSS-SP-69, type 10, and UL and FM approved.

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- .2 Copper piping, with longitudinal movement of less than 25 mm (1 in.): Copper-plated, adjustable swivel ring, to MSS-SP-69, type 10.
- .3 Steel or plastic piping, with longitudinal movement of less than 25 mm (1 in.): Pipe roll/roller support to MSS-SP-69, type 43.
 - .1 Resilient coated for stainless-steel pipe.
- .4 Steel or plastic piping supported by the underside: Pipe roll in accordance with MSS-SP-69, type 44.
 - .1 Resilient coated for stainless-steel pipe.
- .5 Cast iron drain piping and vent piping with steel mechanical joints, double clamp on each side of the joint (for NPS 2 to NPS 6) and cast-iron saddle (for NPS 8 and NPS 10).
- .6 Stainless-steel pipe, with longitudinal movement of less than 25 mm (1 in.): Grade 304 stainless steel adjustable clevis hanger, in accordance with ANSI/MSS SP-69 and MSS-SP-58 (type 1).
- .12 Supports and hangers for fire protection piping.
 - .1 Steel fire protection piping: Adjustable clevis fastener, UL and FM approved, in accordance with MSS-SP-69, type.
 - .2 Copper fire protection piping: Copper adjustable clevis fastener, to MSS-SP-69, type 10.
- .13 Supports and hangers for refrigeration piping.
 - .1 Uninsulated copper refrigeration piping: Electro-galvanized channel and U-clamp, 41 mm x 41 mm (1.6 in x 1.6 in.) 2.6 mm (0.1 in.) thick, assembly to ASTM B633, type III SC1, with plastic packing.
 - .2 Insulated copper refrigeration piping: Electro-galvanized channel and U-clamp, 41 mm x 41 mm (1.6 in x 1.6 in.), 2.6 mm (0.1 in.) thick, assembly to ASTM B633, type III SC1.
- .14 U-bolts: Carbon steel, in accordance with MSS-SP-69, with two nuts at each end to ASTM A563.
 - .1 Galvanized finish for steel pipework.
 - .2 Black finish for copper, glass, brass, or aluminum piping, with formed portion plastic coated.
- .15 U-bolts: Grade 304 stainless steel, to ANSI/MSS-SP-69 and MSS-SP-58 (type 24).

2.4 RISER CLAMPS

- .1 Steel, Cast Iron, or Plastic Piping: Carbon steel clamp, UL and ULC approved to MSS-SP-69, type 8.
- .2 Copper Pipe: Copper-plated carbon steel clamp, to MSS-SP-69, type 8.
- .3 Bolts: According to ASTM A307.
- .4 Nuts: According to ASTM A563.

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- .5 Stainless-Steel Pipe: Grade 304 stainless steel clamp, to ANSI/MSS-SP-69 and MSS-SP-58 (type 8).

2.5 PIPE SHIELDS AND SADDLES

- .1 Use high density insulation with continuous vapour barrier for pipe shields.
- .2 Pipe shields and saddles for support of horizontal, insulated piping complying with the following characteristics:
 - .1 Rigid copper piping, NPS 1¼ or greater: Protective pipe shield.
 - .2 Ferrous metal piping:
 - .1 Chilled water piping: Pipe shield and high-density insulation for all diameters.
 - .2 Hot water pipes: Pipe shields for NPS up to 3 and saddles for NPS greater than 3.
 - .3 Steam and condensate piping: Saddles for all diameters.

2.6 CONSTANT SUPPORT SPRING HANGERS

- .1 Springs: Alloy steel, to ASTM A125, shot peened, magnetic particle inspected, with $\pm 5\%$ spring rate tolerance, tested for free height, spring rate, loaded height and provided with Certified Mill Test Report (CMTR).
- .2 Load adjustability: 10% minimum adjustability each side of calibrated load. Adjustment without special tools and not to affect travel capabilities.
- .3 Provide upper and lower factory set travel stops.
- .4 Provide load adjustment scale for field adjustments.
- .5 Total travel to be actual travel +20%. Difference between total travel and actual travel 25 mm (1 in.) minimum.
- .6 Individually calibrated scales on each side of support calibrated prior to shipment, complete with calibration record.

2.7 VARIABLE SUPPORT SPRING HANGERS

- .1 Vertical Movement: 13 mm (½ in.) minimum to 50 mm (2 in.) maximum, use single spring pre-compressed variable spring hangers.
- .2 Vertical movement greater than 50 mm: Use double-spring pre-compressed variable spring hanger with two springs in series in single casing.
- .3 Variable spring hanger complete with factory calibrated travel stops. Provide certificate of calibration for each hanger.
- .4 Steel Alloy Springs: To ASTM A125, shot peened, magnetic particle inspected, with $\pm 5\%$ spring rate tolerance, tested for free height, spring rate, loaded height, and provided with CMTR.

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2.8 EQUIPMENT SUPPORTS

- .1 Fabricate equipment supports not provided by equipment manufacturer from structural grade steel meeting requirements of Section 23 05 48.16. Submit calculations with shop drawings.

2.9 EQUIPMENT ANCHOR BOLTS AND TEMPLATES

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

2.10 HOUSE-KEEPING PADS

- .1 Provide 100 mm (4 in.) high concrete housekeeping pads for base-mounted equipment; size pads 200 mm (8 in.) larger than equipment; chamfer pad edges.
- .2 Concrete: In accordance with Structural Specifications.

2.11 ROOF SUPPORTS

- .1 UV-resistant recycled rubber mounts as specified.
- .2 U-clamp with bolted collars, galvanized steel fastener, and 12 mm (½ in.) dia. rod assembly.
- .3 Brackets installed on previously cleaned and swept roof, in accordance with manufacturer's instructions.

Part 3 Execution**3.1 MANUFACTURERS INSTRUCTIONS**

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

3.2 INSTALLATION

- .1 Provide anti-vibration devices to pumps, boilers, refrigeration equipment, cooling towers, and other specified items.
- .2 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.
 - .3 Steel pipes: Install below coupling or shear lugs welded to pipe.
 - .4 Cast iron pipes: Install below joint.
- .3 Anchorage components for hangers mounted on concrete structure:
 - .1 Attach elements (plates and stirrup) to concrete inserts, as per manufacturer's recommendations.

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- .4 Use approved constant-support type hangers where:
 - .1 Vertical movement of pipework is 13 mm (½ in.) or more.
 - .2 Transfer of load to adjacent hangers or connected equipment is not permitted.
- .5 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 SPACING BETWEEN SUPPORTS AND SUSPENSIONS

- .1 Plumbing Piping: To National Plumbing Code of Canada.
- .2 Comply with NFPA13 and NFPA14 Standards for fire protection piping.
- .3 Install a support or hanger every 1.5 m (5 ft) for NPS ½ or smaller copper piping.
- .4 Install a support or hanger no more than 300 mm (12 in.) from each elbow.
- .5 Comply with MSS-SP-69 for pipe NPS 12 or greater.
- .6 Flexible Joint Roll Grooved Pipe: Install a support or hanger at each joint.
- .7 Support cast iron piping at all connections and each telescoping joint. The distance between two supports shall not exceed 3 m (10 ft). Reduce this distance for piping with mechanical joints to 1 m (3.3 ft) when two adjacent connections are 300 mm (12 in.) or less apart.
- .8 Install supports at the base, at the high point and at each floor of risers.
- .9 In addition to the above required supports, install supports and suspensions on the straight lengths of the piping as described in the tables below:

FUEL OIL PIPING				
MAXIMUM SPACING ON HORIZONTAL PIPING, METRES (FEET)				
Ø PIPE (NPS)	Ø ROD mm (in.)	STEEL		COPPER
		SCHED. 10	SCHED. 40	
Jusqu'à ½	10 (¾)	---	1,8 (5,9)	1,8 (5,9)
¾	10 (¾)	---	2,4 (7,9)	2,4 (7,9)
1	10 (¾)	2,4 (7,9)	2,4 (7,9)	2,4 (7,9)
1¼	10 (¾)	3,0 (9,8)	3,0 (9,8)	3,0 (9,8)
1½	10 (¾)	3,0 (9,8)	3,0 (9,8)	3,0 (9,8)
2	10 (¾)	3,0 (9,8)	3,0 (9,8)	3,0 (9,8)
2½	13 (½)	3,0 (9,8)	3,0 (9,8)	3,0 (9,8)
3	13 (½)	3,6 (12)	4,6 (15,1)	4,6 (15,1)
3½	13 (½)	---	4,6 (15,1)	4,6 (15,1)
4	16 (⅝)	---	4,6 (15,1)	4,6 (15,1)
5	16 (⅝)	---	6,0 (19,7)	---

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FUEL OIL PIPING				
MAXIMUM SPACING ON HORIZONTAL PIPING, METRES (FEET)				
Ø PIPE (NPS)	Ø ROD mm (in.)	STEEL		COPPER
		SCHED. 10	SCHED. 40	
6	19 (¾)	---	6,0 (19,7)	---
8	19 (¾)	---	6,0 (19,7)	---
10	22 (7/8)	---	7,6 (24,9)	---
12	22 (7/8)	---	7,6 (24,9)	---

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.
- .4 Provide appropriate supports, hangers, guides, anchors, elbows, and thermal-expansion loops required to allow piping to expand due to temperature variations in a flexible manner.
- .5 Piping, devices, and equipment must be supported independently of each other.

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 (½ in.), offset pipe hanger and support so that rod hanger is vertical in the hot position.

3.6 PIPING ATTACHMENT TO METAL STRUCTURE

- .1 Support piping with diameter greater than NPS 4 to distribute load imposed on the structure on several structural elements.
- .2 When pipework is parallel to joists, install pipe in the center at equal distance between two girders and install supports or hangers to distribute load equally among those two girders.

3.7 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.

END OF SECTION

Part 1 GENERAL

- .1 Section 23 05 48.16 - Seismic Restraint Systems.
- .2 Section 23 05 93 - Testing, Adjusting and Balancing for HVAC.

1.2 REFERENCE STANDARDS

- .1 Conduct work in accordance with any other Code or other Standard having jurisdiction, as applicable, including but not limited to:
 - .1 American National Standards Institute (ANSI)/American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE).
 - .1 ANSI/ASHRAE Standard 171, Method of Testing Seismic Restraint Devices for HVAC/R Equipment.
 - .2 American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE).
 - .1 ASHRAE Handbook, HVAC Applications.
 - .2 Practical Guide to Seismic Restraint.
 - .3 National Fire Protection Association (NFPA).
 - .1 NFPA 13, Standard for the Installation of Sprinkler Systems.
 - .4 Health Canada/Workplace Hazardous Materials Information System (WHMIS).
 - .1 Material Safety Data Sheets (MSDS).
 - .5 Sheet Metal and Air-Conditioning Contractors' National Association (SMACNA).
 - .1 ANSI/SMACNA 001, Seismic Restraint Manual, Guidelines for Mechanical Systems.

1.3 ACTION AND INFORMATIONAL 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.
- .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.
 - .2 Provide separate shop drawings for each isolated system, and 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.

1.4 QUALITY ASSURANCE

- .1 Health and Safety:
- .1 Do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

1.5 DELIVERY, STORAGE, AND HANDLING

- .1 Packing, shipping, handling, and unloading:
- .1 Deliver, store, and handle materials in accordance with manufacturer's written instructions.

1.6 USE OF VIBRATION AND SEISMIC CONTROLS

- .1 Provide vibration controls for mechanical equipment as per the requirements in the table below:

Equipment	Power (HP) and Other	RPM	Equipment Location											
			Ground Slab			Slab - Span								
						Up to 6 m			Between 6 and 9 m			Between 9 and 12 m		
			Base	Isolator	Min. flexion (mm)	Base	Isolator	Min. flexion (mm)	Base	Isolator	Min. flexion (mm)	Base	Isolator	Min. flexion (mm)
Condensing Units	All	All	A	1	5	A	4	20	A	4	40	A/D	4	40
Small Fans and Fan-Powered Terminal Boxes														
	≤ 285 L/s	All	A	3	15	A	3	15	A	3	15	A	3	15
	> 285 L/s	All	A	3	20	A	3	20	A	3	20	A	3	20
Generator Set	All	All	A	3	20	A	3	40	A	3	65	A	3	90

- Base types:
- No base; isolators attached directly to equipment.
 - Base or structural steel rail (2.9).
 - Inertia base, concrete (2.10).
 - Roof curb isolation rails (2.11).
- Isolator types:
- Elastomeric pads (2.2).
 - Rubber / steel / rubber elastomeric pads (2.2, EP4).
 - Floor or suspended elastomeric mounts (2.3, 2.6).
 - Floor or suspended springs (2.6).
 - Spring mount(s) (2.5).
 - Thrust restraints (2.8).

Part 2 Products**2.1 GENERAL**

- .1 Size and shape of bases type and performance of vibration isolation, as indicated.
- .2 All products must comply with aseismic Standards.

2.2 ELASTOMERIC PADS

- .1 Type EP1: Neoprene waffle or ribbed, 12 mm (0.5 in.) minimum thick, 50 durometer, maximum load 621 kPa (90 lb/in²).
 - .1 Acceptable products: Vibro-Acoustics, Vibra-Sil; Ingenia "Amber/Booth".
- .2 Type EP2: Rubber waffle or ribbed, 30 durometer, 12 mm (0.5 in.) minimum thick, maximum load 345 kPa (50 lb/in²).
 - .1 Acceptable products: Vibro-Acoustics; Vibra-Sil; Ingenia "Amber/Booth".
- .3 Type EP3: Neoprene-steel-neoprene, comprising two neoprene pads, waffle or ribbed, 50 durometer, 12 mm (0.5 in.) minimum thick, bonded to 1.71 mm (0.067 in.) steel plate, holes sleeved with isolation washers, maximum load 621 kPa (90 lb/in²).
 - .1 Acceptable products: Vibro-Acoustics; Vibra-Sil; Ingenia "Amber/Booth".
- .4 Type EP4: Rubber-steel-rubber, comprising two natural rubber pads, waffle or ribbed, 30 durometer, 12 mm (0.5 in.) minimum thick, bonded to 1.71 mm (0.067 in.) steel plate, holes sleeved with isolation washers, maximum load 345 kPa (50 lb/in²).
 - .1 Acceptable products: Vibro-Acoustics; Vibra-Sil; Ingenia "Amber/Booth".

2.3 ELASTOMERIC MOUNTS

- .1 Type M1: Colour coded; neoprene in shear; maximum durometer of 60, ribbed top and bottom surfaces, threaded insert, and two bolt-down holes.
- .2 Acceptable products: Vibro-Acoustics; Vibra-Sil; Ingenia "Amber/Booth".

2.4 SPRINGS

- .1 Design Stable Springs: Ratio of lateral to axial stiffness is equal to or greater than 1.2 times ratio of static deflection to working height. Select for 50% travel beyond rated load. Units complete with levelling devices.
- .2 Ratio of height when loaded to diameter of spring between 0.8 to 1.0.
- .3 Cadmium plate for all installations.
- .4 Colour coded.

2.5 SPRING MOUNTS

- .1 Zinc or cadmium plated hardware; housings coated with rust resistant paint.
 - .1 Type M2: Stable open spring: Support on bonded 6-mm (0.236 in.) minimum thick ribbed neoprene or rubber friction and soundproof pad.
 - .1 Acceptable products: Vibro-Acoustics; Vibra-Sil; Ingenia "Amber/Booth".
 - .2 Type M4: Restrained stable open spring: Supported on bonded 12-mm (0.5 in.) minimum thick ribbed neoprene or rubber friction and soundproof pad; built-in resilient limit stops, removable spacer plates.
 - .1 Acceptable products: Vibro-Acoustics; Vibra-Sil; Ingenia "Amber/Booth".
 - .3 Type M5: Enclosed spring mounts with snubbers for isolation up to 950 kg (2,090 lb) maximum.
 - .1 Acceptable products: Vibro-Acoustics, type S WSR; Vibra-Sil; Ingenia "Amber/Booth".
- .2 Performance: Minimum damping efficiency of 95%.

2.6 HANGERS

- .1 Colour-coded springs, rust resistant, painted box type hangers. Arrange to permit hanger box or rod to move through a 30-degree arc without metal-to-metal contact.
 - .1 Type H1: With neoprene washer, in-shear, moulded with rod isolation bushing.
 - .1 Acceptable products: Vibro-Acoustics; Vibra-Sil; Ingenia "Amber/Booth".
 - .2 Type H2: Stable spring, elastomeric washer, cup with moulded isolation bushing which passes through hanger box.
 - .1 Acceptable products: Vibro-Acoustics; Vibra-Sil; Ingenia "Amber/Booth".
 - .3 Type H3: Stable spring, elastomeric element, cup with moulded isolation bushing which passes through hanger box.
 - .1 Acceptable products: Vibro-Acoustics; Vibra-Sil; Ingenia "Amber/Booth".
 - .4 Type H4: Stable spring, elastomeric element with precompression washer and nut with deflection indicator.
 - .1 Acceptable products: Vibro-Acoustics; Vibra-Sil; Ingenia "Amber/Booth".
- .2 Performance: Minimum damping efficiency of 95%.

2.7 ACOUSTIC GASKETS FOR ANCHORS AND GUIDES

- .1 Acoustic Gaskets: Between pipe and support, consisting of 25 mm (1 in.) minimum thick heavy-duty duck and neoprene isolation material.
 - .1 Acceptable products: Vibro-Acoustics; Vibra-Sil; Ingenia "Amber/Booth".

2.8 HORIZONTAL THRUST RESTRAINTS

- .1 L1 Type: Horizontal thrust restraints, spring, and elastomeric elements housed in box frame; assembly complete with rods and angle brackets for equipment and ductwork attachment. Provision for adjustment to limit maximum start and stop movement to 9 mm (0.354 in.).
- .2 Arrange restraints symmetrically on either side of unit and attach at centerline of thrust.
- .3 Acceptable products: Vibro-Acoustics; Vibra-Sil; Ingenia "Amber/Booth".

2.9 STEEL BASES

- .1 Types:
 - .1 Type B1: Prefabricated steel base: integrally welded on sizes up to 2,400 mm (8 ft.), for field welding on sizes over 2,400 mm (8 ft.); reinforced for alignment of drive and driven equipment; without supplementary hold down devices; complete with isolation element attached to base brackets arranged to minimize height; pre-drilled holes to receive equipment anchor bolts; and complete with adjustable built-in motor slide rail where indicated.
 - .1 Acceptable products: Vibro-Acoustics; Vibra-Sil; Ingenia "Amber/Booth".
 - .2 Type B2: Steel base: Structural steel, positioned for alignment of drive and driven equipment; without supplementary hold-down devices; complete with isolation element attached to base brackets arranged to minimize height; and pre-drilled holes to receive equipment anchor bolts.
 - .1 Acceptable products: Vibro-Acoustics; Vibra-Sil; Ingenia "Amber/Booth".
 - .3 Set bases to clear housekeeping pads by 25 mm (1 in.) minimum.

2.10 INERTIA BASES

- .1 Type:
 - .1 Type B3: Full depth perimeter structural or formed channels, frames: welded in place reinforcing rods running in both directions; bottom (formwork): 1.3 mm (0.051 in.) thick frame-welded sheet for frame widths of up to 2,400 mm (8 ft.), and bolted when the frame width exceeds 2,400 mm (8 ft.); spring mounted, carried by gusseted height-saving brackets welded to frame; and clear housekeeping pads by 50 mm (2 in.) minimum.
 - .2 Pump bases: "T" shaped, where applicable, to support elbows.

- .2 Concrete: As indicated.
- .3 Concrete base thickness to be one-tenth ($\frac{1}{10}$) of the maximum span between isolators, but no less than 150 mm and no more than 300 mm, unless otherwise indicated.
- .4 Acceptable products: Vibro-Acoustics; Vibra-Sil; Ingenia "Amber/Booth".

2.11 ROOF CURB ISOLATION RAILS

- .1 General: Type B4, complete factory assembled.
- .2 Lower Members: Rectangular steel tube or extruded aluminum channels.
- .3 Upper Members: Continuous rectangular steel tubes or extruded aluminum channel to provide continuous support for equipment, complete with all-directional neoprene snubber bushings 6-mm (0.236 in.) thick to resist wind and seismic forces.
- .4 Springs: Steel, adjustable, removable, selected for 50-mm (2 in.) maximum static deflection plus 50% additional travel to solid, cadmium plated, sized and positioned to ensure uniform deflection.
- .5 High Frequency Isolation: Continuous gasket on top and bottom of complete assembly or pads on top and bottom of each spring. Material: 6 mm (0.236 in.) thick closed cell neoprene.
- .6 Weatherproofing: Continuous flexible counterflashing to curb and providing access to springs. Material: Aluminium or neoprene.
- .7 Hardware: Cadmium plated or galvanized.
- .8 Acceptable Products: Vibro-Acoustics; Vibra-Sil; Ingenia "Amber/Booth".

2.12 SEISMIC CONTROL MEASURES

- .1 General:
 - .1 Seismic control devices and systems must comply with requirements set out in Section 23 05 48.16.
 - .2 Seismic control systems and devices to work in all directions.
 - .3 Fasteners and attachment points to resist same maximum load as seismic restraints.
 - .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 must not interfere with integrity of fire-stopping devices.
- .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 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 Earthquake-resistant devices and systems must provide cushioning action that is gentle and steady.
 - .2 Never reach metal-like stiffness.
- .3 Vibration Isolated Equipment:
 - .1 Seismic control measures not to jeopardize noise and vibration isolation systems. Provide 6 to 9 mm clearance during normal operation of equipment and systems between seismic restraint and equipment.
 - .2 Incorporate seismic restraints into vibration isolation system to resist complete isolator unloading.
 - .3 As indicated.
- .4 Piping Systems.
 - .1 Fire protection system: To NFPA 13 Standard.
 - .2 Piping systems: hangers longer than 300 mm; brace at each hanger.
 - .3 Compatible with requirements for anchoring and guiding of piping systems.
- .5 Bracing Methods: As approved by seismic specialist engineer.
 - .1 Structural steel angles or channels.
 - .2 Cable restraint system incorporating grommets, shackles, and other hardware to ensure alignment of restraints and to avoid bending of cables at connection points. Incorporate neoprene into cable connections to reduce shock loads.

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 Seismic control measures to meet National Building Code of Canada requirements.

- .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, conduits, and ducts passing 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. Comply with the following:
 - .1 Up to NPS 4: First 3 points of support. NPS 5 to NPS 8: First 4 points of support. NPS 10 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.
- .7 Place ventilation units on elastomer pads selected for static deflection of 4 mm and spaced a maximum of 2,400 mm apart, centre to centre.

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 to provide product use recommendations and carry out periodic site visits to review installation, scheduled as follows:
 - .1 After delivery and storage of products;
 - .2 After preparatory work and other preliminary work is complete, but before installation commences;
 - .3 Upon completion of installation.
 - .3 Submit manufacturer's reports to the Department representative within three (3) days of manufacturer representative's site visit.
 - .4 Make adjustments and corrections in accordance with written report.
- .2 Inspection and certification of seismic restraints.
 - .1 Experienced and competent sound and vibration testing professional engineer to take vibration measurement for HVAC systems after start-up and TAB of systems to Section 23 05 93.
 - .2 Take vibration measurements for equipment as indicated.
 - .3 Provide Department representative with 24-hour advance notice prior to 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.

END OF SECTION

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Part 1 General**1.1 REFERENCE STANDARDS**

- .1 CSA Group (CSA).
 - .1 CAN/CSA G40.20/G40.21-04, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
- .2 National Research Council Canada (NRC).
 - .1 National Building Code of Canada - 2015 (NBC).

1.2 DEFINITIONS

- .1 Priority Two (P2) Buildings: Buildings in which life safety is of paramount concern. It is not necessary that P2 buildings remain operative during or after earthquake activity.
- .2 SRS: Acronym for Seismic Restraint System.

1.3 DESCRIPTION

- .1 SRS fully integrated into, and compatible with:
 - .1 Noise and vibration controls prescribed.
 - .2 Structural, mechanical, electrical design of project.
- .2 Systems, equipment not required to be operational during and after seismic event.
- .3 During seismic event, SRS to prevent systems and equipment from causing personal injury and from moving from normal position.
- .4 Designed by Professional Engineer specializing in design of SRS and registered in Province of Quebec.

1.4 ACTION AND INFORMATIONAL 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 the Province of Quebec, Canada.
- .3 Submit design data including:
 - .1 Full details of design criteria.
 - .2 Working drawings (prepared to same standard of quality and size as documents forming these tender documents), materials lists, schematics, full specifications for components of each SRS to be provided.
 - .3 Design calculations, including restraint loads resulting from seismic forces in accordance with National Building Code (detailed work sheets, tables).
 - .4 Separate shop drawings for each SRS and devices for each system, equipment.

- .5 Identification of location of devices.
- .6 Schedules of types of SRS equipment and devices.
- .7 Details of fasteners and attachments to structure, anchorage loadings, attachment methods.
- .8 Installation procedures and instructions.
- .9 Design calculations including restraint loads to NBC and Supplement.
- .10 Detailed design of SRS including complete working drawings prepared to same standard of quality and size as Contract Documents, materials lists, design calculations, schematics, specifications.
- .4 Submit additional copy of shop drawings and product data to Structural Engineer, for review, of connection points to building structure.

1.5 DELIVERY, STORAGE, AND HANDLING

- .1 Packing, shipping, handling, and unloading:
 - .1 Deliver, store, and handle materials in accordance with manufacturer's written instructions.

Part 2 Products

2.1 NOT USED

- .1 Not used.

2.2 SRS MANUFACTURER

- .1 SRS from one manufacturer regularly engaged in SRS production.

2.3 GENERAL

- .1 SRS to provide gentle and steady cushioning action and avoid high-impact loads.
- .2 SRS to restrain seismic forces in all directions.
- .3 Fasteners and attachment points to resist same load as SRS.
- .4 SRS of piping systems compatible with:
 - .1 Expansion, anchoring, and guiding requirements.
 - .2 Action of acoustic and vibration isolation systems.
- .5 SRS utilizing cast-iron, threaded pipe, other brittle materials not permitted.
- .6 Attachments to RC structure:
 - .1 Use high-strength mechanical expansion anchors.
 - .2 Drilled or power-driven anchors not permitted.
- .7 Seismic control measures not to interfere with integrity of fire stopping.

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2.4 SRS FOR STATIC EQUIPMENT, SYSTEMS

- .1 Floor-mounted equipment, systems:
 - .1 Anchor equipment to equipment supports.
 - .2 Anchor equipment supports to structure.
 - .3 Use size of bolts scheduled in approved shop drawings.
- .2 Suspended equipment, systems:
 - .1 Use one or combination of following methods:
 - .1 Install tight to structure;
 - .2 Cross-brace in every direction;
 - .3 Brace back to structure;
 - .4 Slack cable restraint system.
 - .2 SCS to prevent sway in horizontal plane, rocking in vertical plane, sliding or buckling in axial direction.
 - .3 Hanger rods to withstand compressive loading and buckling.

2.5 SRS FOR VIBRATION ISOLATED EQUIPMENT

- .1 Floor mounted equipment, systems:
 - .1 Use one or combination of following methods:
 - .1 Vibration isolators with built-in snubbers;
 - .2 Vibration isolators and separate snubbers;
 - .3 Built-up snubber system approved by Departmental Representative, consisting of structural elements and elastomeric layer.
 - .2 SRS to resist complete isolator unloading.
 - .3 SRS not to jeopardize noise and vibration isolation systems. Provide 4-8 mm clearance between seismic restraint snubbers and equipment during normal operation of equipment and systems.
 - .4 Cushioning action: gentle and steady by utilizing elastomeric material or other means in order to avoid high impact loads.
- .2 Suspended equipment, systems:
 - .1 Use one or combination of following methods:
 - .1 Slack cable restraint system;
 - .2 Brace back to structure via vibration isolators and snubbers.

2.6 SLACK CABLE RESTRAINT SYSTEM (SCS)

- .1 Use elastomer materials or similar to avoid high-impact loads and provide gentle and steady cushioning action.
- .2 SCS to prevent sway in horizontal plane, rocking in vertical plane, sliding or buckling in axial direction.

- .3 Hanger rods to withstand compressive loading and buckling.

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 data sheets.

3.2 INSTALLATION

- .1 Attachment Points and Fasteners:
 - .1 To withstand same maximum load that seismic restraint is to resist and in every direction.
- .2 Slack Cable Systems (SCS):
 - .1 Connect to suspended equipment so that axial projection of wire passes through centre of gravity of equipment.
 - .2 Use appropriate grommets, shackles, other hardware to ensure alignment of restraints and to avoid bending of cables at connection points.
 - .3 Piping systems: Provide transverse SCS at 10 m spacing maximum, longitudinal SCS at 20 m maximum or as limited by anchor/slack cable performance.
 - .4 Small pipes may be rigidly secured to larger pipes for restraint purposes, but not reverse.
 - .5 Orient restraint wires on ceiling hung equipment at approximately 90° to each other (in drawing), tie back to structure at maximum of 45° to structure.
 - .6 Adjust restraint cables so that they are not visibly slack but permit vibration isolation system to function normally.
 - .7 Tighten cable to reduce slack to 40 mm under thumb pressure. Cable not to support weight during normal operation.
- .3 Install SRS at least 25 mm from equipment, systems, services.
- .4 Miscellaneous equipment not vibration-isolated:
 - .1 Bolt through house-keeping pad to structure.
- .5 Co-ordinate connections with other disciplines.
- .6 Vertical Tanks:
 - .1 Anchor through house-keeping pad to structure.
 - .2 Provide steel bands above centre of gravity.
- .7 Horizontal Tanks:
 - .1 Provide at least two straps with anchor bolts fastened to structure.

3.3 FIELD QUALITY CONTROL**.1 Inspection and Certification:**

- .1 SRS: Inspected and certified by Seismic Engineer upon completion of installation.
- .2 Provide written report to Departmental Representative.

.2 Commissioning Documentation:

- .1 Upon completion and acceptance of certification, hand over to Departmental Representative complete set of construction documents, revised to show "As-Built" conditions.

END OF SECTION

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Part 1 General**1.1 REFERENCE STANDARDS**

- .1 Canadian Gas Association (CGA).
 - .1 CSA/CGA B149.1-05, Natural Gas and Propane Installation Code.
- .2 Canadian General Standards Board (CGSB).
 - .1 CAN/CGSB-1.60-97, Interior Alkyd Gloss Enamel.
 - .2 CAN/CGSB-24.3-92, Identification of Piping Systems.
- .3 National Fire Protection Association (NFPA).
 - .1 NFPA 13-2002, Standard for the Installation of Sprinkler Systems.
 - .2 NFPA 14-2003, Standard for the Installation of Standpipe and Hose Systems.

1.2 ACTION AND INFORMATIONAL 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 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.

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- .2 Lettering and numbers raised or recessed.
- .3 Information to include, as appropriate:
 - .1 Equipment: Manufacturer s name, model, size, serial number, and capacity.
 - .2 Motor: Voltage, Hz, phase, power factor, duty, and frame size.

2.2 **SYSTEM NAMEPLATES**

- .1 Colours:
 - .1 Hazardous Material: Red letters, white background.
 - .2 Elsewhere: Black letters, white background (except where required otherwise by applicable Codes).
- .2 Construction:
 - .1 3 mm thick white anodized aluminum, matte finish, with square corners, letters accurately aligned, and machine engraved into core.
- .3 Sizes:
 - .1 As to following table:

Size # mm	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 Locations:
 - .1 Terminal cabinets, control panels: Use size #5.
 - .2 Equipment and mechanical rooms: Use size #9.
- .5 Identification for PSPC 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.

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2.3 EXISTING IDENTIFICATION SYSTEMS

- .1 Apply existing identification system to new work.
- .2 Where existing identification system does not cover for new work, use identification system specified this Section.
- .3 Before starting work, obtain written approval of identification system from Departmental Representative.

2.4 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 Height: To full circumference of pipe or insulation.
 - .2 Length: Sufficient 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, heat-resistant, and pressure sensitive plastic marker tags.
 - .2 Other pipes: Pressure sensitive vinyl with protective overcoating, waterproof contact adhesive undercoating, suitable for ambient of 100% RH and continuous operating temperature of 150°C and intermittent temperature of 200°C.

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.7 Colours and Legends:

- .1 Where not listed, obtain direction from Departmental Representative.
- .2 Colours for legends, arrows: To following table:

Background Colour	Legend, Arrows
Yellow	BLACK
Green	WHITE
Red	WHITE

.3 Background colour marking and legends for piping systems:

Contents	Background Colour Marking	Legend
** Add design temperature		
++ Add design temperature and pressure		
storm Water	Green	STORM
Fuel Oil Filling Piping	Yellow	FUEL OIL
Engine Exhaust	Yellow	ENGINE EXHAUST

2.5 IDENTIFICATION DUCTWORK SYSTEMS

- .1 50 mm high stencilled letters and directional arrows 150 mm long x 50 mm high.
- .2 Colours: Black, or co-ordinated with base colour to ensure strong contrast.

2.6 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.

2.7 LANGUAGE

- .1 Identification in French and English.
- .2 Use nameplates and labels for each language.

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 data sheets.

3.2 INSTALLATION

- .1 Perform work in accordance with CAN/CGSB-24.3, except as specified otherwise.

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- .2 Identify systems, equipment complying with PWGSC PMSS.

3.3 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 nameplates.

3.4 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. If not 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.

3.5 CLEANING

- .1 Proceed in accordance with Section 01 74 00 - Cleaning.
- .2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools, and equipment.

END OF SECTION

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Part 1 General**1.1 METHODS**

- .1 Submit names of personnel to perform TAB to the Departmental Representative within 90 days of award of Contract.
- .2 TAB: Performed in accordance with the requirements of following Standards:
 - .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.
- .3 Recommendations and prescribed practices contained in the TAB Standard: Mandatory.
- .4 Use TAB Standard provisions, including checklists and report forms to satisfy Contract requirements.
- .5 Use TAB Standard for TAB, including qualifications for TAB Firm and Specialist and calibration of TAB instruments.
- .6 Where instrument manufacturer calibration recommendations are more stringent than those listed in TAB Standard, use manufacturer's recommendations.
- .7 TAB Standard quality assurance provisions such as performance guarantees form part of this Contract.
 - .1 For systems or system components not covered in TAB Standard, use TAB procedures developed by TAB Specialist.
 - .2 Where new procedures and requirements are applicable to Contract requirements have been published or adopted by body responsible for TAB Standard used (AABC, NEBB, or TABB), requirements and recommendations contained in these procedures and requirements are mandatory.

1.2 PURPOSE OF TAB

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

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1.3 EXCEPTIONS

- .1 TAB of systems and equipment regulated by Codes, Standards to satisfaction of Authority Having Jurisdiction.

1.4 WORK COORDINATION

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

1.5 PRE-TAB REVIEW

- .1 Review Contract Documents before project construction is started and confirm in writing to Departmental Representative adequacy of provisions for TAB and other aspects of design and installation pertinent to success of TAB.
- .2 Review specified Standards and report to Departmental Representative in writing proposed procedures which vary from Standard or Reference Documents.
- .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 Departmental Representative for verification of TAB reports.

1.8 START OF TAB

- .1 Notify Departmental Representative seven days prior to start of TAB.
- .2 Start TAB when building is essentially completed, including:
 - .1 Installation of ceilings, doors, windows, other construction affecting TAB;
 - .2 Application of weather stripping, sealing, and caulking;
 - .3 Pressure, leakage, other tests specified elsewhere in Division 23;
 - .4 Provisions for TAB installed and operational;
 - .5 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.

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- .2 Air systems:
 - .1 Filters in place, clean;
 - .2 Ducts clean and free of debris;
 - .3 Ducts, air shafts, ceiling plenums are airtight within specified tolerances;
 - .4 Correct fan rotation;
 - .5 Fire, smoke, volume control dampers installed and open;
 - .6 Coil fins combed, clean;
 - .7 Access doors, installed, closed;
 - .8 Outlets installed, volume control dampers open.

1.9 APPLICATION TOLERANCES

- .1 Do TAB to following tolerances of design values:
 - .1 Mechanical systems: Plus 5%, minus 5%.

1.10 APPLICATION TOLERANCES

- .1 Measured values accurate to, within $\pm 2\%$, actual values.

1.11 TAB INSTRUMENTS

- .1 Prior to TAB, submit to Departmental Representative 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 mechanical system.
- .3 Calibrate within three months of TAB. Provide a calibration certificate to the Departmental Representative.

1.12 SUBMITTALS

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

1.13 TAB REPORT

- .1 Format in accordance with referenced Standard.
- .2 In the report, express results in units as indicated on drawings and include:
 - .1 Project record drawings;
 - .2 System schematics of systems involved.
- .3 Submit two hard copies of TAB Report to Departmental Representative for verification and approval, in French, in "D" ring binders with tab dividers.

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1.14 VERIFICATION OF RESULTS

- .1 Reported results subject to verification by Departmental Representative.
- .2 Number and location of verified results, as directed by Departmental Representative.
- .3 Pay costs to repeat TAB as required, to satisfaction of Departmental Representative.

1.15 SETTINGS

- .1 Once TAB is completed to satisfaction of Departmental Representative, replace drive guards, close access doors, block devices in set positions, ensure sensors are at required settings.
- .2 Permanently mark settings; these must not be erased or covered in any way.

1.16 COMPLETION OF TAB

- .1 TAB considered complete only when final TAB Report will have been approved by Departmental Representative.

1.17 AIR SYSTEMS

- .1 Standard: TAB to most stringent of this Section or TAB Standards of AABC, ASHRAE, SMACNA or NEBB.
- .2 Do TAB of systems, equipment, components, controls as specified in Contract Documents.
- .3 Personnel performing TAB qualified to standards of NEBB and current member in good standing of NEBB.
- .4 Perform TAB under direction of supervisor qualified to standards of NEBB.
- .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 devices.
- .7 Locations of systems measurements to include as appropriate: main ducts, main branch, sub-branch, run-out (or grille, register or diffuser).

1.18 OTHER TAB REQUIREMENTS

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

Part 2 Products**2.1 NOT USED**

.1 Not used.

Part 3 Execution**3.1 NOT USED**

.1 Not used.

END OF SECTION

1.1 RELATED REQUIREMENTS

- .1 Section 23 05 00 - Common Work Results for HVAC.
- .2 Section 23 05 29 - Hangers and supports for HVAC Piping and Equipment.

1.2 REFERENCE STANDARDS

- .1 American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE).
 - .1 ANSI/ASHRAE/IESNA 90.1-04, SI; Energy Standard for Buildings Except Low-Rise Residential Buildings.
- .2 ASTM International (ASTM).
 - .1 ASTM B209M-07, Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric).
 - .2 ASTM C335-05ae1, Standard Test Method for Steady State Heat Transfer Properties of Pipe Insulation.
 - .3 ASTM C411-05, Standard Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation.
 - .4 ASTM C449/C449M-00, Standard Specification for Mineral Fiber-Hydraulic-Setting Thermal Insulating and Finishing Cement.
 - .5 ASTM C547-07e1, Standard Specification for Mineral Fiber Pipe Insulation.
 - .6 ASTM C553-02e1, Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.
 - .7 ASTM C612-04e1, Standard Specification for Mineral Fiber Block and Board Thermal Insulation.
 - .8 ASTM C795-03, Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel.
 - .9 ASTM C921-03a, Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.
- .3 Canadian General Standards Board (CGSB).
 - .1 CGSB 51-GP-52Ma-89, Vapour Barrier, Jacket and Facing Material for Pipe, Duct and Equipment Thermal Insulation.
- .4 Green Seal Environmental Standards (GSES).
 - .1 Standard GS-36-00, Commercial Adhesives.
- .5 South Coast Air Quality Management District (SCAQMD), California State.
 - .1 SCAQMD Rule 1168-A2005, Adhesive and Sealant Applications.
- .6 Thermal Insulation Association of Canada (TIAC): National Insulation Standards (2005).
- .7 Underwriters Laboratories of Canada (ULC).
 - .1 CAN/ULC-S102-03, Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.

- .2 CAN/ULC-S701-05, Standard for Thermal Insulation, Polystyrene, Boards and Pipe Covering.

1.3 DEFINITIONS

- .1 For purposes of this section, the following definitions must apply:
 - .1 “Concealed”: Insulated mechanical services, piping, and ducts in suspended ceilings and non-accessible chases and furred-in spaces.
 - .2 “Exposed”: Means “not concealed” (as previously defined).
 - .3 “Insulation systems”: Insulation material, fasteners, jackets, and other accessories.
 - .4 “Ductwork”: Overall duct system including ducts, elbows, tees, and all related accessories.
- .2 Insulation thickness is the thickness required to cover every component of the insulated element, including reinforcements, angle irons, T-joints, flanges, etc.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Provide manufacturer's printed product literature and data sheets for duct insulation, and include product characteristics, performance criteria, physical size, finish, and limitations.
 - .1 Description of equipment giving manufacturer's name, type, model, year and capacity.
 - .2 Details of operation, servicing, and maintenance.
 - .3 Recommended spare parts list.
- .3 Manufacturers Instructions:
 - .1 Provide manufacture’s written duct insulation jointing recommendations. and special handling criteria, installation sequence, cleaning procedures.

1.5 QUALITY ASSURANCE

- .1 Qualifications:
 - .1 Installer: Specialist in performing work of this section, have at least three years of successful experience in this size and type of project, and be a member of TIAC.

1.6 DELIVERY, STORAGE, AND HANDLING

- .1 Deliver, store, and handle in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

Part 2 Products**2.1 FIRE AND SMOKE RATING**

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

2.2 INSULATION

- .1 Thermal conductivity ("k" factor) not to exceed specified values at 24°C (75.20°F) mean temperature when tested in accordance with ASTM C335.
- .2 **D-1** type thermal insulation: Rigid mineral fibre panels to ASTM C612, with factory-applied vapour retarder shield to ASTM E96.
 - .1 Maximum "K" factor of 0.0337 W/m•°C (0.234 Btu-in/h•ft²•°F) at 24°C (75°F) mean temperature.
 - .2 Temperature limits: 120°C (250°F).
 - .3 Density: 36 kg/m³ minimum (2.25 lb/ft³).
 - .4 Acceptable products: Manson AK Board FSK.

2.3 JACKETS

- .1 Canvas:
 - .1 220 g/m² (0.45 lb/in²), cotton, plain weave, ULC listed fire resistance, treated with dilute fire-retardant lagging adhesive to ASTM C921.
 - .2 Acceptable products: Fattal Thermocanvas.
 - .3 Lagging adhesive: Compatible with insulation.

2.4 ACCESSORIES

- .1 Vapour Retarder Lap Adhesive:
 - .1 Water based, fire-retardant type, compatible with insulation.
- .2 Vapour retarder to be applied to the insulation:
 - .1 Acrylic type vinyl emulsion, compatible with insulation.
- .3 Insulating Cement: Hydraulic setting, on mineral wool, to ASTM C449.
- .4 ULC listed canvas jacket:
 - .1 220 g/m² (0.045 lb/in²) cotton, plain weave, treated with dilute fire-retardant lagging adhesive to ASTM C921.
- .5 Outdoor Vapour Retarder Mastic:
 - .1 Acrylic type vinyl emulsion, compatible with insulation.
 - .2 Reinforcing fabric: Fibrous glass, untreated, 305 g/m² (0.062 lb/in²).
- .6 Tape: Self-adhesive, aluminum, reinforced, 75 mm (3 in.) wide minimum.

- .7 Contact Adhesive: Quick-setting.
- .8 Canvas Adhesive: Washable.
- .9 Tie wire: 1.5 mm (0.06 in.) stainless steel.
- .10 Bandings: Stainless steel, 0.5 mm (0.02 in.) thick, and 19 mm (¾ in.) wide.
- .11 Facing: 25 mm (1 in.), stainless-steel hexagonal wire mesh stitched on both faces of insulation or on one face of insulation, with expanded metal lath on other face.
- .12 Fasteners: 4 mm (0.16 in.) diameter pins with 35 mm (1.4 in.) diameter clips, length to suit thickness of insulation.

2.5 ACCEPTABLE PRODUCTS

- .1 Specified products or approved equivalent by Owens Corning, John Manville, Knauf, Certain Teed.

Part 3 Execution

3.1 PREPARATORY WORK

- .1 Pressure test ductwork systems complete, witnessed, and certified.
- .2 Ensure surfaces are clean, dry, and free from foreign material.

3.2 INSTALLATION

- .1 Install in accordance with TIAC National Standards.
- .2 Install materials in accordance with manufacturers' instructions and as indicated on drawings.
- .3 Use two layers with staggered joints, when required nominal thickness exceeds 75 mm (3 in.).
- .4 Secure any raised joints with an overlapping strip of flexible insulating material with an integrated vapour retarder.
- .5 Maintain uninterrupted continuity and integrity of vapour retarder jacket and finishes:
 - .1 Ensure hangers and supports must not pierce the vapour retarder jacket.
- .6 Hangers and Supports:
 - .1 Apply high compressive strength insulation where insulation may be compressed by weight of ductwork.
- .7 Fasteners: Install at 300 mm (12 in.) on centre in horizontal and vertical directions, minimum two rows each side.

3.3 TABLE - THERMAL INSULATION OF AIR DUCTS

- .1 Insulate duct systems as indicated in the table below:

SYSTEMS AND EQUIPMENT		THICKNESS OF INSULATION mm (in.)	TYPE OF INSULATION
.1	Rectangular air conditioning supply ducts	25 (1)	D-1
.2	Rectangular exhaust ducts	75 (3)	D-1
.3	Duct from louver to grille	75 (3)	D-4

1.1 FINISHING

- .1 Exposed Indoor Ducts: Canvas jacket.

END OF SECTION

Part 1 General**1.1 REFERENCE STANDARDS**

- .1 American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE).
 - .1 ANSI/ASHRAE 90.1-04 -SI Edition, Energy Standard for Buildings Except Low-Rise Residential Buildings.
- .2 ASTM International (ASTM).
 - .1 ASTM C335-05ae1, Standard Test Method for Steady State Heat Transfer Properties of Horizontal Pipe Insulation.
 - .2 ASTM C449/C449M-07, Standard Specification for Mineral Fiber-Hydraulic-Setting Thermal Insulating and Finishing Cement.
 - .3 ASTM C533-07, Standard Specification for Calcium Silicate Block and Pipe Thermal Insulation.
 - .4 ASTM C547-07, Standard Specification for Mineral Fiber Pipe Insulation.
 - .5 ASTM C553-02, Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.
 - .6 ASTM C612-04e1, Standard Specification for Mineral Fiber Block and Board Thermal Insulation.
 - .7 ASTM C795-03, Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel.
 - .8 ASTM C921-03a, Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.
- .3 South Coast Air Quality Management District (SCAQMD), California State.
 - .1 SCAQMD Rule 1168-A2005, Adhesive and Sealant Applications.
- .4 Thermal Insulation Association of Canada (TIAC).
 - .1 National Insulation Standards 2005.
- .5 Underwriters Laboratories of Canada (ULC).
 - .1 CAN/ULC-S102-07, Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Provide manufacturer's printed product literature and data sheets for insulation and adhesives, include product characteristics, performance criteria, physical size, finish, and limitations.

- .3 Manufacturer's Instructions:
 - .1 Include procedures to be used and installation standards to be achieved.

1.3 DELIVERY, STORAGE, AND HANDLING

- .1 Deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .2 Store at temperatures and conditions recommended by manufacturer.

Part 2 Products

2.1 FIRE AND SMOKE RATING

- .1 Fire and smoke ratings to CAN/ULC-S102:
 - .1 Maximum flame spread rating: 25.
 - .2 Maximum smoke developed rating: 50.

2.2 INSULATION

- .1 Thermal conductivity ("k" factor) not to exceed specified values at 24°C mean temperature when tested in accordance with ASTM C335.
- .2 Insulation type E-1: Ceramic fiber:
 - .1 Ceramic fiber panels.
 - .2 Thermal Conductivity Coefficient "K" of 0.15 W / m•°C (1.01 Btu in / hr•ft²•°F) at a temperature of 538°C (1,000°F).
 - .3 Density: 96 kg/m³ (6 lb/ft³).
 - .4 Temperature limit: 1,093°C (2,000°F) continuous.

2.3 JACKETS

- .1 Aluminum:
 - .1 To ASTM B209.
 - .2 Thickness: 0.50 mm sheet.
 - .3 Finish: Smooth.
 - .4 Joining: Longitudinal and circumferential slip joints, with 50 mm laps.
 - .5 Fittings: 0.5 mm thick die-shaped fitting covers with factory-attached protective liner.
 - .6 Metal jacket banding and mechanical seals: Stainless steel, 19 mm wide, 0.5 mm thick at 300 mm spacing.

2.4 INSULATION SECUREMENTS

- .1 Tape: Self-adhesive, aluminum reinforced, 50 mm wide minimum.

- .2 Tie Wire: 1.5 mm diameter stainless steel.
- .3 Bands: Stainless steel, 19 mm wide, 0.5 mm thick.
- .4 Facing: 25 mm galvanized steel hexagonal wire mesh on one face of insulation with expanded metal lath on other face or on both faces of insulation.
- .5 Fasteners: 4 mm diameter pins with 35 mm diameter clips. Length of pin to suit thickness of insulation.

Part 3 Execution

3.1 APPLICATION

- .1 Manufacturer's Instructions: Comply with manufacturer's written recommendations, including product technical bulletins, handling, storage and installation instructions, and data sheets.

3.2 PRE- INSTALLATION REQUIREMENTS

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

3.3 INSTALLATION

- .1 Install in accordance with TIAC National Standards
 - .1 Hot equipment: To TIAC code 1503-H.
- .2 Provide vapour retarder as recommended by manufacturer.
- .3 Apply materials in accordance with insulation and equipment manufacturer's instructions and this Specification.
- .4 Use two layers with staggered joints when required nominal wall thickness exceeds 75 mm.
- .5 Maintain uninterrupted continuity and integrity of vapour retarder jacket and finishes.
 - .1 Hangers, supports outside vapour retarder jacket.
- .6 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 EQUIPMENTS AND ACCESSORIES INSULATION

- .1 Muffler and generator exhaust.
 - .1 Type E-1 insulation with 25 mm (1 in.) air gap, retained by mechanical fasteners.

- .2 Thickness of insulation:
 - .1 Two thicknesses of 50 mm (2 in.).
- .3 Finish.
- .4 Inside the building.
 - .1 Exhaust and silencer exhaust piping: Aluminum liner.
- .2 Specific Requirements:
 - .1 Diesel engine generator muffler and exhaust: Allow 25 mm (1 in.) air space with wire mesh on steel linkage. Cover with 100-mm (4-in.) thick ceramic fiber insulation and retain it in place using galvanized pins; cover everything with an aluminum jacket.

END OF SECTION

Part 1 General**1.1 RELATED REQUIREMENTS**

- .1 Section 23 05 00 - Common Work Results for HVAC.
- .2 Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment.

1.2 REFERENCE STANDARDS

- .1 American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE).
 - .1 ASHRAE Standard 90.1-01, Energy Standard for Buildings Except Low-Rise Residential Buildings (IESNA co-sponsored; ANSI approved; Continuous Maintenance Standard).
- .2 ASTM International (ASTM).
 - .1 ASTM B209M-04, Standard Specification for Aluminum and Aluminum Alloy Sheet and Plate Metric.
 - .2 ASTM C335-04, Standard Test Method for Steady State Heat Transfer Properties of Horizontal Pipe Insulation.
 - .3 ASTM C411-04, Standard Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation.
 - .4 ASTM C449/C449M-00, Standard Specification for Mineral Fiber-Hydraulic-Setting Thermal Insulating and Finishing Cement.
 - .5 ASTM C533-2004, Calcium Silicate Block and Pipe Thermal Insulation.
 - .6 ASTM C547-2003, Mineral Fiber Pipe Insulation.
 - .7 ASTM C795-03, Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel.
 - .8 ASTM C921-03a, Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.
- .3 Canadian General Standards Board (CGSB).
 - .1 CGSB 51-GP-52Ma-89, Vapour Barrier, Jacket and Facing Material for Pipe, Duct and Equipment Thermal Insulation.
 - .2 CAN/CGSB-51.53-95, Poly (Vinyl Chloride) Jacketing Sheet, for Insulated Pipes, Vessels and Round Ducts
- .4 Department of Justice Canada (Jus).
 - .1 Canadian Environmental Assessment Act (CEAA), 1995, c. 37.
 - .2 Canadian Environmental Protection Act (CEPA), 1999, c. 33.
 - .3 Transportation of Dangerous Goods Act (TDGA), 1992, c. 34.

- .5 Health Canada/Workplace Hazardous Materials Information System (WHMIS).
 - .1 Safety Data Sheets (SDS).
- .6 Manufacturer's Trade Associations.
 - .1 Thermal Insulation Association of Canada (TIAC): National Insulation Standards (Revised 2004).
- .7 Underwriters Laboratories of Canada (ULC).
 - .1 CAN/ULC-S102-03, Surface Burning Characteristics of Building Materials and Assemblies.
 - .2 CAN/ULC-S701-01, Thermal Insulation, Polystyrene, Boards and Pipe Covering.
 - .3 CAN/ULC-S702-1997, Thermal Insulation, Mineral Fibre, for Buildings
 - .4 CAN/ULC-S702.2-03, Thermal Insulation, Mineral Fibre, for Buildings, Part 2: Application Guidelines.

1.3 DEFINITIONS

- .1 For purposes of this section, the following definitions must apply:
 - .1 "Concealed": Insulated mechanical services in suspended ceilings and non-accessible chases and furred-in spaces.
 - .2 "Exposed": Will mean "not concealed" as specified.
 - .3 "System": Piping, including all incorporated accessories, trim, etc., such as valves, elbows, pumps, tees, etc.
- .2 Insulation must be thick enough to cover all components of element to be insulated, such as reinforcements, angle irons, supports, joints, etc.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications, and data sheets in accordance with Section 01 33 00 - Submittal Procedures. Include product characteristics, performance criteria, and limitations.
- .3 Shop Drawings:
 - .1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.

1.5 QUALITY ASSURANCE

- .1 Qualifications:
 - .1 Installer: Specialist in performing work of this Section having at least 3 years successful experience in this size and type of project, and member of TIAC.

1.6 DELIVERY, STORAGE, AND HANDLING

- .1 Packing, shipping, handling, and unloading:
 - .1 Deliver, store, and handle in accordance with manufacturer's written instructions.
 - .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.
- .2 Storage and Protection:
 - .1 Protect from weather and construction traffic.
 - .2 Protect against damage.
 - .3 Store at temperatures and conditions required by manufacturer.

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 Materials must be tested according to ASTM C411.

2.2 SEALANTS

- .1 Do not use sealants emitting strong odours, containing toxic chemicals or are not certified as mould-resistant in air handling units.
- .2 When low-toxicity products are not possible, confine usage to areas which offgas to exterior are contained behind air barriers or are applied several months before occupancy to maximize offgas time.

2.3 INSULATION

- .1 Thermal conductivity ("k" factor) not to exceed specified values at 24°C (75°F) mean temperature when tested in accordance with ASTM C335.
- .2 Type P-1 Thermal Insulation: Rigid moulded mineral fibre with factory applied vapour retarder jacket.
 - .1 Mineral fibre: To ASTM C547.
 - .2 Jacket: To CGSB 51-GP-52Ma.
 - .3 Maximum "k" factor: Of 0.033 W/m•°C (0.231 Btu-po/h•pi²•°F) at an average temperature of 24°C (75°F).
 - .4 Temperature limits: -29°C (-20°F) to 454°C (850°F).

2.4 ADHESIVES, TAPE AND FASTENERS

- .1 Accessories:
 - .1 Tape: Self-adhesive, aluminum, reinforced, 50-mm (2 in.) wide minimum.
 - .2 Contact adhesive: Quick-setting.
 - .3 Canvas adhesive: Washable.
 - .4 Tie wire: 1.5 mm (0.6 in.) diameter stainless steel.
 - .5 Banding: 19 mm (¾ in.) wide, 0.5 mm (0.02 in.) thick stainless steel.
- .2 For P-1 insulation:
 - .1 Tape: Aluminum, self-adhesive ULC listed for the following characteristics: flame spread rating of not more than 25 and a smoke developed classification of not more than 50:
 - .2 Quick-setting lap adhesive: used to seal vapour barrier joints and overlaps.
 - .3 Thermal insulation adhesive, fireproof coating:

2.5 JACKETS

- .1 Polyvinyl Chloride (PVC):
 - .1 One-piece moulded type and sheets to CAN/CGSB-51.53 with pre-formed shapes as required.
 - .2 Colour: White.
 - .3 Minimum service temperatures: -20°C (-4°F).
 - .4 Maximum service temperature: 65°C (149°F).
 - .5 Moisture vapour transmission: 0.02 perm.
 - .6 Thickness: 0.5 mm (0.02 in.).
 - .7 Fastenings:
 - .1 Solvent weld adhesive compatible with insulation to seal laps and joints.
 - .2 Tacks.
 - .3 Pressure sensitive vinyl tape of matching colour.
 - .8 Special requirements:
 - .1 Outdoor: UV rated material at least 0.8-mm (0.03 in.) thick.

2.6 INSULATING CEMENT

- .1 Thermal insulating and finishing cement.
 - .1 Hydraulic setting or air drying on mineral wool, to ASTM C449/C449M.

Part 3 Execution**3.1 INSTALLATION**

- .1 Apply insulation after all tests have been completed and approved by Departmental Representative.
- .2 Insulation and surfaces to be clean and dry during installation and during application of finishes.
- .3 Apply insulation, accessories, jackets and finishes in accordance with manufacturer's recommendations and as specified herein. Apply at least two finish coats.
- .4 Apply adhesive to entire surface (100%) of insulation installed on roof drain bodies to hold it in place.
- .5 Provide protection saddles and shields:
 - .1 Cut insulation under piping over at least the length of the saddle or shell and one third the circumference of the piping.
 - .2 Replace insulation with high-density insulation.
 - .3 Cover vapour barrier to maintain continuity for cold pipes.
 - .4 Install protective shield.
- .6 Vapour barrier to have no openings or breaks in sleeves, connectors or supports.

3.2 THERMAL INSULATION

- .1 Install thermal insulation in compliance with ANSI/NFPA 90A and 90B Standards.
- .2 Use shell insulation for piping up to NPS 12 and shell or sectional insulation for piping over NPS 12.
- .3 Multiple Thickness Insulation: Stagger joints of each insulation layer.
- .4 Vertical pipe over NPS 3: Install insulation supports welded or bolted to pipes directly above lowest fitting, thereafter, at 4.5 m intervals.
- .5 Expansion joints in insulation: Terminate each layer in straight cut at intervals recommended by manufacturer, leaving space of 25 mm (1 in.) between successive sections, and fill with Type P-2 flexible mineral fibre insulation without packing.
- .6 Seal and finish exposed ends and other terminations of all insulation with insulating cement.
- .7 Piping Expansion Joints: Provide for adequate expansion and contraction of piping without damage to insulation or jacket.
- .8 Orifice plate mounting flanges, flanges and unions on inlets and outlets, expansion joints, valves and other elements requiring periodic maintenance: install insulation and finishes to permit disassembly and reassembly without damage to adjacent insulation and finishes.
- .9 Connectors, cold application (5°C (41°F) to 15°C (59°F)): Insulate connectors with flexible, tight fitting insulation covered with reinforcing membrane and vapour barrier

coating. Alternatively, insulate connectors with flexible tight-fitting insulation covered with reinforcing membrane and vapour barrier coating then enclosed in PVC.

- .10 Do not insulate the following chrome-plated elements:
 - .1 Pipes, valves, and connectors.

3.3 FASTENINGS OF INSULATION

- .1 Fasten each section of insulation with tape at a maximum of 900 mm (36 in.) centres with at least one piece at each end and in its centre.

3.4 PIPING INSULATION SCHEDULE

- .1 Includes valves, valve bonnets, strainers, flanges, and fittings, unless otherwise specified.
- .2 Do not insulate exposed chrome plated runouts to chrome plated piping, valves, fittings.
- .3 Insulate piping systems and equipment as indicated in the following table:

SYSTEMS AND EQUIPMENT	FLUID TEMPERATURE °C (°F)	INSULATION TYPE
.1 Exposed storm drainage, thickness of insulation 25 mm (1 in.)	--	P-1

3.5 FINISHES

- .1 Exposed indoors: PVC jackets.
- .2 Fasteners: SS bands and screws, at 150 mm (6 in.) on centre. Seals: wing or closed.
- .3 Install: In accordance with TIAC recommendations.

3.6 REMOVABLE, PRE-FABRICATED INSULATION, AND ENCLOSURES

- .1 Destination Applications: Pumps, access doors, expansion joints, valves, flow measuring elements, mechanical joints, flanges, unions, and other accessories.
- .2 Design: To permit periodic removal and replacement without damage to adjacent insulation.
- .3 Insulation.
 - .1 Of type requested for piping concerned, shaped to suit form of components to be insulated.
 - .2 Thickness: Twice thickness requested for device or piping concerned.
 - .3 Vapour barrier added for water cooling installations and other cold surfaces.
- .4 Enclosures: In aluminum 1.3 mm (0.051 in.) thick or stainless steel 0.6 mm (0.24 in.) thick with exterior finish and quick-release belt.

3.7 SEALANTS

- .1 Complying with manufacturer's recommended temperatures, relative humidity, and substrate moisture content for application and curing of sealants including special conditions governing use.

END OF SECTION

Part 1 General**1.1 RELATED REQUIREMENTS**

- .1 Section 23 05 00 - Common Work Results for HVAC.

1.2 REFERENCE STANDARDS

- .1 American Society of Mechanical Engineers (ASME).
 - .1 ASME-B16.3-2006, Malleable-Iron Threaded Fittings: Classes 150 and 300.
 - .2 ASME-B16.9-2007, Factory-Made Wrought Steel Butt welding Fittings.
- .2 ASTM International (ASTM).
 - .1 ASTM A47/A47M-99 (2004), Standard Specification for Ferritic Malleable Iron Castings.
 - .2 ASTM A53/A53M-07, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc Coated, Welded and Seamless.
 - .3 ASTM B61-08, Standard Specification for Steam or Valve Bronze Castings.
 - .4 ASTM B75M-99 (2005), Standard Specification for Seamless Copper Tube Metric.
- .3 Canadian Environmental Protection Act (CEPA).
 - .1 CCME PN 1326-2008, Environmental Code of Practice for Aboveground and Underground Storage Tank Systems for Petroleum Products and Allied Petroleum Products.
- .4 CSA Group (CSA).
 - .1 CSA-B139-09, Installation Code for Oil Burning Equipment.
 - .2 CSA-B140.0-03, Oil Burning Equipment: General Requirements.
 - .3 CSA-C282-05, Emergency Electrical Power Supply for Buildings.
- .5 Green Seal Environmental Standards (GSES).
 - .1 Standard GS-11-2008, 2nd Edition, Paints and Coatings.
- .6 Health Canada/Workplace Hazardous Materials Information System (WHMIS).
 - .1 Safety Data Sheets (SDS).
- .7 Manufacturers Standardization Society of the Valve and Fitting Industry (MSS).
 - .1 MSS-SP-80-08, Bronze Gate, Globe, Angle and Check Valves.
- .8 National Association of Corrosion Engineers (NACE).
 - .1 NACE SP0169-2007, Control of External Corrosion on Underground or Submerged Metallic Piping Systems.
- .9 National Research Council Canada (NRC).
 - .1 National Fire Code of Canada 2015 (NFC).

- .10 South Coast Air Quality Management District (SCAQMD), California State, Regulation XI. Source Specific Standards.
 - .1 SCAQMD Rule 1113-A2007, Architectural Coatings.
- .11 Underwriter s Laboratories of Canada (ULC).
 - .1 CAN/ULC S603.1-03, External Corrosion Protection Systems for Steel Underground Tanks for Flammable and Combustible Liquids.
 - .2 ULC ORD-C107.12-1992, Line Leak Detection Devices for Flammable Liquid Piping.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Provide manufacturer s printed product literature, specifications and datasheets for piping, fittings, and equipment, and include product characteristics, performance criteria, physical size, finish, and limitations.
- .3 Indicate VOCs for adhesive and solvents during application and curing.
- .4 Test Reports:
 - .1 Submit certified test reports from approved independent testing laboratories indicating compliance with specifications for specified performance characteristics, and physical properties.
- .5 Certificates:
 - .1 Submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
- .6 Manufacturers Instructions: Provide manufacturer's installation instructions.

1.4 CLOSEOUT SUBMITTALS

- .1 Submit maintenance and engineering data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.5 QUALITY ASSURANCE

- .1 Ensure piping is installed by individual company authorized by Authority Having Jurisdiction.

1.6 DELIVERY, STORAGE, AND HANDLING

- .1 Deliver, store, and handle materials in accordance with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements:
 - .1 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

Part 2 Products**2.1 FILL VENT AND CARRIER PIPE**

- .1 Materials as per CSA-B139, CEPA SOR/2008-197, taken under CEPA and CNPIC.
- .2 Exterior Filling Piping: Steel, ASTM A53, wall anchored, electrically welded (ERW).
 - .1 Filling piping must be extended to a height of 1 m (3.3 ft.) From the ground and must be provided with a waterproof cap with lock eyelet.
- .3 Vent.
 - .1 Exterior piping.
 - .1 Steel, ASTM A53, wall anchored, electrically welded (ERW).
 - .2 Above ground piping.
 - .1 Steel pipe, to ASTM A53, Grade B, Schedule 40, manufactured by Electrical Welding (ERW).
 - .2 Steel Pipe Coating: Bituminous paint in accordance with manufacturers' recommendations.
 - .3 Vents ending with rain hoods.

2.2 JOINTS

- .1 Above Ground Piping.
 - .1 Pipes NPS 2 or less: Threaded connections with Teflon tape, taper thread, to ASTM A47M, grade 32510.
 - .2 Pipes with a diameter greater than or equal to NPS 2½: Weld neck fittings and flanges to CSA W47.1
 - .3 Flanges: With raised joint face, butt welded.
 - .4 Flange fittings: To ANSI / AWWA C111 / A21.11.
 - .5 Bolts and nuts: To ANSI B18.2.1 and ANSI / ASME B18.2.2.
 - .6 Teflon tape in accordance with CAN / ULC S642 or ULC C340 lead-based white lead sealant.

2.3 FITTINGS

- .1 Above ground piping.
 - .1 Malleable steel, threaded, flanged, Class 150, to ASME B16.3.
 - .2 Series 40 nipples, to ASTM A53 / A53M.
 - .3 Forged steel, screw-in, beading, Class 2000, to ANSI / ASME B16.11.
 - .4 Solderless: Butt welded, butt welded, Series 40, to ASTM A234 and ANSI / ASME B16.9.
 - .5 Forged Steel, Rectified, Threaded, Class 3000, to MSS SP-83.
 - .6 Malleable cast steel, bronze-iron, screw-down, Class 150, threaded unions to ASTM A47 / 47M.
 - .7 Steel flanges for flanged pipe and fittings: Class 150, to ANSI / ASME B16.5.

2.4 TANK WHISTLE ALARM

- .1 HDPE hyper sonore tank whistle with grey cast-iron body, for DN 1¼ and DN 2 openings, 85 dB sound level, and ULC approved.

2.5 STAINLESS STEEL FLEXIBLE FITTINGS

- .1 Flexible fittings to UL 536.
- .2 Internal pipe: Flexible and corrugated stainless steel pipe.
- .3 Exterior of the fitting made of stainless steel mesh.
- .4 Diameter and type of end elements: as indicated on plans.
- .5 Flexible connections shall be designed to withstand pressure and service temperature of 1034 kPa (150 lb/po²) and 93°C (200 °F). respectively.
- .6 The operating conditions must meet the requirements that apply to the network.
- .7 The fittings shall be capable of absorbing a lateral displacement of 13 mm (½ po), and the ratio of the length of the flexible portion to the diameter of the fitting shall not be less than six.
- .8 End caps: suitable for piping.

Part 3 Execution**3.1 APPLICATION**

- .1 Manufacturer's Instructions: Comply with manufacturer s written recommendations, including product technical bulletins, handling, storage and installation instructions, and data sheets.

3.2 PIPING

- .1 Install piping in accordance with Section 23 05 15, as well as specified in the present Section.
- .2 Install oil piping system in accordance with CSA-B139.
- .3 Slope piping down in direction of storage tank (at least 1%), unless otherwise indicated.
- .4 Above ground piping to be protected from physical impact due to impact.
- .5 Piping inside building:
 - .1 Use approved fittings, to CSA-B139, for steel piping.
- .6 Fill, vent, piping outside building:
 - .1 Steel piping welded throughout except at tanks where electrically isolating fittings are used.
 - .2 Grading: Slope piping at 1 % minimum back to tanks.
- .7 Install buried piping in double-wall piping outer casings to Authority Having Jurisdiction CSA-B139.

- .8 Piping at tanks:
 - .1 Comply with CSA-B139 and CNPI 2015 for piping for venting at tanks including venting whistle.
 - .2 Fill pipes: Install to comply with CSA-B139.
 - .1 Include liquid-tight cover.
 - .2 Label piping by clearly stipulate the following:
 - .1 Delivered product.

3.3 OVERFILL AND SPILL PROTECTION

- .1 To CSA-B139.

3.4 LEAK DETECTION

- .1 Install line leak detector to ULC ORD C107.12.
- .2 Install secondary containment systems that will allow leaks to accumulate in containment sump available for visual inspection.

3.5 FIELD QUALITY CONTROL

- .1 Site Tests/Inspection:
 - .1 Test system to CSA-B139 and Authorities Having Jurisdiction.

3.6 CLEANING

- .1 Clean in accordance with manufacturer's written recommendations, supplemented as follows:
 - .1 Flush after pressure test with No. 2 fuel oil for a minimum of two hours. Clean strainers and filters.
 - .2 Dispose of fuel oil used for flushing out in accordance with requirements of Authority Having Jurisdiction.
 - .3 Ensure vents from regulators, control valves are terminated in approved location and are protected against blockage and damage.
 - .4 Ensure entire installation is approved by Authority Having Jurisdiction.

END OF SECTION

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Part 1 General**1.1 RELATED REQUIREMENTS**

- .1 Section 23 05 00 - Common Work Results for HVAC.
- .2 Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment.
- .3 Section 23 05 48.16 - Seismic Restraint Systems.
- .4 Section 23 05 93 - Testing, Adjusting and Balancing for HVAC.
- .5 Section 23 07 13 - Duct Insulation.

1.2 REFERENCE STANDARDS

- .1 American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE)
- .2 ASTM International (ASTM).
 - .1 ASTM A480/A480M-12, Standard Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet and Strip.
 - .2 ASTM A635/A635M-09b, Standard Specification for Steel, Sheet and Strip, Heavy-Thickness Coils, Hot-Rolled, Alloy, Carbon, Structural, High-Strength Low-Alloy, and High-Strength Low-Alloy with Improved Formability, General Requirements for.
 - .3 ASTM A653/A653M-11, Standard Specification for Steel Sheet, Zinc Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-Dip Process.
- .3 Green Seal Environmental Standards (GS).
 - .1 GS-36-11, Standard for Adhesives for Commercial Use.
- .4 National Fire Protection Association (NFPA).
 - .1 NFPA 90A-12, Standard for the Installation of Air-Conditioning and Ventilating Systems.
 - .2 NFPA 90B-12, Standard for the Installation of Warm Air Heating and Air-Conditioning Systems.
 - .3 NFPA 96, Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations.
- .5 Sheet Metal and Air Conditioning Contractors National Association (SMACNA).
 - .1 SMACNA - HVAC Duct Construction Standards - Metal and Flexible, 2005.
 - .2 SMACNA - HVAC Air Duct Leakage Test Manual, 2012.
 - .3 IAQ Guideline for Occupied Buildings Under Construction 2007.

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

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

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer s instructions, printed product literature, and data sheets for metal ducts, and include product characteristics, performance criteria, physical size, finish, and limitations.
- .3 Test and Evaluation Reports:
 - .1 Certification of Ratings:
 - .1 Catalogue or published ratings to be those obtained from tests carried out by manufacturer or independent testing agency signifying adherence to Codes and Standards.

1.4 DELIVERY, STORAGE, AND HANDLING

- .1 Deliver, store, and handle materials in accordance with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: Deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials off ground, indoors, in dry location, and in accordance with manufacturer s recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect metal ducts from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.

Part 2 Products

2.1 SEAL CLASSIFICATION

- .1 Classification as follows:

Maximum Pressure	Seal Class
500 Pa	B (SMACNA)

- .2 Seal classification:
 - .1 Class B: longitudinal seams, transverse joints and connections made airtight with sealant, tape, or combination thereof.

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- .2 In accordance with SMACNA's HVAC Air Duct Leakage Test Manual.

2.2 SEALANT

.1 General:

- .1 Tapes and sealants must conform to CAN/ULC-S109 (tape), NFPA 90A and 90B Standards, and have a maximum flame spread of 25 and a smoke index of not more than 50.
- .2 All sealants must meet LEED criteria (IEQ 4.1) - Low Emitting Materials: Adhesives and Sealants.

.2 Transverse Joints:

- .1 Round ducts and rectangular ducts with sliding or "S" joints. Operating temperature: -40°C to +116°C.
 - .1 ULC labeled self-adhesive kraft/canvas/aluminum laminated tape.
- .2 "T" joints and flanged joints.
 - .1 Tape.

.3 Longitudinal Seams:

- .1 Round.
 - .1 ULC labeled self-adhesive kraft/canvas/aluminum laminated tape.
- .2 Rectangular.
 - .1 Tube sealant.

.4 Miscellaneous:

- .1 Operating temperature above -7°C (19.4°F).
 - .1 Sealant: Water-based, ULC-certified watertight sealant with a flame spread of not more than 25 and a smoke index of not more than 50, which can be used in an operating temperature range from -28°C (-20°F) to +82°C (190°F).

2.3 TAPE

- .1 Tape: Polyvinyl treated, open weave fiberglass tape, 50 mm wide.

2.4 FITTINGS

- .1 Fabrication: To SMACNA.

.2 Radiused Elbows:

- .1 Rectangular: Centreline radius equal the width of the duct.
- .2 Round: Centreline radius 1.5 times the manufacturer's standard duct diameter.

.3 Mitred elbows: rectangular:

- .1 To 400 mm: With single thickness turning vanes.

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- .2 Over 400 mm: With double thickness turning vanes.
- .4 Branches:
 - .1 Rectangular main and branch:
 - .1 90° entry branch: With balancing damper in the branch as close as possible to the main duct.
 - .2 45° entry branch: With a radius of curvature equal to the width of the duct and with a balancing damper in the branch as close as possible to the main duct.
 - .2 Round main and branch: Enter main duct with conical connection.
- .5 Transitions:
 - .1 Diverging: 20° maximum included angle.
 - .2 Converging: 30° maximum included angle.
- .6 Offsets: Mitred elbows or radiused elbows, as indicated.
- .7 Obstruction Deflectors: Maintain full cross-sectional area. Maximum included angles: As for transitions.

2.5 FIRE STOPPING

- .1 Retaining angles around duct, on both sides of fire separation.
- .2 Firestopping material and installation must not distort duct.

2.6 GALVANIZED STEEL

- .1 Galvanized steel ducts with G90 zinc coating, flexible, lock forming quality, to ASTM A653/A653M.
- .2 Design Criteria: Pressure of 500 Pa.
- .3 Thickness, fabrication, and reinforcement: To ASHRAE and SMACNA.
- .4 Joints:
 - .1 To ASHRAE and SMACNA, for the following uses:
 - .1 Greatest dimension is equal to or under 1,200 mm or diameter is 900 mm.
 - .2 Proprietary prefabricated flanged joints for air ducts, for the following uses:
 - .1 Greatest dimension is greater than 1,200 mm or diameter is 900 mm.

2.7 HANGERS AND SUPPORTS

- .1 Hanger Straps: Of same material as duct, but next sheet metal thickness heavier than duct. Maximum size duct supported by strap hanger: 500 mm.
- .2 Hanger Configuration: To ASHRAE and SMACNA.

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- .3 Angles and Hanger Rods: Galvanized steel angles retained by galvanized steel rods to ASHRAE and SMACNA, and the indications in the following table:

Duct Size (mm)	Angle Size (mm)	Rod Size (mm)
Up to 750	25 x 25 x 3	6
751 to 1,050	40 x 40 x 3	6
1,051 to 1,500	40 x 40 x 3	10
1,501 to 2,100	50 x 50 x 3	10
2,101 to 2,400	50 x 50 x 5	10
2,401 and higher	50 x 50 x 6	10

- .4 "Ramset" impact anchors and simply laid anchors (drop-in anchors) are prohibited.
- .5 Upper Hanger Attachments:
- .1 Concrete:
- .1 Zinc-plated steel anchor bolts with a hexagon head and internal threaded washer.
- .2 Galvanized steel expansion anchor (¼ in. diameter to 1 in. diameter):
- .2 Steel joist: Prefabricated steel joist clamp or steel plate.
- .3 Steel beam: Prefabricated beam clamps.

Part 3 Execution

3.1 GENERAL

- .1 Do work in accordance with ASHRAE and SMACNA, as well as ANSI/NFPA 90A and ANSI/NFPA 90B Standards.
- .2 Do not break continuity of insulation vapor barrier with hangers or rods. Insulate strap hangers 100 mm beyond insulated duct.
- .3 Support risers in accordance with ASHRAE and SMACNA, and as indicated.
- .4 Install breakaway joints in ductwork on sides of fire separation.
- .5 Install proprietary manufactured flanged duct joints in accordance with manufacturer's instructions.
- .6 Manufacture duct in lengths to accommodate installation of acoustic duct lining.

3.2 HANGERS

- .1 Strap hangers: Install in accordance with SMACNA.
- .2 Angle hangers: Complete with locking nuts and washers.

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- .3 Hanger spacing:

Duct Size (mm)	Spacing (mm)
To 1,500	3,000
1,501 and over	2,500

3.3 WATERTIGHT DUCT

- .1 Provide watertight ducts for:
- .1 Fresh air intake and exhaust.
 - .2 Minimum 1,000 mm from duct mounted humidifier in all directions.
 - .3 As indicated.
- .2 Form bottom of horizontal duct without longitudinal seams. Solder or weld transverse joints of bottom and side sheets. Seal other joints with duct sealer.
- .3 Slope horizontal branch ductwork down towards fume hoods served or their drainage point.
- .4 Fit base of main riser with 150 mm deep drip tray. Solder or weld all joints.
- .5 At the following locations, install a NPS 1¼ drain connected to a deep seal P trap; the water seal must be at least 1.5 times the static pressure measured at this location, but not less than 300 mm.
- .1 At the bottom of fresh air intake and exhaust.
 - .2 At the bottom of riser drip trays.
 - .3 At the low point of horizontal watertight ducts.
 - .4 As indicated.

3.4 SEALING

- .1 Apply sealant to outside of joint to manufacturer's recommendations.
- .2 Bed tape in sealant and recoat with minimum of one coat of sealant to manufacturer's recommendations.
- .3 Seal all openings in air ducts, such as instrumentation openings, damper linkage, coils, etc., using neoprene or silicone sealant, while allowing the normal movement of the equipment installed in the ducts.

END OF SECTION

Part 1 General**1.1 RELATED REQUIREMENTS**

- .1 Section 23 05 00 - Common Work Results for HVAC.

1.2 REFERENCE STANDARDS

- .1 Sheet Metal and Air Conditioning Contractors National Association (SMACNA).
 - .1 SMACNA - HVAC Duct Construction Standards - Metal and Flexible, 2005.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, as well as manufacturer's printed product literature, and data sheets for the following:
 - .1 Duct access doors;
 - .2 Instrument test ports.

1.4 DELIVERY, STORAGE, AND HANDLING

- .1 Deliver, storage, and handle materials in accordance with Section with manufacturer s written instructions.
- .2 Storage and Handling Requirements:
 - .1 Store materials indoors, off ground, in dry location and in accordance with manufacturer s recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect air duct accessories from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.

Part 2 Products**2.1 GENERAL**

- .1 Manufacture in accordance with the following Standards:
 - .1 CSA B228.1.
 - .2 SMACNA - HVAC Duct Construction Standards.

2.2 DUCT ACCESS DOORS

- .1 Non-Insulated Ducts: Sandwich construction of same material as duct, one sheet metal thickness heavier, minimum 0.6 mm (0.02 in.) thick complete with sheet metal angle frame.

- .2 Insulated Ducts: Sandwich construction of same material as duct, one sheet metal thickness heavier, minimum 0.6 mm (0.02 in.) thick complete with sheet metal angle frame and 25 mm (1 in.) thick rigid glass fibre insulation.
- .3 Gaskets: Neoprene, 20 mm x 10 mm (0.79 in. x 0.39 in.).
- .4 Hardware.
 - .1 Doors, up to 1,000 mm (39 in.): One continuous piano type hinge and at least two locks, Duro Dyne SL-1.
 - .2 Doors, over 1,000 mm (39 in.): One continuous piano type hinge and three handles operable from both inside and outside.
 - .3 Door holder: Device to keep doors in open position.
- .5 For high velocity ducts: Access door must open to the inside.

2.3 INSTRUMENT TEST

- .1 1.6 mm (0.06 in.) thick steel, zinc plated after manufacture.
- .2 Cam lock handles with neoprene expansion plug and handle chain.
- .3 28 mm (1.1 in.) minimum inside diameter. Length suitable to insulation thickness.
- .4 Neoprene mounting gasket.
- .5 Acceptable Products: Duro Dyne IP1 or IP2.

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 data sheets.

3.2 INSTALLATION

- .1 Access Door Duct:
 - .1 Size:
 - .1 450 mm x 1,000 mm (18 in. x 39 in.) for person size entry.
 - .2 300 mm x 300 mm (12 in. x 12 in.) for handhole.
 - .3 300 mm x 450 mm (12 in. x 18 in.) for viewing.
 - .4 As indicated.
 - .2 Locations:
 - .1 Balancing dampers.
 - .2 Devices requiring maintenance.
 - .3 Required by Code.

- .4 Reheat coils, one on each side.
 - .5 Elsewhere as indicated.
- .2 Instrument test ports:
 - .1 General.
 - .1 Install in accordance with recommendations of SMACNA and in accordance with manufacturer's instructions.
 - .2 Locate to permit easy manipulation of instruments.
 - .3 Install insulation port extensions as required.
 - .4 Locations.
 - .1 For traverse readings:
 - .1 Inlets and outlets of other fan systems.
 - .2 Main and sub-main ducts.
 - .3 As indicated.
 - .2 For temperature readings:
 - .1 At outside air intakes.
 - .2 At inlet and outlet of coils.
 - .3 Downstream of junctions of two converging air streams of different temperatures.
 - .4 As indicated.

END OF SECTION

Part 1 General**1.1 RELATED REQUIREMENTS**

- .1 Section 23 05 00 - Common Work Results for HVAC.

1.2 REFERENCE STANDARDS

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

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature, and data sheets for dampers, and include product characteristics, performance criteria, physical size, finish, and limitations.

1.4 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Operation and Maintenance Data: Submit operation and maintenance data for dampers for incorporation into manual.

1.5 DELIVERY, STORAGE, AND HANDLING

- .1 Deliver, store, and handle materials in accordance with Section with manufacturer s written instructions.
- .2 Delivery and Acceptance Requirements: Deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials indoors, in dry location, off ground, and in accordance with manufacturer s recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect dampers from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.

Part 2 Products**2.1 MULTI-BLADE DAMPERS**

- .1 Opposed blade type, except where dampers are located at the mixing boxes of air handling units, in which case they must be parallel blade type or as indicated on the drawings.
- .2 Flanged connection type only if one dimension is less than or equal to 500 mm (20 in.) or if the mechanism is not accessible for maintenance purposes (disassembly and replacement of linkages).
- .3 Dampers without insulation for return air and with insulation for new and exhaust air.
- .4 Materials:
 - .1 Insulated damper (fresh air and exhaust):
 - .1 Chassis and blades must be made from aluminum extrusion 2.05 mm (0.08 in.) thick. "Air-Foil" type blades, with a width of 125 mm (5 in.) to 155 mm (6 in.) and must be aluminum extruded with insulated cavities with 22 mm thick polyurethane foam with thermal barrier. The extruded aluminum frames must be 100 mm (4 in.) deep with three (3) insulated sides with polystyrene foam with a factor RSI-088 (R-5.0). Bearings must be a dual bearing system composed of a Celcon inner bearing inserted into the chassis so there is no rotation. The linkage hardware must be installed in the frame side, out of the airstream.
- .5 Dimensions:
 - .1 Blades: Width of at least 125 mm (5 in.) to at most 155 mm (6 in.) and length of at most 1,200 mm (47 in.).
 - .2 Maximum module dimensions: Width of 1,200 mm (47 in.) by a height of 2,400 mm (94 in.).
 - .3 Multiple blade dampers must be fitted with stiffeners and transverse coupling rods.
 - .4 The dampers must be of sufficient size so it does not restrict the useful area of the duct. The installation of such inserted registers is not acceptable if one dimension is less than or equal to 500 mm (20 in.) or if the mechanism is not accessible for maintenance.
- .6 Performance:
 - .1 Maximum allowable leak: 50 L/s.m² (9.85 pcm/in²) for a static pressure of 1.0 kPa (4 in water).
 - .2 Temperature range for insulated registers: from -40°C to 68°C (-40°F to 154°F).
 - .3 Temperature range for uninsulated registers: from -40°C to 100°C (-40°F to 212°F).
 - .4 Maximum speed: 5 m/s (16.4 in/s) at the face.

Part 3 Execution**3.1 MANUFACTURER'S INSTRUCTIONS**

- .1 Comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and data sheet.

3.2 INSTALLATION

- .1 Install insulated dampers on fresh air intakes and exhaust.
- .2 Install where indicated.
- .3 Install in accordance with recommendations of SMACNA and the manufacturer's instructions.
- .4 Install so the blades are horizontal.
- .5 Install on tilted or vertical conduits so the blades are horizontal.
- .6 Seal the joints of multiple dampers modules using a non-transparent sealant silicone, that is recognized by UL, and in accordance with NFPA 90A.
- .7 At the start-up of the system, ensure that dampers registers are working properly.
- .8 Install an access door near each damper.

END OF SECTION

Part 1 General**1.1 RELATED REQUIREMENTS**

- .1 Section 23 05 00 - Common Work Results for HVAC.

1.2 REFERENCE STANDARDS

- .1 ASTM International (ASTM).
 - .1 ASTM E90-09, Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.
- .2 National Research Council Canada (NRC).
 - .1 National Building Code of Canada 2015 (NBC).
- .3 Sheet Metal and Air Conditioning Contractors National Association (SMACNA).
- .4 Society of Automotive Engineers (SAE).

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature, and data sheets for louvers, intakes, and vents, and include product characteristics, performance criteria, physical size, finish, and limitations.
 - .2 Indicate following:
 - .1 Pressure drop;
 - .2 Face area;
 - .3 Free area.
- .3 Certificates: Submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
- .4 Test Reports: Submit certified data from independent laboratory substantiating acoustic and aerodynamic performance to ASTM E90.

1.4 DELIVERY, STORAGE, AND HANDLING

- .1 Deliver, store, and handle materials in accordance with Section with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: Deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

- .3 Storage and Handling Requirements:
 - .1 Store materials indoors, in dry location, off ground, and in accordance with manufacturer,s recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect the equipment from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.

Part 2 Products

2.1 FIXED LOUVERS

- .1 Construction: Fully welded, exposed joints ground until flush then polished.
- .2 Material: Blades and frames must be made of extruded aluminum alloy 6063-T6, 2.05 mm (0.081 in.) thick.
- .3 Blades: Weatherproof, 45° angled, with drip at the bottom of the blade and stiffening boss, with the blade no longer than 1,500 mm (5 ft) in length.
- .4 Frame, Head, Bearing, and Jamb: Extruded aluminum profiles, one-piece U-shaped or L-shaped, at least 3 mm (0.118 in.) thick, with groove for approved sealant, incorporated to element.
- .5 Mullions: Not more than 1,500 mm (5 ft) apart.
- .6 Fasteners: Stainless steel, in accordance with SAE-194-8F (Society of Automotive Engineers) with SAE-194-SFB approved nuts and soft neoprene washers between the aluminum surface and the bolt head or between the nut, the stainless-steel washer and the aluminum body.
- .7 Bird Screen: Aluminum mesh made of 1.6 mm (0.063 in.) diameter wire or stainless-steel wire of the same diameter, with 12 mm (0.5 in.) mesh, placed on a U-bend or L-shaped frame and installed on the internal face of the louvers.
- .8 Finish: Factory applied KYNAR ®500 (70%) inert resin fluorocarbon baked enamel. Color approved by the Departmental Representative.
 - .1 Thickness: 100 mm (4 in.).

2.2 SCREENS

- .1 Aluminum screens, removable for cleaning, to be installed on the internal face of louvers.

Part 3 Execution**3.1 INSTALLATION**

- .1 In accordance with manufacturer's and SMACNA recommendations.
- .2 Reinforce and brace to confer resistance to wind load for air vents, intakes, and
gooseneck hoods. Refer to the NBC for wind speeds in a particular area.
- .3 Anchor securely into opening. Seal with caulking around to ensure weather tightness.

END OF SECTION

Part 1 General**1.1 RELATED REQUIREMENTS**

- .1 Section 23 05 00 - Common Work Results for HVAC.

1.2 REFERENCE STANDARDS

- .1 American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE).
 - .1 ASHRAE, Equipment Handbook for Chimney, Gas Vent, and Fireplace Systems, Material Requirements and Design Criteria.
- .2 American Society for Testing and Materials International (ASTM).
 - .1 ASTM A307, Carbon Steel Bolts and Studs Ranging from 1/4" through 4" diameter.
- .3 American Welding Society (AWS).
 - .1 AWS, Structural Welding Code for Welder's Qualifications, Welding Details, and Workmanship Standards.
- .4 Association canadienne de normalisation (CSA)/CSA International.
 - .1 CAN/CSA-B72, Code d'installation des paratonnerres.
 - .2 CAN/CSA-G40.21, Structural Quality Steel.
 - .3 CAN/CSA-S16-01, Limit States Design of Steel Structures.
 - .4 CAN/CSA-W59, Welded Steel Construction.
 - .5 CSA B139, Installation Code for Oil-Burning Equipment.
- .5 National Fire Protection Association (NFPA).
 - .1 NFPA 37, Installation and Use of Stationary Combustion Engines and Gas Turbines.
- .6 Sheet Metal and Air-Conditioning Contractors National Association (SMACNA).
 - .1 SMACNA, Low Pressure Duct Standards for Fabricated Breeching and Smoke Pipe.
- .7 Underwriters Laboratories (UL).
- .8 Underwriters Laboratories of Canada (ULC).

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature, and data sheets for chimneys and stacks, and include product characteristics, performance criteria, physical size, finish, and limitations.

.3 Shop Drawings:

.1 Indicate following:

- .1 Methods of sealing sections.
- .2 Methods of expansion.
- .3 Details of thimbles.
- .4 Bases/Foundations.
- .5 Supports.
- .6 Guy details.
- .7 Rain caps.
- .8 Manufacturing and insulation materials.
- .9 Complete fabrication plans for the installation of all the elements that composed the gas exhaust systems, including the supports drawn to scale.

- .4 Certificates: Submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

1.4 QUALITY ASSURANCE

- .1 Regulatory Requirements: Work to be performed in compliance with applicable Provincial/Territorial regulations.
- .2 All components of the systems must be provided by a single manufacturer.
- .3 Chimneys and stacks must be ULC approved.

1.5 DELIVERY, STORAGE, AND HANDLING

- .1 Deliver, store, and handle materials in accordance with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: Deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials off ground, in dry location, indoors, and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect chimneys and stacks from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.

Part 2 Products

2.1 STEEL CHIMNEY AND BREECHINGS CONNECTED TO A GENERATOR (50 MM TO 125 MM DIAMETER)

- .1 Stainless steel pipe grade 316, schedule 10S.

2.2 ACCESSORIES

- .1 Hangers and supports in accordance with recommendations SMACNA.
- .2 Rain hood.
- .3 Expansion sleeve: Caulked with a heat resistant product and held in place as indicated.

2.3 PARASISMIC SYSTEM

- .1 The flue gas exhaust system must be earthquake resistant.

Part 3 Execution**3.1 EXAMINATION**

- .1 Verification of Conditions: Verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for chimney and stack installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate in presence of Departmental Representative.
 - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
 - .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 INSTALLATION - GENERAL

- .1 Follow manufacturer's and SMACNA installation recommendations for shop fabricated components.
- .2 Support chimneys at bottom, roof and intermediate levels as indicated.
- .3 Install thimbles where penetrating roof, floor, ceiling and where breeching enters masonry chimney. Pack annular space with heat resistant caulking.
- .4 Install flashings on chimneys penetrating roofs, as indicated.
- .5 Install rain caps and cleanouts, as indicated.

END OF SECTION

Part 1 General**1.1 RELATED REQUIREMENTS**

- .1 Section 23 05 00 - Common Work Results of HVAC.
- .2 Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment.
- .3 Section 23 05 48.16 - Seismic Restraint Systems (SRS).

1.2 REFERENCE STANDARDS

- .1 American National Standards Institute/Air-Conditioning, Heating and Refrigeration Institute (ANSI/AHRI).
 - .1 ANSI/AHRI 430-10, Performance Rating of Central Station Air-Handling Units.
- .2 American National Standards Institute/American Society of Heating, Refrigeration and Air Condition Engineers/Illuminating Engineering Society (ANSI/ASHRAE/IES).
 - .1 ANSI/ASHRAE 52.2-2012, Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size.
 - .2 ANSI/ASHRAE/IES 90.1-2010, Energy Standard for Buildings Except Low-Rise Residential Buildings.
- .3 Green Seal (GS).
 - .1 GS-11-11, Standard for Paints and Coatings.
 - .2 GS-36-11, Standard for Adhesives for Commercial Use.
- .4 Master Painters Institute (MPI).
 - .1 Architectural Painting Specification Manual - current edition.
 - .1 MPI #18.
- .5 South Coast Air Quality Management District (SCAQMD).
 - .1 SCAQMD Rule 1113-11, Architectural Coatings.
 - .2 SCAQMD Rule 1168-05, Adhesives and Sealants.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature, and data sheets for insulation, filters, adhesives, and paints, and include product characteristics, performance criteria, physical size, finish, and limitations.

- .3 Shop Drawings:
 - .1 Indicate on drawings: Coil, bearings, dampers, fan curves showing point of operation, filters, VAV, motor drive, mixing box, fan; include performance data.

1.4 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Operation and Maintenance Data: Submit operation and maintenance (O&M) data for air handling equipment for incorporation into manual.

1.5 MAINTENANCE MATERIAL SUBMITTALS

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Provide one spare set of filters.
- .3 Provide list of individual manufacturer's recommended spare parts for equipment such as bearings and seals, and addresses of suppliers, together with list of specialized tools necessary for adjusting, repairing or replacing, for placement into operating manual.

1.6 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: Deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials off ground, in dry location, indoors, and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect air handling equipment from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.

Part 2 Products

2.1 GENERAL

- .1 Equipment to CSA C22.2 No. 236.
- .2 Factory assembled components to form unit supplying air at designed conditions, as indicated.
- .3 Certify Ratings: To ANSI/AHRI 430 with AHRI seal.
- .4 Vertical type, wall mounted, as indicated, having air tight modular components, consisting of casing, fan section with motor and drive, mixing box, economiser, cooling coil, electric heating coil, and dampers.

2.2 CASINGS

- .1 Galvanized steel gage 16 reinforced and braced for rigidity.
 - .1 Removable panels: provide access for maintenance of internal parts.
 - .2 Paint steel parts, where not galvanized, with corrosion resistant paint to MPI #18.
 - .3 Finish unit, inside and out, with rust-resistant enamel.

2.3 DRAIN PANS

- .1 Construction: Stainless steel, rounded corners.
- .2 Insulation: External foam type, minimum 13 mm thick.
- .3 Drain Connection: In bottom at low point.
- .4 Installation: Slope without sag minimum 1% to ensure no standing water at any time or at any point.

2.4 FANS

- .1 AMCA-rated for sound and performance centrifugal fans with, direct drive motor ODP, selected to operate in stable part of performance curve at times and 200,000 hours heavy-duty service self aligning bearings.
 - .1 Provide internally mounted motor.
- .2 Internally mounted motor and fan.

2.5 VARIABLE VOLUME DEVICES

- .1 Adjustable inlet vanes operated from centre mechanism linked to each damper vane or cantilevered vane mechanism.
 - .1 Support vanes in self lubricated bronze bearings.
 - .2 On DWDI fans interconnect vanes to operate simultaneously.
 - .3 Provide locking devices for manual operation.

2.6 FILTER BOX

- .1 Material to match casing. For flat type filter arrangement.
 - .1 Provide access to filter through removable panels with suitable hardware.
- .2 Provide blank-off plates and gaskets to prevent air bypass.
- .3 Thickness of 50 mm, MERV 7 efficiency.

2.7 MIXING BOX

- .1 Material to match casing and produce uniformly mixed air temperature within $\pm 5^{\circ}\text{C}$ of design across face of outlet.

2.8 CHILLED SECTION

- .1 Capacity: As indicated.
- .2 Ratings: AHRI certified.
- .3 Construction:
 - .1 Casings: 1.5 mm thick galvanized sheet steel gage 16.
 - .1 Supports of galvanized steel double angle frames.
 - .2 Blank-off plates. Insulated sandwich construction.
 - .2 Direct expansion refrigerant coils:
 - .1 Serpentine type, arranged to prevent trapping of oil.
 - .1 Liquid distributors to ensure even distribution of liquid refrigerant to all circuits.
 - .2 Silver solder or braze joints in refrigerant tubing.
 - .3 Evacuate and charge coil with nitrogen and seal before sending to site.
 - .2 Tubes: Copper.
 - .3 Fins: Spiral wound aluminum.
 - .4 Headers: Copper.
 - .5 Pressure tests: To Canadian Refrigeration Code. Dehydrated. Sealed with nitrogen charge.
 - .6 Direct expansion coil with copper tubes and aluminum fins.
 - .7 Scroll type compressors, mounted on anti-vibration isolators with service valves. Crankcase heater and overload protection included.
 - .8 High and low-pressure protection, compressor anti-cycling timer.

2.9 ELECTRIC COIL

- .1 Construction to CSA Standards with certification label.
- .2 6-kW electric coil with thermal protection and fuses.
- .3 Steps:
 - .1 Heaters at various power stages operating and balanced current demand on all phases for each step.
 - .2 On each step, the heating element must provide its full rated power.

2.10 ECONOMIZER

- .1 Single enthalpy energy saver with damper and actuator modulating from 0% to 100% of fresh air and barometric air exhaust damper.

2.11 ELECTRIC CONNECTION

- .1 Electrical panel with main switch without fuses, starters, relays, transformers, and safety elements included. All internal connections are prefilled at the factory. A single point of connection by the Division 26 is required.
- .2 Control:
 - .1 Wall control panel with digital display for operation of two heating and cooling systems in Master-Slave mode.
 - .2 The controller has the following characteristics:
 - .1 24 VAC power supply;
 - .2 Two cooling stages and two heating stages;
 - .3 Adjustable setpoint and differential points;
 - .4 Indicator lights for power supply, operating status, and alarms;
 - .5 Auxiliary contacts for high temperature alarms, low temperature, refrigeration anomaly, power failure, fire or smoke detection;
 - .6 Entry for fire or smoke detector;
 - .7 Contacts for high temperature, low temperature, high- or low-pressure alarms.
 - .8 Contacts for the control of external heaters.

Part 3 Execution**3.1 EXAMINATION**

- .1 Verification of Conditions: Verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for air handling equipment installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate in presence of Departmental Representative.
 - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
 - .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 INSTALLATION

- .1 Provide appropriate protection apparatus.
- .2 Install units in accordance with manufacturer's instructions and as indicated.
- .3 Ensure adequate clearance for servicing and maintenance.

3.3 FANS

- .1 Install fan sheaves required for final air balance.
- .2 Install flexible connections at fan inlet and fan outlets.
- .3 Install vibration isolators.

3.4 CLEANING

- .1 Progress Cleaning: Clean in accordance with Section 01 74 00 - Cleaning.
 - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: Upon completion remove surplus materials, rubbish, tools, and equipment in accordance with Section 01 74 00 - Cleaning.

END OF SECTION

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Part 1 General**1.1 RELATED REQUIREMENTS**

- .1 Section 26 05 00 - Common Work Results for Electrical.

1.2 REFERENCE STANDARDS

- .1 CSA Group (CSA).
 - .1 CAN/CSA-C22.2 No.130-03(R2013), Requirements for Electrical Resistance Heating Cables and Heating Device Sets.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature, and data sheets for radiant heating electrical cables, and include product characteristics, performance criteria, physical size, finish, and limitations.
- .3 Certificates: Submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

1.4 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Operation and Maintenance Data: Submit operation and maintenance data for radiant heating electrical cables for incorporation into manual.
- .3 Record on drawings, layout of snow melting cables.

1.5 DELIVERY, STORAGE, AND HANDLING

- .1 Deliver, store, and handle materials in accordance with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: Deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials in dry location indoors and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect radiant heating electrical cables from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.

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Part 2 Products**2.1 GENERAL**

- .1 Heating Cables: to CAN/CSA-C22.2 No.130.

2.2 SNOW MELTING CABLES

- .1 Copper alloy conductor with X-linked/PVC nylon insulation, copper ground braid, fluoropolymer protective jacket factory spliced and sealed cold leads, and as indicated.
- .2 Self-limiting type cable.

2.3 ACCESSORIES

- .1 Polyester fixing tape.
- .2 Splices and cables termination kits.
- .3 Caution label.

2.4 CONTROLS

- .1 Thermostat: Electronic, line voltage, rating as indicated.
- .2 Remote RTD probe.

2.5 MANUFACTURERS

- .1 Heating Cable: Thermon BSX-10-2-FOJ or equivalent.
- .2 Temperature Sensor: Thermon RTD-500 avec 5 m of cable or equivalent;
- .3 Control: Thermon ECM-C-13-P-XP-DP-A or equivalent.
- .4 Power and End Termination Kits: PETK-1D or equivalent.
- .5 Splice Kit: SCTK-1D or equivalent.
- .6 Polyester Fiber Tape: FT-1L or equivalent.
- .7 Caution Label: CL-bilingual or equivalent.

Part 3 Execution**3.1 EXAMINATION**

- .1 Verification of Conditions: Verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for radiant heating electrical cables installation, in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate in presence of Departmental Representative.
 - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.

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- .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 INSTALLATION

- .1 Install cables in accordance with manufacturer's instructions.
- .2 Do not alter heating cable length.
- .3 Ensure cables do not bunch or cross.
- .4 Make power and control connections.

3.3 FIELD QUALITY CONTROL

- .1 Tests:
 - .1 Perform tests in accordance with Section 26 05 00 - Common Work Results for Electrical.
 - .2 Use 500 V Megger to test cables for continuity and insulation value and record readings as follows:
 - .1 On cable reel.
 - .2 After installation.
 - .3 24 hours after installation.
 - .3 Where resistance of 50 megohms or less is measured, stop work and advise Departmental Representative.
 - .4 The Contractor must retain the services of a technician certified by the manufacturer of the heating cable system. The certified technician must inspect the complete installation prior to installation of the insulation on the pipe, as well as before and after energizing.
 - .5 The certified technician must submit a detailed system verification report and certified that the installation has been performed according to the manufacturer's recommendations.

3.4 CLEANING

- .1 Progress Cleaning: Clean in accordance with Section 01 74 00 - Cleaning.
 - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: Upon completion remove surplus materials, rubbish, tools, and equipment, in accordance with Section 01 74 00 - Cleaning.

END OF SECTION

DIVISION 25

Integrated Automation

Part 1 General**1.1 RELATED SECTIONS**

- .1 Section 25 90 01 - EMCS: Site Requirement, Applications and Systems Sequences of Operation.

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 Departmental Representatives (IEEE).
 - .1 ANSI/IEEE 260.1-1993, 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 Departmental Representatives (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-FM89(C1995), 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), 1997, c. 37.
 - .2 Canadian Environmental Protection Act (CEPA), 1999, c. 33.
- .7 Health Canada - Workplace Hazardous Materials Information System (WHMIS).
 - .1 Data Sheet (DS).
- .8 Transport Canada (TC).
 - .1 Transportation of Dangerous Good Act, c. 34.

1.3 CONTRACTOR

- .1 The controls installer must have a minimum experience of 5 years in automatic controls.

- .2 Only the following contractors can submit a quote:
 - .1 Original equipment manufacturers or authorized distributors carrying the complete line of equipment required to do the job;
 - .2 Who have as main activity the installation and commissioning of digital control systems;
 - .3 Who have qualified technicians able to answer to a service call 24 hours a day, 365 days a year.

1.4 SYSTEM DESCRIPTION

- .1 Design Requirements:
 - .1 Design and provide conduit and wiring linking elements of system.
 - .2 Supply enough programmable controllers of types to meet project requirements. Quantity and points contents as reviewed by Departmental Representative prior to installation.
 - .3 Location of controllers must be reviewed by Departmental Representative prior to installation.

1.5 COMMISSIONING

- .1 Confirm with the Departmental Representative that Design Criteria and Design Intents are still applicable.
- .2 Do commissioning under the Departmental Representative's supervision.
 - .1 Inform the Departmental Representative in writing, at least 5 days before the start of commissioning or before each test, to get his approval.
- .3 Test each system independently and then in unison with other related systems.
- .4 Correct deficiencies, re-test in until satisfactory performance is obtained.
- .5 Acceptance of tests will not relieve Contractor from responsibility of ensuring that complete systems are compliant with requirements of Contract.
- .6 Commissioning personnel to be fully aware of and qualified to interpret Design Criteria and Design Intents.
- .7 Demonstrate to the Departmental Representative the operation of the systems, including control sequences in normal and emergency mode, and in normal and emergency modes, the start/stop, interlocks, and safeties resulting in system stops.
- .8 Provide a written commissioning report stating that each system operates as per Design Criteria.

1.6 SUBMITTALS

- .1 Submit for review:
 - .1 The technical data sheets of all equipment used.
 - .2 Controls schematics, material lists, sequences of operation, and points lists.
- .2 Quality Control:
 - .1 Provide equipment and material from manufacturer's regular production, CSA certified, manufactured to standard quoted plus additional specified requirements.
 - .2 Where CSA certified equipment is not available, submit such equipment to inspection authorities for special inspection and approval before delivery to site.
 - .3 Submit proof of compliance to specified Standards with shop drawings and product data. Listing of specified organization is acceptable evidence.
 - .4 In lieu of such evidence, submit certificate from testing organization, approved by the Departmental Representative, certifying that item was tested in accordance with their test methods and that item complies with their Standard/Code.
 - .5 For material whose compliance with organizational Standards/Codes/ Specifications is not regulated by organization using its own listing or label as proof of compliance, provide a certificate stating that material complies with applicable referenced Standard or Specification.
 - .6 Permits and fees: In accordance with general conditions of Contract.
 - .7 Submit an acceptance certificate provided by the competent authority to the Departmental Representative.
 - .8 Existing devices intended for re-use: Submit test report.

1.7 TRAINING

- .1 Provide the required training for a complete comprehension of the system. Required training for this Contract is 4 hours, divided into two sessions spaced at least a week apart.
- .2 Provide the required material for the training.
- .3 Coordinate the training with the Departmental Representative for required dates and personnel to train.
- .4 Submit training content for approval by the Departmental Representative.

1.8 QUALITY ASSURANCE

- .1 Have local office within 100 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 showing experience with similar installations.

- .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.

1.9 IDENTIFICATIONS

- .1 Nameplates for panels:
 - .1 Identify by plastic laminate, 3-mm thick, melamine matt white finish, black core, square corners, lettering accurately aligned and engraved into core.
 - .2 Dimensions: 25 x 67 mm minimum.
 - .3 Lettering: Minimum 7-mm high, black.
 - .4 Inscriptions: Machine engraved to identify function.
- .2 Nameplates for field devices:
 - .1 Identify by plastic encased cards attached by chain or plastic tie.
 - .2 Dimensions: 50 x 100 mm minimum.
 - .3 Lettering: Minimum 5-mm high, black color, engraved and indelible.
 - .4 Companion cabinet: Identify interior components using plastic enclosed cards with point name and point address.
 - .5 The identifications used must be the same as those appearing in the control diagrams.
- .3 Wiring Identification:
 - .1 Supply and install numbered tape markings on wiring at panels, junction boxes, splitters, cabinets, and outlet boxes.
 - .2 Colour coding: To CSA C22.1. Use colour coded wiring in communication cables, matching throughout system.
 - .3 Cables without conduit must be orange color or bear a marking of this colour.
 - .1 Power wiring: Identify circuit breaker panel/circuit breaker.
- .4 Conduits Identification:
 - .1 All conduits, boxes, and connections must be identified with an orange color paint or tag.
- .5 Existing Panels:
 - .1 Correct existing identifications to show the changes made to the system.

1.10 WARRANTY

- .1 All the equipment, and systems provided must be warranted against defects for one year from date of acceptance of the project.

- .2 Provide services, material, and equipment to maintain the system for specified warranty period. Provide detailed preventative maintenance schedule for system components as described in SUBMITTALS article.
- .3 Emergency Service Calls:
 - .1 Initiate service calls when controls are not functioning correctly.
 - .2 Qualified control personnel to be available during warranty period to provide service to "CRITICAL" components whenever required at no extra cost.
 - .3 Perform work continuously until controls are restored to reliable operating condition.
- .4 Work Requests: Record each service call request on approved form, including:
 - .1 Location, date, and time call received.
 - .2 Nature of trouble or incident.
 - .3 Names of personnel assigned.
 - .4 Quantity and type of material or equipment used.
 - .5 Date and time of the beginning and end of the intervention.

1.11 OPERATION AND MAINTENANCE (O & M) MANUALS

- .1 Custom design O&M Manuals (both hard and soft copies) to contain material pertinent to this project only, and to provide full and complete coverage of subjects referred to in this Section.
- .2 Include complete coverage in concise language, readily understood by operating personnel using common terminology of functional and operational requirements of system. Do not presume knowledge of computers, electronics, or in-depth control theory.
- .3 The manuals must include:
 - .1 Controls schematics, including the existing equipment related to modified systems.
 - .2 Lists of material and points lists.
 - .3 Control sequences.
 - .4 O&M Manuals.
 - .5 Specific procedures: Restarting, alarms reception, printing, etc.
 - .6 Informations related to licences: Version, certificates, update procedures.

1.12 WORK IN EXISTING INSTALLATIONS

- .1 If the work is to be done in existing building, integrate the controls modifications to the Departmental Representative's documents, soft and hard copies, to keep an up-to-date version.

- .2 Incorporate to the documents all modifications to the control systems, while keeping the informations relative to the existing equipment still in use.

1.13 EXISTING CONTROL ELEMENTS

- .1 Collect the existing control elements that will not be reused or not necessary. Store them in an approved storage area, to dispose of them.

Part 2 Products

2.1 NOT APPLICABLE

- .1 Not applicable.

Part 3 Execution

3.1 MANUFACTURER'S RECOMMENDATIONS

- .1 Installation: To manufacturer's recommendations.

3.2 PAINTING

- .1 Perform painting in accordance with the following requirements:
 - .1 Clean and retouch the surfaces that were scratched so that they have the same original finish;
 - .2 Where retouches are not enough, a complete reconditioning (primer coat and finishing coat) of the damaged surfaces is required;
 - .3 Clean and use a primer coating on visible elements such as supports, equipment frames, and any other fixing devices;
 - .4 Paint all unfinished material that has been installed indoors.

END OF SECTION

Part 1 General**1.1 REFERENCES**

- .1 American National Standards Institute (ANSI).
 - .1 ANSI C2, National Electrical Safety Code.
- .2 American National Standards Institute (ANSI)/American Society of Mechanical Engineers (ASME).
 - .1 ANSI/ASME B16.22, Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
- .3 American National Standards Institute (ANSI)/National Fire Protection Association (NFPA).
 - .1 ANSI/NFPA 70, National Electrical Code.
- .4 Canadian Standards Association (CSA)/CSA International.
 - .1 CSA C22.1, Canadian Electrical Code, Part 1.
 - .2 CSA C22.2, Canadian Electrical Code, Part 2.
 - .3 CAN/CSA C22.3 No. 1, Networks.
 - .4 CAN/CSA C22.3 No. 7, Underground Networks.
 - .5 CSA 22.2 No. 45, Rigid Steel Conduits.

1.2 SYSTEM DESCRIPTION

- .1 Electrical:
 - .1 Installation of power supply cables from existing distribution and emergency panels or provided by the Electrical Contractor. Circuits to be for exclusive use of controls equipment. Panel breakers to be identified on panel legends tagged and locks applied to breaker switches. Each table must have a legend identifying the different circuit breakers.
 - .2 Hard wiring between field control devices.
 - .3 Refer to wiring diagrams included as part of flow diagrams, trace existing control wiring installation, and provide updated wiring schematics, including additions and/or deletions to control circuits, for approval by Departmental Representative before commencing work.
- .2 Construction (Structural):
 - .1 Special steelwork as required for installation of Work.

1.3 PERSONNEL QUALIFICATIONS

- .1 Qualified supervisory personnel to:
 - .1 Continuously direct and monitor all work.
 - .2 Attend all site meetings.

1.4 EXISTING CONDITIONS

- .1 Opening and Resurfacing: Refer to the prescription hereafter.
- .2 Repair all surfaces damaged during execution of Work.
- .3 Turn over to Departmental Representative existing material and equipment removed from work not identified for re-use.

Part 2 Products**2.1 SPECIAL SUPPORTS**

- .1 Structural grade steel, primed, and painted after construction, but before installation.

2.2 WIRING

- .1 As per requirements of Division 26 - Electrical.
- .2 For 70 V and above: Copper conductor with chemically cross-linked thermosetting polyethylene insulation rated RW90 and 600 V. Colour code to CSA 22.1.
- .3 For wiring under 70 V: Use FT4 rated wiring.
- .4 Sizes:
 - .1 120V Power supply: To match or exceed breaker, size #12 minimum.
 - .2 Wiring for safeties/interlocks for starters, motor control centres, to be stranded, #14 minimum.
 - .3 Field wiring to digital device: At least 20AWG stranded twisted pair.
 - .4 Analog input and output: Shielded #20 minimum stranded twisted pair. Wiring must be continuous without joints.
- .5 Terminations:
 - .1 Terminate wires with set-screw connectors suitable for wire size, and number of scheduled terminations.

2.3 CONDUITS

- .1 As per requirements of Division 26 - Electrical.

- .2 Conduits must have a minimum of 20 mm diameter.
- .3 Electrical metallic tubing (EMT) to CSA C22.3. Flexible and liquid tight flexible metal conduit to CSA C22.2. Rigid steel threaded conduit to CSA C22.2 No. 45.
- .4 Junction and Pull Boxes: Welded steel.
 - .1 Surface mounting cast FS: Screw-on flat covers.
 - .2 Flush mounting: Covers with 25 mm minimum extension all round.
- .5 Outlet Boxes: 100 mm minimum, square.
- .6 Conduit Boxes, Fittings:
 - .1 Bushings and connectors: With nylon insulated throats.
 - .2 With push pennies to prevent entry of foreign materials.
- .7 Fittings for Rigid Conduit:
 - .1 Couplings and fittings: Threaded type steel.
 - .2 Double locknuts and insulated bushings: Use on sheet metal boxes.
 - .3 Use factory "ells" where 90-degree bends required for 25 mm and larger conduits.
- .8 Fittings for Thin Wall Conduit:
 - .1 Connectors and couplings: steel, set-screw type.

2.4 WIRING DEVICES, COVER PLATES

- .1 Complying with CSA.
- .2 Receptacles:
 - .1 Duplex: CSA type 5-15R.
 - .2 Single: CSA type 5-15R.
 - .3 Cover plates and blank plates: Finish to match other plates in area.

2.5 SUPPORTS FOR CONDUIT, FASTENINGS, AND EQUIPMENT

- .1 Solid Masonry, Tile, and Plastic Surfaces: Lead anchors or nylon shields.
 - .1 Hollow masonry walls, suspended drywall ceilings: Toggle bolts.
- .2 Exposed Conduits or Cables:
 - .1 50 mm diameter and smaller: One-hole steel straps.
 - .2 Larger than 50 mm diameter: Two-hole steel straps.
- .3 Suspended Support Systems:

- .1 Individual cable or conduit runs: Support with 6 mm diameter threaded rods and support clips.
- .2 Two or more suspended cables or conduits: Support channels supported by 6 mm diameter threaded rod hangers.

Part 3 Execution

3.1 INSTALLATION

- .1 Install equipment and components so that manufacturer's and CSA labels are visible and legible after commissioning is complete.
- .2 Conduits for wiring.
 - .1 All wiring must be installed in EMT conduits:
 - .1 In exposed areas, mechanical and electrical rooms.
 - .2 In gypsum ceilings and other non-accessible ceilings.
 - .3 Masonry walls.
 - .2 In suspended ceilings, protected wires can be installed without conduit if they are properly affixed to the structure.
 - .3 Use rigid conduits and weatherproof joints for conduits installed outside the building.

3.2 OTHER SUPPORTS

- .1 Install special supports as required and as indicated.

3.3 ELECTRICAL NETWORK - GENERAL

- .1 Do complete installation in accordance with requirements of:
 - .1 Division 26 - Electrical and this specification.
 - .2 ANSI/NFPA 70.
 - .3 ANSI C2.
 - .4 CSA 22.1 Canadian Electrical Code.
- .2 Fully enclose or properly guard electrical wiring, terminal blocks, high voltage above 70 V contacts and mark to prevent accidental injury.
- .3 Do underground installation to CAN/CSA C22.3 No. 7, except where otherwise specified.
- .4 Comply with manufacturer's recommendations for storage, handling, and installation.
- .5 Verify factory connections and joints. Tighten where necessary to ensure continuity.

- .6 Install electrical equipment between 1,000 and 2,000 mm above finished floor wherever possible, adjacent to related equipment.
- .7 Protect exposed live equipment, such as panel, mains, outlet wiring, during construction for personnel safety.
- .8 Shield and mark live parts "LIVE 120 VOLTS" or other appropriate voltage.
- .9 Install conduits, and sleeves prior to pouring of concrete.
- .10 Holes through exterior wall and roofs: Flash and make weatherproof.
- .11 Make necessary arrangements for cutting of chases, drilling holes and other structural work required to install electrical conduit, cable, pull boxes, outlet boxes.
- .12 Install cables, conduits, and fittings which are to be embedded or plastered over, neatly and closely to building structure to minimize furring.

3.4 CONDUIT NETWORK

- .1 Install conduits parallel or perpendicular to building lines, to preserve headroom and to minimize interference.
- .2 Do not run exposed conduits in normally occupied spaces, unless otherwise indicated or unless impossible to do otherwise. Obtain approval from Departmental Representative before starting such work. Provide complete conduit network to link field panels and devices with main control centre. Conduit size to match conductors plus future expansion capabilities, as specified in the specification.
- .3 Bend conduit so that diameter is reduced by less than $\frac{1}{10}$ th original diameter.
- .4 Field thread on rigid conduit to be of sufficient length to draw conduits up tight.
- .5 Limit conduit length between pull boxes to less than 30 m.
- .6 Use conduit outlet boxes for conduit up to 32 mm diameter and pull boxes for larger sizes.
- .7 Use flexible conduits to make the transition between control elements and the EMT conduits. Flexible conduits length must not exceed 500 mm.
- .8 Fastenings and supports for conduits, cables, and equipment:
 - .1 Provide metal brackets, frames, hangers, clamps, and related types of support structures, as indicated and as required, to support cable and conduit runs.
 - .2 Provide adequate support for raceways and cables, sloped vertically to equipment.

- .3 Use supports or equipment installed by other trades for conduit, cable, and raceway supports only after written approval from Departmental Representative.
- .9 Install polypropylene fish cord in empty conduits for future use.
- .10 Remove and replace blocked conduit sections.
- .11 Pass conduits through structural members only after receipt of Departmental Representative written approval.
- .12 Conduits may be run in flanged portion of structural steel.
- .13 Group conduits wherever possible on suspended or surface channels.
- .14 Pull Boxes:
 - .1 Install in inconspicuous, but accessible locations.
 - .2 Support boxes independently of connecting conduits.
 - .3 Fill boxes with paper or foam to prevent entry of construction material.
 - .4 Provide correct size of openings. Reducing washers not permitted.
 - .5 Mark location of pull boxes on record drawings.
 - .6 Identify AC power junction boxes, by panel and circuit breaker.
- .15 Install terminal blocks or strips indicated in cabinets to Section 26 - Electrical.
- .16 Install bonding conductor for 120 V and above in conduit.

3.5 WIRING

- .1 Install simultaneously multiple wiring in ducts.
- .2 Do not pull spliced wiring inside conduits or ducts.
- .3 Use CSA certified lubricants of type compatible with insulation to reduce pulling tension.
- .4 Tests: Use only qualified personnel. Demonstrate that:
 - .1 Circuits are continuous, free from shorts, unspecified grounds.
 - .2 Resistance to ground of all circuits is greater than 50 Megohms.
- .5 Provide Departmental Representative with test results showing, among others, locations and circuits.
- .6 Carefully remove insulation from ends of conductors and install to manufacturer's recommendations. Accommodate all strands in lugs. Where insulation is stripped in excess, neatly tape so that only lug remains exposed.

- .7 Wiring in main junction boxes and pull boxes to terminate on terminal blocks only, clearly and permanently identified. Junctions or splices not permitted for sensing or control signal covering wiring.
- .8 Do not allow wiring to come into direct physical contact with compression screws.
- .9 Install ALL strands of conductor in lugs of components. Strip insulation only to extent necessary for installation.

3.6 WIRING DEVICES, COVER PLATES

- .1 Receptacles:
 - .1 Install vertically in gang type outlet box when more than one receptacle is required in one location.
- .2 Cover Plates:
 - .1 Install suitable common cover plate where wiring devices are grouped.
 - .2 Use flush type cover plates only on flush type outlet boxes.

3.7 GROUNDING

- .1 Install complete, permanent, continuous grounding system for equipment, including conductors, connectors, and accessories.
- .2 Install separate grounding conductors in conduit within building.
- .3 Install ground wire in all PVC ducts and in tunnel conduit systems.
- .4 Tests: Perform ground continuity and resistance tests, using approved method appropriate to site conditions.

3.8 TESTS

- .1 Perform following tests:
 - .1 Preliminary tests:
 - .1 Conduct as directed to verify compliance with specified requirements.
 - .2 Make needed changes, adjustments, and replacements.
 - .3 Insulation resistance tests:
 - .1 Measure all circuits, feeders, equipment for 120 - 600 V with 1,000 V instrument. Resistance to ground to be more than required by Electrical Code before energizing.
 - .2 Test insulation between conductors and ground. Efficiency of grounding system to satisfaction of Departmental Representative and authority having jurisdiction.

- .2 Give 14-day written notice of intention to test.
- .3 Conduct in presence of Departmental Representative and authority having jurisdiction.
- .4 Conceal work only after tests satisfactorily completed.
- .5 Report results of tests to Departmental Representative in writing.

END OF SECTION

Part 1 General**1.1 RELATED SECTIONS**

- .1 Section 25 05 01 - EMCS: General Requirements.
- .2 Section 25 90 01 - EMCS: Site Requirements, Applications and Systems Sequences of Operation.

1.2 REFERENCES

- .1 Air Movement and Control Association, Inc. (AMCA).
 - .1 AMCA Standard 500-D, Laboratory Method of Testing Dampers for Rating.
- .2 American National Standards Institute (ANSI).
 - .1 ANSI C12.7-1993 (R1999), Requirements for Watthour Meter Sockets.
 - .2 ANSI/IEEE C57.13-1993, Standard Requirements for Instrument Transformers.
- .3 American Society for Testing and Materials International, (ASTM).
 - .1 ASTM B148-97(03), Standard Specification for Aluminum-Bronze Sand Castings.
- .4 Canadian Standards Association (CSA).
 - .1 CSA-C22.1SB-F02, Canadian Electrical Code, Part 1 (19th Edition) - Safety Standard for Electrical Installations.

1.3 SUBMITTALS

- .1 Submit shop drawings and manufacturer's installation instructions.
- .2 Pre-Installation Tests:
 - .1 Submit random samples of delivered equipment as required by the Departmental Representative, which must be tested prior to installation. Replace devices or components whose performance and accuracy do not meet the prescribed requirements.
- .3 Manufacturer's Instructions:
 - .1 Submit manufacturer's installation instructions for specified equipment and devices.

1.4 EXISTING CONDITIONS

- .1 Cutting and Adjusting: In accordance with the requirements of the specific conditions and those indicated below.

- .1 If needed, repair surfaces that were damaged during Work execution.
- .2 Hand over to the Departmental Representative all removed material that cannot be reused.

Part 2 Products

2.1 GENERAL

- .1 Control devices of each category to be of same type and manufacturer.
- .2 External trim materials to be corrosion resistant. Internal parts to be assembled in watertight, shock-proof, heat resistant, vibration-proof assembly, and suitable for application.
- .3 Operating Conditions: 0 - 32°C with 10 - 90% relative humidity (RH) (non-condensing), unless otherwise specified.
- .4 Terminations: Use standard type conduit box with a terminal block for connecting wires using a flat screwdriver, unless otherwise specified.
- .5 Transmitters and sensors to be unaffected by external transmitters, among others, walkie-talkies.
- .6 Account for hysteresis, relaxation time, maximum and minimum limits, in selection of sensors and controls.
- .7 Installed measuring instruments ranges must be such that normal reading should be between the first third and second third of the total measuring range of the instrument. The choice of operating ranges is the responsibility of the Contractor, even after approval of the shop drawings.
- .8 Devices installed in user occupied space not exceed Noise Criteria (NC) of 35. Noise generated by any device must not be detectable above space ambient conditions.

2.2 ELECTRONIC DAMPERS ACTUATORS

- .1 Direct coupling actuators, "on-off", or modulating.
 - .1 Gear mechanism, 2-direction electric motor with feedback position control.
 - .2 Limit switch electronic stops.
 - .3 95° rotating span limited by mechanical stops.
 - .4 Power supply 120 VAC or 24 VAC; typical power consumption of 5 VA. Prioritize 24-VAC actuators.
 - .5 Control signal 0-10 VDC for modulating actuators. Rotation direction selectable button.

- .6 Safety spring return mechanism for outside air and mixing dampers, for return to normal position in case of power loss. Direction of safety return by actuator inversion on the shaft.
- .7 Feedback signal: 0-10 VDC indicating the 0-100% position.
- .8 Maximum travel time of 120 seconds for 0-100 % positioning.
- .9 Sufficient power to allow the positioning of dampers at maximum operating pressure and dynamic pressure for opening and closing. Use multiple actuators mounting when required. Coordinate with the damper supplier.
- .10 Provide and install remote installation kits if required where the direct mounting of actuators does not allow the access to actuators for service.
- .2 Acceptable Products: Belimo AFB/NFB; Johnson Controls M9200; Siemens GCA.

2.3 ELECTROMECHANICAL RELAYS

- .1 Inverter relays, bipolar, pluggable, with connection base.
 - .1 Activation by electromagnetic coil.
 - .2 Inverter contacts plated or not subject to corrosion.
 - .3 Mounting to DIN rail base.
 - .4 5-A output contacts at 120 VAC.
 - .5 Coils supplied at 120 VAC or 24 VDC.
 - .6 LED status indicator light.

2.4 SMOKE DETECTOR

- .1 Photoelectric detector with integrated relay and buzzer.
- .2 Supply: 12/24 VDC, 4 wires.
- .3 Alarm Buzzer: 85 dB.
- .4 Contact: "C" Form for the alarm.
- .5 Time Out: Delay of 8 seconds at relay activation.
- .6 Acceptable Model: System Sensor, model 2012JA.

2.5 MOTION DETECTOR

- .1 Double-beam detector.
- .2 Supply: 11 to 16 VDC.
- .3 Wall or corner mounting, at height of 2.1 to 2.7 m.

- .4 Coverage: 11 m by 11 m.
- .5 Contact: "C" Form, 100 mA at 28 VDC.
- .6 Acceptable Model: Paradox, DG-75C

2.6 CO GAZ DETECTOR

- .1 Electronic type detection.
- .2 Supply: 12/24 VDC, 4 wires.
- .3 Alarm Buzzer: 85 dB.
- .4 Contact: "C" Form for the alarm.
- .5 Wall or ceiling mounting.
- .6 Approval: CSA 6.19-01.
- .7 Acceptable Model: System Sensor CO1224A.

2.7 DOOR CONTACT

- .1 Magnetic door contact for mounting on steel door.
- .2 Contact: "C" Form for the alarm.
- .3 Diameter: 2.22 cm.
- .4 Acceptable Model: 1078C, GE-Sentrol.

2.8 LEAK DETECTOR (LIQUID LEVEL)

- .1 Ultrasonic liquid level detector.
- .2 Detection from 0 to 1.25 m, accuracy of 3 mm.
- .3 4-output contacts.
- .4 Measuring Ray: 2 in. diameter.
- .5 Suitable for water and petroleum products.
- .6 Acceptable Model: Flowline Echopod DL14-01

2.9 EMERGENCY PUSHBUTTON

- .1 400-mm pushbutton with sturdy plastic mounting box, NEMA 4.
- .2 Plastic protection cover.
- .3 Push to activate, turn to release.
- .4 3-output contacts.
- .5 Acceptable Model: Sprecher & Schuh, D7-1YPB14-PX03, with D7-A6PR5 protector.

2.10 CONTROL PANEL (ALARMS)

- .1 The controls panel is provided by the Client. It includes the DC power supplies, potentiometer for the dampers, 24-VAC transformer, and all required terminal blocks. All the connections are done on the terminal blocks.

Part 3 Execution**3.1 INSTALLATION**

- .1 Install equipment and components so that manufacturer's and CSA labels are visible and legible after commissioning is complete.
- .2 Install field control devices in accordance with manufacturers recommended methods, procedures, and instructions.
- .3 Temperature transmitters, humidity transmitters, current-to-pneumatic transducers, solenoid air valves, controllers, relays: install in NEMA I enclosure or as required for specific applications. Provide for electrolytic isolation in cases when dissimilar metals make contact.
- .4 Support field-mounted panels, transmitters, and sensors on pipe stands or channel brackets.
- .5 Provide space for fire protection. Ensure and maintain rated fire ratings.
- .6 Electrical Network:
 - .1 Complete installation in accordance with Section 25 05 60.
 - .2 Modify existing starters where required, as per indications.
 - .3 Trace existing control wiring installation and provide updated wiring schematics including additions, deletions to control circuits for review by Departmental Representative before beginning Work. Refer to electrical control schematics

included as part of control design schematics on drawings mentioned in Section 25 90 01.

- .4 Terminate wires with set-screw connectors suitable for wire size and number of terminations.
- .5 Unless otherwise indicated or unless impossible to do otherwise, do not run exposed conduits in normally occupied spaces. Wiring in mechanical rooms, in service rooms, as well as exposed wiring, must be in conduit.

3.2 ROOM THERMOSTATS

- .1 Install the thermostats to ensure minimum field adjustments or calibrations.
- .2 Readily accessible and adaptable to each type of application to allow for quick easy replacement and servicing without special tools or skills.

3.3 IDENTIFICATION

- .1 Identify field devices in accordance with Section 25 05 01 - EMCS: General Requirements.

3.4 TESTING AND COMMISSIONING

- .1 Calibrate and test field devices for accuracy and performance in accordance with Section 25 05 01.

END OF SECTION

Part 1 Sequences of Operation**1.1 GENERAL**

- .1 Following sequences apply for all the mechanical systems, when necessary:
 - .1 The following sequences must be read together with drawings and list of points. Supply all control points necessary for the control sequences performing, listed or implicit.

1.2 GENERATOR ROOM VENTILATION

- .1 Sequence of Operation:
 - .1 When generator starts, generation fan starts, the fresh air damper opens at minimum to admit combustion air.
 - .2 The room thermostat modulates de fresh air, return air, and exhaust air dampers to maintain room temperature at a maximum of 25°C.

1.3 ROOM TEMPÉRATURE CONTROL

- .1 Sequence of Operation:
 - .1 The thermostat provided with the A/C unit controls also the unit heater to provide heating of the room.
 - .2 High- and low-temperature alarms and A/C unit fault are reported to the alarms management panel (PGA).

Part 2 Execution**2.1 INSTALLATION SPECIAL REQUIREMENTS**

- .1 Dismantle the existing controls, including the controls for VE-1.

2.2 ALARMS MANAGEMENT PANEL

- .1 The control panel is provided by the Client. Provide and install all indicated equipment, such as occupancy sensors, smoke detectors, pushbuttons, etc. Make all conduits and wiring to allow the alarms transmission.
- .2 The panel also contains the minimum fresh air damper potentiometer.

END OF SECTION

DIVISION 26

Electrical

Part 1 General**1.1 REFERENCE STANDARDS**

- .1 CSA Group.
 - .1 CSA C22.1-F15, Canadian Electrical Code, Part 1 (23rd Edition), Safety Standard for Electrical Installations.
 - .2 CSA C22.2 No. 0.3-06(R2014), Test Methods for Electrical Wires and Cables.
 - .3 CAN/CSA-C22.3 No.7-F10, Underground Systems.
 - .4 CAN3-C235-83(R2010), Preferred Voltage Levels for AC Systems, 0 to 50,000 V.
 - .5 CSA 282-09, Emergency Electrical Power Supply for Buildings.
 - .6 CSA-Z462-15, Electrical Safety.
- .2 Institute of Electrical and Electronics (IEEE)/National Electrical Safety Code Product Line (NESC).
 - .1 IEEE SP1122-2000, 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 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit for review single line electrical diagrams under plexiglass, in A1 format, and located in the main electrical installations local.
- .3 Submit, for review, fire alarm riser diagram, plan, and zoning of building under plexiglass in A2 format, and place near the fire alarm control panel and annunciator.
- .4 Shop Drawings:
 - .1 Submit drawings stamped and signed by professional engineer registered or licensed in the Province of Quebec.
 - .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 If changes are required, notify Departmental Representative of these changes before they are made.
- .5 Electrical Arc-Flash Danger:
 - .1 Supply the "Arc-Flash" report. The study must be signed by a certified engineer from the province of Quebec.
 - .2 Supply and install a label on each electrical equipment (excepted those who comply to article 4.3.3.1 of the CSA Z462 Standard), as requested by CCQ-E and types "Figures Q.2 and Q.3" as indicated in appendix Q of the CSA Z462 Standard. The manufacturer must affix the labels on the equipment according to the study results.
- .6 Certificates.
 - .1 Provide CSA certified material and equipment.
 - .2 Where CSA certified equipment and material is not available, submit such equipment and material to an authority having jurisdiction for approval before delivery to site.
 - .3 Submit test results of installed electrical systems and instrumentation.
 - .4 Permits and fees: in accordance with General Conditions of Contract.
 - .5 Submit, upon completion of Work, load balance report as described in PART 3 - LOAD BALANCE.
 - .6 Submit certificate of acceptance from authority having jurisdiction upon completion of Work to Departmental Representative.

1.4 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Operation and Maintenance Data: Submit operation and maintenance data:
 - .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.

1.5 DELIVERY, STORAGE, AND HANDLING

- .1 Deliver, store, and handle materials in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Delivery and Acceptance Requirements: Deliver material and equipment to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials, indoor, off ground, and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Replace defective or damaged materials with new.
- .4 Packaging Waste Management: Remove for reuse as specified in Waste Reduction Workplan in accordance with Section 01 74 19 - Waste Management and Disposal.

1.6 FIREPROOFING

- .1 When ducts or cables pass through walls and fireproof floors, provide fire and smoke tightness using 3M, CP25, 303, FS195 and CS95, and 7902 and 7904 Series sealing kits. The installation must meet the requirements of CAN/CGSB 19.13-M87 and the manufacturer's recommendations.
- .2 All ducts must be clogged with a firewall product such as HILTI CP620 or equivalent. The Contractor must block all new and existing ducts entering the generator room located on the ground floor and the telecom room located on the fourth level. The penetration of the product must be 150 mm inside the duct and the Contractor must ensure that there is no space between conductors.

1.7 WORK UNDER TENSION AND DANGER OF ARCING FLASH

- .1 All work must be done off.
- .2 Live work:
 - .1 All work must be done off. However, if the Contractor is to perform live work for exceptional reasons, the latter must make a written request to the Departmental Representative with a clear indication of the conditions requiring live work.
 - .2 Any work carried out on live equipment must be carried out in accordance with the CSA Standard Z462 "Safety in the Field of Electricity at Work". Refer to tables 1 and 4 of CSA Standard Z462.
 - .3 The Contractor must obtain acceptance from the Departmental Representative before starting the work under tension.

- .3 "Electric Arc Hazard" Marking:
 - .1 Provide and install a label on all electrical equipment (except those that comply with CSA Z462, item 4.3.3.1), as requested by the CCQ-E and of type "Figure Q.1", as shown in Appendix Q of CSA Z462 Standard.

1.8 ARC DEFECT (FLASH ARC) STUDY

- .1 The Contractor must provide an arc defect (flash arc) study that consists of, but is not limited to, the supply of the arc defect (flash arc) study and the labels on all electrical distribution equipment of the building. The marking sheets on the equipment must detail the characteristics of the equipment, the faults as well as the protective measures to be taken. The arc defect study must be signed and sealed by an engineer member in good standing of the "Ordre des ingénieurs du Québec".
- .2 The work also includes the readings of the electrical installation of the building, the production of the study and the issuance of the report, the affixing of the labels on all equipment, as well as any incidental expenses to the realization of the work. The labels must also indicate the energy level and the type of protection required.

Part 2 Products

2.1 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 for control items in French and English.
- .4 Use one nameplate for each language.

2.2 MATERIAL AND EQUIPMENT

- .1 Provide material and equipment in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Equipment and material to be CSA certified. Where CSA certified are equipment and material is not available, obtain special approval from authority having jurisdiction before delivery to site and submit such approval as described in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS.
- .3 Factory assemble control panels and component assemblies.

2.3 ELECTRIC MOTORS, EQUIPMENT, AND CONTROLS

- .1 Verify installation and co-ordination responsibilities related to motors, equipment, and controls, as indicated.
- .2 Control Wiring and Conduit: In accordance with Section 26 29 03 - Control Devices except for conduit, wiring, and connections below 50 V which are related to control systems specified in Mechanical Sections.

2.4 WARNING SIGNS

- .1 Warning Signs: In accordance with requirements of Departmental Representative.
- .2 Porcelain enamel signs, minimum size 175 x 250 mm.

2.5 WIRING TERMINATIONS

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

2.6 EQUIPMENT IDENTIFICATION

- .1 Identify electrical equipment with nameplates as follows:
 - .1 Nameplates: 3 mm thick lamicoid, matt white finish face, black core, mechanically attached with self-tapping screws.
 - .2 Sizes as follows:

NAMEPLATE SIZES	DIMENSIONS	NB. OF LINES	HEIGHT
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 Labels: Embossed plastic labels with 6 mm high letters, unless specified otherwise.
- .3 Wording on nameplates to be approved by Departmental Representative prior to manufacture.
- .4 Allow for minimum of twenty-five (25) letters per nameplate.
- .5 Nameplates for terminal cabinets and junction boxes to indicate system and/or voltage characteristics.
- .6 Identify equipment with Size 3 labels engraved "ASSET INVENTORY NO. ____" of Departmental Representative.
- .7 Disconnects, Starters, and Contactors: Indicate equipment being controlled and voltage.
- .8 Terminal Cabinets and Pull Boxes: Indicate system and voltage.

- .9 Transformers: Indicate capacity, primary, and secondary voltages.

2.7 WIRING IDENTIFICATION

- .1 Identify wiring with permanent indelible identifying markings, numbered, 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.

2.8 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.

Type	Prime	Auxiliary
Up to 250 V	Yellow	---
Up to 600 V	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

2.9 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 outdoor electrical equipment "equipment green" finish as per the AMEEECY1-1-1195 Standard.
- .2 Paint indoor switchgear and distribution enclosures light gray as per the AMEEECY1-1-1958 Standard.

Part 3 Execution

3.1 EXAMINATION

- .1 Verification of Conditions: Prior to installation:
- .1 Visually inspect substrate in presence of Departmental Representative.

- .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
- .3 Proceed with installation only after unacceptable conditions have been remedied and after received of written approval to proceed from the Departmental Representative.

3.2 INSTALLATION

- .1 Do complete installation in accordance with CSA C22.1, except where specified otherwise.
- .2 Do overhead and underground systems in accordance with CAN/CSA-C22.3 No.71, except where specified otherwise.

3.3 NAMEPLATES AND LABELS

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

3.4 CONDUIT AND CABLE INSTALLATION

- .1 Install conduit and sleeves prior to pouring of concrete.
 - .1 Sleeves through concrete: Plastic, sized for free passage of conduit, and protruding 50 mm.
- .2 If plastic sleeves are used in fire rated walls or floors, remove before conduit installation.
- .3 Install cables, conduits, and fittings embedded or plastered over, close to building structure so furring can be kept to minimum.

3.5 LOCATION OF OUTLETS

- .1 Locate outlets in accordance with Section 26 05 32 - Outlet Boxes, Conduit Boxes and Fittings.
- .2 Do not install outlets back-to-back in wall; allow minimum 150 mm horizontal clearance between boxes.
- .3 Change location of outlets at no extra cost or credit, providing distance does not exceed 3,000 mm, and information is given before installation.
- .4 Locate light switches on latch side of doors.
 - .1 Locate disconnect devices in mechanical and elevator machine rooms on latch side of floor.

3.6 MOUNTING HEIGHTS

- .1 Mounting height of equipment is from finished floor to centreline of equipment, unless specified or indicated otherwise.

- .2 If mounting height of equipment is not specified or indicated, verify before proceeding with installation.
- .3 Install electrical equipment at following heights, unless indicated otherwise.
 - .1 Local switches: 1,200 mm.
 - .2 Wall receptacles:
 - .1 General: 400 mm.
 - .2 Above top of continuous baseboard heater: 200 mm.
 - .3 Above top of counters or counter backsplashes: 175 mm.
 - .4 In mechanical rooms: 1,200 mm.
 - .3 Panelboards: as required by Code or as indicated.
 - .4 Telephone and interphone outlets: 400 mm.
 - .5 Wall mounted telephone and interphone outlets: 1,500 mm.
 - .6 Fire alarm stations: 1,200 mm.
 - .7 Fire alarm bells: 2,100 mm.
 - .8 Television outlets: 400 mm.
 - .9 Wall mounted speakers: 2,100 mm.
 - .10 Clocks: 2,100 mm.
 - .11 Door bell pushbuttons: 1,500 mm.

3.7 CO-ORDINATION OF PROTECTIVE DEVICES

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

3.8 FIELD QUALITY CONTROL

- .1 Load Balance:
 - .1 Measure phase current of all existing and new panel boards with normal loads operating at time of acceptance; adjust branch circuit connections as required to obtain best balance of current between phases and record changes.
 - .2 Measure phase voltages at loads and adjust transformer taps to within 2% of rated voltage of equipment.
 - .3 Provide upon completion of work, load balance report as directed in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS, phase and neutral currents on panel boards, dry-core transformers and motor control centres, operating under normal load, as well as hour and date on which each load was measured, and voltage at time of test.
- .2 Conduct following tests in accordance with Section 01 45 00 - Quality Control.
 - .1 Power distribution system including phasing, voltage, grounding, and load balancing.
 - .2 Circuits originating from branch distribution panels.

- .3 Lighting and its control.
- .4 Motors, heaters and associated control equipment including sequenced operation of systems where applicable.
- .5 Systems: fire alarm and communications.
- .6 Insulation resistance testing:
 - .1 Megger circuits, feeders and equipment up to 350 V with a 500 V instrument.
 - .2 Megger 350-600 V circuits, feeders and equipment with a 1,000 V instrument.
 - .3 Check resistance to ground before energizing.
- .3 Carry out tests in presence of Departmental Representative.
- .4 Provide instruments, meters, equipment, and personnel required to conduct tests during and at conclusion of project.
- .5 Manufacturer's Field Services:
 - .1 Obtain written report from the manufacturer of the generator and the automatic transfer switches confirming compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in PART 1 - ACTION AND INFORMATIONAL 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.

3.9 SYSTEM STARTUP

- .1 Instruct Departmental Representative 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 with aspects of its care and operation.

3.10 CLEANING

- .1 Progress Cleaning: Clean in accordance with Section 01 74 00 - Cleaning.
 - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: Upon completion remove surplus materials, rubbish, tools, and equipment, in accordance with Section 01 74 00 - Cleaning.

- .3 Waste Management: Separate waste materials for recycling in accordance with Section 01 74 19 - Waste Management and Disposal.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

Part 1 General**1.1 SUMMARY**

1. This section includes requirements for selective demolition and removal of electrical installations.
2. Selective demolition works shall consist, but are not limited to, the removal and disposition, in whole or in part, of the following equipment and networks:
 1. Generator sets and transfer switch with bypass device and related equipment;
 2. Electrical distribution in the generator room, including electrical distribution panels, gutters, transformers, circuit breakers, starters, sockets, conduits, wiring, hardware and accessories;
 3. Indoor and outdoor lighting fixtures and controls;
 4. Intrusion system and door contacts;
 5. Battery charger;
 6. Ventilation Control Panel;
 7. Power supply of the building's mechanical loads to be removed;
 8. Heating baseboard thermostat;
 9. Electric toilet;
 - .1 Circuitry in BX and duct and cables.

1.2 RELATED REQUIREMENTS

- .1 Section 02 41 13 - Selective Site Demolition.

1.3 REFERENCE STANDARDS

- .1 CSA Group (CSA).
 - .1 CSA S350 M1980 (R2003), Code of Practice for Safety in Demolition of Structures.

1.4 DEFINITIONS

- .1 Demolish: Detach items from existing construction and legally dispose of items off site, unless indicated as removed and salvaged or removed and reinstalled.
- .2 Remove: Planned deconstruction and disassembly of electrical items from existing construction including removal of conduit, junction boxes, cabling and wiring from electrical component to panel, taking care not to damage adjacent assemblies designated to remain; legally dispose of items off site, unless indicated as removed and salvaged or removed and reinstalled.
- .3 Remove and Salvage: Detach items from existing construction and deliver them to Departmental Representative ready for reuse.

- .4 Remove and Reinstall: Detach items from existing construction, prepare them for reuse, and reinstall them where indicated.
- .5 Existing to Remain: Existing items of construction that are maintained onsite.
- .6 Hazardous Substances: Dangerous substances, dangerous goods, hazardous commodities and hazardous products may include asbestos, mercury and lead, PCB's, poisons, corrosive agents, flammable substances, radioactive substances, or other material that can endanger human health or wellbeing or environment, if handled improperly, as defined by Federal Hazardous Products Act (RSC 1985), including latest amendments.

1.5 ADMINISTRATIVE REQUIREMENTS

- .1 Coordination: Coordinate work of this Section to avoid interference with work by other Sections.

1.6 QUALITY ASSURANCE

- .1 Regulatory Requirements: Perform work of this Section in accordance with:
 - .1 Provincial/Territorial Workers' Compensation Boards/Commissions.

1.7 SITE CONDITIONS

- .1 Existing Conditions: Condition of materials identified as being salvaged or demolished are based on their observed condition at time of site examination, before tendering.
- .2 Discovery of Hazardous Substances: It is not expected that Hazardous Substances will be encountered in Work; immediately notify Departmental Representative if materials suspected of containing hazardous substances are encountered and perform following activities:
 - .1 Refer to Section 01 41 00 - Regulatory Requirements for directives associated with specific material types.
 - .2 Hazardous substances will be as defined in Hazardous Products Act.
 - .3 Stop work in area of suspected hazardous substances.
 - .4 Take preventative measures to limit users' and workers' exposure. Provide barriers and other safety devices and do not disturb.
 - .5 Hazardous substances will be removed by Departmental Representative under a separate contract or as a change to Work.
 - .6 Proceed only after written instructions have been received from Departmental Representative.

Part 2 Products**2.1 MATERIALS**

- .1 Electrical Repair Materials: Use only new materials, CSA or ULC labelled as appropriate and matching components remaining after work associated with components identified for removal or demolition are completed.
- .2 Fire stopping Repair Materials: Use fire stopping materials compatible with existing fire stopping systems where removal or demolition work affects rated assemblies, restore to match existing fire-rated performance.

Part 3 Execution**3.1 EXAMINATION**

- .1 Verification of Existing Conditions: Visit site, thoroughly examine and become familiar with conditions that may affect the work of this Section before tendering the Bid; Departmental Representative will not consider claims for extras for work or materials necessary for proper execution and completion of the contract that could have been determined by a site visit.

3.2 PREPARATION

- .1 Protection of existing systems to remain: Protect systems and components indicated to remain in place during selective demolition operations and as follows:
 - .1 Prevent movement and install bracing to prevent settlement or damage of adjacent services and parts of existing buildings scheduled to remain;
 - .2 Notify Departmental Representative and cease operations where safety of buildings being demolished, adjacent structures or services appears to be endangered and await additional instructions before resuming demolition work specified in this Section;
 - .3 Prevent debris from blocking drainage inlets;
 - .4 Protect mechanical systems that will remain in operation.
- .2 Protection of Building Occupants: Sequence demolition work so that interference with the use of the building by the Departmental Representative and users is minimized and as follows:
 - .1 Prevent debris from endangering safe access to and egress from occupied buildings.
 - .2 Notify Departmental Representative and cease operations where safety of occupants appears to be endangered and await additional instructions before resuming demolition work specified in this Section.

3.3 EXECUTION

- .1 Coordinate requirements of this Section as follows:
 - .1 Remove existing luminaires, electrical devices and equipment including associated conduits, boxes, wiring, and similar items, unless specified otherwise;
 - .2 Perform demolition work in a neat and workmanlike manner:
 - .1 Remove tools or equipment after completion of work and leave site clean and ready for subsequent renovation work;
 - .2 Repair and restore damages caused as a result of work of this Section to match existing materials and finishes.
 - .3 Remove existing conduits, boxes, cabling and wiring associated with removed luminaires, electrical devices, and equipment;
 - .4 Grind off conduits and make flush with surface of concrete where conduits are cast into concrete; seal open ends of conduit with silicone sealant;
 - .5 Seal open ends of conduit with silicone sealant where they are inaccessible or cannot be removed without damaging adjacent construction.

3.4 CLOSEOUT ACTIVITIES

- .1 Demolition Waste Disposal: Arrange for legal disposal and remove demolished materials to accredited provincial landfill site or alternative disposal site (recycle centre).

END OF SECTION

Part 1 General**1.1 RELATED REQUIREMENTS**

- .1 Section 26 05 00 - Common Work Results for Electrical.

1.2 REFERENCE STANDARDS

- .1 CSA Group (CSA).
 - .1 CAN/CSA-C22.2 No.18-98(R2003), Outlet Boxes, Conduit Boxes and Fittings.
 - .2 CAN/CSA-C22.2 No.65-03(R2008), Wire Connectors (Tri-National Standard with UL 486A-486B and NMX-J-543-ANCE-03).
- .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 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for wire and box connectors, and include product characteristics, performance criteria, physical size, finish, and limitations.
- .3 Sustainable Design Submittals:
 - .1 Construction Waste Management:
 - .1 Submit project Waste Management Plan highlighting recycling and salvage requirements.

1.4 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Operation and Maintenance Data: Submit operation and maintenance data for wire and box connectors for incorporation into manual.

1.5 DELIVERY, STORAGE, AND HANDLING

- .1 Deliver, store and handle materials in accordance with the manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: Deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

- .3 Storage and Handling Requirements:
 - .1 Store materials off ground and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect wire and box connectors from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.
- .4 Packaging Waste Management: Remove for reuse in accordance with Section 01 74 19 - Waste Management and Disposal.

Part 2 Products

2.1 MATERIALS

- .1 Pressure Type Wire Connectors: To CAN/CSA-C22.2 No.65, with current carrying parts of copper sized to fit copper conductors, as required.
- .2 Fixture Type Splicing Connectors: To CAN/CSA-C22.2 No.65, with current carrying parts of copper sized to fit copper conductors 10 AWG or less.
- .3 Bushing Stud Connectors: To NEMA and to consist of:
 - .1 Connector body and stud clamp for round copper conductor.
 - .2 Clamp for stranded copper conductors.
 - .3 Stud clamp bolts.
 - .4 Bolts for copper conductors.
 - .5 Sized for conductors as indicated.
- .4 Clamps or connectors for TECK cable, armoured cable, aluminum sheathed cable, mineral insulated cable, as required, to CAN/CSA-C22.2 No.18.

Part 3 Execution

3.1 EXAMINATION

- .1 Verification of Conditions: Verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for wire and box connectors installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate.
 - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
 - .3 Proceed with installation only after unacceptable conditions have been remedied and after received of written approval to proceed from Departmental Representative.

3.2 INSTALLATION

- .1 Remove insulation carefully from ends of conductors and cables, and, depending, proceed with the following:
 - .1 Install mechanical pressure type connectors and tighten screws with appropriate compression tool recommended by manufacturer. Installation must meet secureness tests in accordance with CAN/CSA-C22.2 No.65;
 - .2 Install fixture type connectors and tighten to CAN/CSA-C22.2 No.65. Replace insulating cap;
 - .3 Install bushing stud connectors in accordance with pertinent NEMA Regulations and in accordance with the manufacturer's recommendations.

3.3 CLEANING

- .1 Progress Cleaning: Clean in accordance with Section 01 74 00 - Cleaning.
 - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: Upon completion remove surplus materials, rubbish, tools, and equipment, in accordance with Section 01 74 00 - Cleaning.
- .3 Waste Management: Separate waste materials for recycling in accordance with Section 01 74 19 - Waste Management and Disposal.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

Part 1 General**1.1 RELATED REQUIREMENTS**

- .1 Section 26 05 00 - Common Work Results for Electrical.
- .2 Section 26 05 20 - Wire and Box Connectors (0-1000 V).
- .3 Section 26 05 43.01 - Installation of Cables in Trenches and in Ducts.

1.2 REFERENCE STANDARDS

- .1 Canadian Standards Association (CSA)/ CSA International.
 - .1 CSA C22.2 No. 0.3, Testing Methods for Electrical Cables and Wires.
 - .2 CAN/CSA-C22.2 No. 131, TECK 90 Cables.
- .2 ULC Laboratories.
 - .1 ULS-S139-00, Method of Fire Test for Evaluation of Integrity of Electrical Cables.

1.3 PRODUCT DATA

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

1.4 DELIVERY, STORAGE, AND HANDLING

- .1 Packaging Waste Management: Remove for reuse in accordance with Section 01 74 19 - Waste Management and Disposal.

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 or 1,000 V insulation of cross-linked thermosetting polyethylene material rated RW90 XLPE or RWU90 XLPE, as indicated on drawings.

2.2 TECK 90 CABLE

- .1 Cable: in accordance with Section 26 05 00 - Common Work Results for Electrical.
- .2 Conductors:
 - .1 Grounding conductor: Copper.
 - .2 Circuit conductors: Copper, size as indicated on drawings.

- .3 Insulation:
 - .1 Cross-linked polyethylene XLPE.
 - .2 Rating: 1,000 V.
- .4 Inner Jacket: Polyvinyl chloride material.
- .5 Armour: Interlocking galvanized steel.
- .6 Overall Covering: Thermoplastic polyvinyl chloride, compliant with applicable Building Code classification for this Project.
- .7 Fastenings:
 - .1 One-hole galvanized steel straps to secure surface cables 50 mm and smaller. Two-hole galvanized steel straps for cables larger than 50 mm.
 - .2 Channel type supports for two or more cables at a distance of 1,500 mm.
 - .3 Threaded rods: 6 mm diameter to support suspended channels.
- .8 Connectors:
 - .1 Watertight approved for TECK cable.

2.3 MINERAL-INSULATED CABLES

- .1 Mineral insulated cable according to ULC-S139.
- .2 Conductors: Solid bare, soft-annealed copper, size as indicated.
- .3 Insulation: Compressed powdered magnesium oxide or silicon dioxide, to form compact homogeneous mass throughout entire length of cable.
- .4 Outer Covering: Seamless, annealed copper sheath, Type M1 rated 600 V, at a temperature of 250°C.
- .5 Overall Jacket: None.
- .6 Two-hour fire rating.
- .7 Termination Kits: Approved for MI cable.

2.4 CONTROL CABLES

- .1 Type: LVT: Two soft annealed copper conductors, sized as indicated:
 - .1 Insulation: Thermoplastic.
 - .2 Sheath: Thermoplastic jacket, and armour of closely wound aluminum wire.
- .2 Type: Low-energy, 300 V control cable: Solid annealed copper conductors, size as indicated:
 - .1 Insulation: Polyethylene.
 - .2 Overall covering: Interlocked armour of steel strip or FT-4 rated PVC jackets.

2.5 ACCEPTED PRODUCTS

- .1 Prysmian.
- .2 Alcatel.
- .3 Southwire.
- .4 General Cable.
- .5 Materials or replacement products approved by addendum, compliant with instructions given to bidders.

Part 3 Execution**3.1 FIELD QUALITY CONTROL**

- .1 Perform tests in accordance with Section 26 05 00 - Common Work Results for Electrical.
- .2 Perform the tests according to the methods approved by the local authority having jurisdiction over installation.
- .3 Perform tests before energizing electrical system.

3.2 GENERAL - CABLE INSTALLATION

- .1 Install cables in trenches in accordance with Section 26 05 43.01 - Installation of Cables in Trenches and in Ducts.
- .2 Lay cable in cable trays in accordance with Section 26 05 36 - Cable Trays for Electrical Systems.
- .3 Terminate cables in accordance with Section 26 05 20 - Wire and Box Connectors - (0-1000 V).
- .4 Cable Colour Coding: To Section 26 05 00 - Common Work Results for Electrical.
- .5 Conductor length for parallel feeders to be identical.
- .6 Lace or clip groups of feeder cables at distribution centres, pull boxes, and termination points.
- .7 Wiring in Walls: Typically drop or loop vertically from above to better facilitate future renovations. Generally wiring from below and horizontal wiring in walls to be avoided, unless indicated.
- .8 Branch circuit wiring for surge suppression receptacles and permanently wired computer and electronic equipment to be 2-wire circuits only. Common neutrals not permitted.
- .9 Provide numbered wire collars for control wiring. Numbers to correspond to control shop drawing legend.

3.3 INSTALLATION OF BUILDING WIRES

- .1 Install wiring:
 - .1 In conduits, in accordance with Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings.

3.4 INSTALLATION OF TECK90 CABLE (0-1,000 V)

- .1 Wherever possible on channels, group cables.
- .2 Install cable exposed, securely supported by straps.

3.5 INSTALLATION OF MINERAL-INSULATED CABLES

- .1 Install securely, supported by straps, exposed or concealed cable.
- .2 Support 2-hour fire rated cables at 1-m intervals.
- .3 Make cable terminations by using factory-made kits.
- .4 Cable Terminations: Use thermoplastic sleeving over bare conductors.
- .5 Where cables are buried in cast concrete or masonry, sleeve for exit and entry of cables.
- .6 Identify each MI cable with a "600 V" indication sticker at each 3-m interval.
- .7 Install the MI cables according to the manufacturer's recommendations.
- .8 Do not splice cables, unless indicated.

3.6 INSTALLATION OF CONTROL CABLES

- .1 Install control cables in conduit.
- .2 Ground control cable shield.

3.7 INSTALLATION OF CABLES SUPPLIED WITH EQUIPMENT

- .1 Install cables supplied with the equipment, instrument or component in conduits, flexible or rigid, metallic or non-metallic, according to the application.
- .2 Use appropriate box connectors.
- .3 No gland connectors will be accepted for the cabling installed directly to an equipment, an instrument or a component.

END OF SECTION

Part 1 General**1.1 RELATED REQUIREMENTS**

- .1 Section 26 05 00 - Common Work Results for Electrical.
- .2 Section 27 05 26 - Grounding and Bonding for Communications Systems.

1.2 REFERENCE STANDARDS

- .1 American National Standards Institute /Institute of Electrical and Electronics Engineers (ANSI/IEEE).
 - .1 ANSI/IEEE 837-02, IEEE Standard for Qualifying Permanent Connections Used in Substation Grounding.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions to install the grounding products. Printed product literature and data sheets for grounding equipment must include product characteristics, performance criteria, physical size, finish, and limitations.

1.4 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Operation and Maintenance Data: Submit operation and maintenance data for grounding equipment for incorporation into manual.

1.5 DELIVERY, STORAGE, AND HANDLING

- .1 Deliver, store, and handle materials in accordance with the manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: Deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials off ground, indoor, and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect wire and box connectors from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.
- .4 Packaging Waste Management: Remove for reuse in accordance with Section 01 74 19 - Waste Management and Disposal.

Part 2 Products**2.1 EQUIPMENT**

- .1 Grounding Conductors: Bare stranded copper, tinned, soft annealed, size as indicated.
- .2 Insulated Grounding Conductors: Green, copper conductors, size as indicated.
- .3 Ground Bus: Copper, size as indicated, complete with insulated supports, fastenings, connectors.
- .4 Non-corroding accessories necessary for grounding system, type, size, material as indicated, including, but not necessarily limited to:
 - .1 Grounding and bonding bushings.
 - .2 Protective type clamps.
 - .3 Bolted type conductor connectors.
 - .4 Thermit welded type conductor connectors.
 - .5 Bonding jumpers, straps.
 - .6 Pressure-wire connectors.

Part 3 Execution**3.1 EXAMINATION**

- .1 Verification of Conditions: Verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for grounding equipment installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate/supports.
 - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
 - .3 Proceed with installation only after unacceptable conditions have been remedied.

3.2 INSTALLATION - GENERAL

- .1 Install complete permanent, continuous grounding system including, electrodes, conductors, connectors, accessories. Install connectors in accordance with manufacturer's instructions.
- .2 Protect exposed grounding conductors from mechanical injury.
- .3 Use mechanical connectors for grounding connections to equipment provided with lugs.
- .4 Make buried connections, and connections to conductive water main, electrodes, using permanent mechanical connectors or inspectable wrought copper compression connectors to ANSI/IEEE 837.
- .5 Soldered joints not permitted.

- .6 Install bonding wire for flexible conduit, connected at both ends to grounding bushing, solderless lug, clamp or cup washer and screw. Neatly cleat bonding wire to exterior of flexible conduit.
- .7 Install flexible ground straps for bus duct enclosure joints, where such bonding is not inherently provided with equipment.
- .8 Make grounding connections in radial configuration only, with connections terminating at single grounding point. Avoid loop connections.

3.3 SYSTEM AND CIRCUIT GROUNDING

- .1 Install system and circuit grounding connections.

3.4 EQUIPMENT GROUNDING

- .1 Install grounding connections to typical equipment included in, but not necessarily limited to following list. Service equipment, transformers, switchgear, duct systems, frames of motors, motor control centres, starters, control panels, building steel work, generators, elevators and escalators, distribution panels, outdoor lighting, cable trays, variable frequency drives, lighting frames, fuel tanks, and natural gas entrances.

3.5 GROUNDING BUS

- .1 Install copper grounding bus mounted on insulated supports on wall of electrical room and communication equipment room.
- .2 Ground items of electrical equipment in electrical room and IT equipment in communication equipment room to ground bus with individual bare stranded copper connections size, as per drawing indications.

3.6 COMMUNICATION SYSTEMS

- .1 Install grounding connections for telephone, sound, fire alarm, security systems, intercommunication systems as follows:
 - .1 Telephone: Make telephone grounding system in accordance with Section 27 05 26 - Grounding and Bonding for Communications Systems and telephone company's requirements.
 - .2 Sound, fire alarm, security systems, intercommunication systems according to the manufacturer's requirements.

3.7 FIELD QUALITY CONTROL

- .1 Perform tests in accordance with Section 26 05 00 - Common Work Results for Electrical.
- .2 Perform ground continuity and resistance tests using method appropriate to site conditions and to approval of the local authority having jurisdiction over installation.
- .3 Perform tests before energizing electrical system.

- .4 Disconnect ground fault indicator during tests.

3.8 CLEANING

- .1 Progress Cleaning: Clean in accordance with Section 01 74 00 - Cleaning.
 - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: Upon completion remove surplus materials, rubbish, tools, and equipment, in accordance with Section 01 74 00 - Cleaning.
- .3 Waste Management: Separate waste materials for recycling in accordance with Section 01 74 19 - Waste Management and Disposal.

END OF SECTION

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Part 1 General**1.1 RELATED REQUIREMENTS**

- .1 Section 26 05 00 - Common Work Results for Electrical.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for wire and box connectors, and include product characteristics, performance criteria, physical size, finish, and limitations.

1.3 DELIVERY, STORAGE, AND HANDLING

- .1 Deliver, store, and handle materials in accordance with Section 01 61 00 - Common Product Requirements with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: Deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials indoors, in dry location, off ground, and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect hangers and supports from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.
- .4 Packaging Waste Management: Remove for recycling in accordance with Section 01 74 19 - Waste Management and Disposal.

Part 2 Products**2.1 SUPPORT CHANNELS**

- .1 "U" shape, size 41 x 41 mm, 2.5 mm thick, set in poured concrete walls and ceilings, suspended, or surface mounted.
- .2 Galvanized steel supports.
- .3 Fasteners made of galvanized steel.

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Part 3 Execution**3.1 EXAMINATION**

- .1 Verification of Conditions: Verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for wire and box connectors installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate.
 - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
 - .3 Proceed with installation only after unacceptable conditions have been remedied and after received of written approval to proceed from the Departmental Representative.

3.2 INSTALLATION

- .1 Secure equipment to masonry, tile, and plaster surfaces with nylon shields.
- .2 Secure equipment to poured concrete with expandable inserts.
- .3 Secure equipment to hollow masonry walls or suspended ceilings with toggle bolts.
- .4 Support equipment, conduit or cables using clips, spring loaded bolts, cable clamps designed as accessories to basic channel members.
- .5 Fasten exposed conduit or cables to building construction or support system using straps.
 - .1 One-hole steel straps to secure surface conduits and cables 50 mm and smaller.
 - .2 Two-hole steel straps for conduits and cables larger than 50 mm.
 - .3 Beam clamps to secure conduit to exposed steel work.
- .6 Suspended support systems.
 - .1 Support individual cable or conduit runs with 6 mm diameter threaded rods and spring clips.
 - .2 Support 2 or more cables or conduits on "U"-channels supported by 6 mm diameter threaded rod hangers where direct fastening to building construction is impractical.
- .7 For surface mounting of two or more conduits use "U"-channels at a maximal 1.5-m interval.
- .8 Provide metal brackets, frames, hangers, clamps, and related types of support structures where indicated or as required to support conduit and cable runs.
- .9 Ensure adequate support for raceways and cables dropped vertically to equipment where there is no wall support.
- .10 Do not use wire lashing or perforated strap to support or secure raceways or cables.
- .11 Do not use supports or equipment installed for other trades for conduit or cable support.

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- .12 Install fastenings and supports as required for each type of equipment cables and conduits, and in accordance with manufacturer's installation recommendations.
- .13 Install lattice supports for the vertical conductors located in the vertical channels independent of the terminal connections and at interval not exceeding Table 21 of the Canadian Electrical Code – First Part. These supports shall maintain the channel continuity without damaging the latter's conductor or envelope. Anchor the supports inside the boxes.

3.3 CLEANING

- .1 Progress Cleaning: Clean in accordance with Section 01 74 00 - Cleaning.
 - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: Upon completion remove surplus materials, rubbish, tools, and equipment, in accordance with Section 01 74 00 - Cleaning.
- .3 Waste Management: Separate waste materials for recycling in accordance with Section 01 74 19 - Waste Management and Disposal.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

Part 1 General**1.1 RELATED REQUIREMENTS**

- .1 Section 26 05 00 - Common Work Results for Electrical.

1.2 REFERENCE STANDARDS

- .1 Canadian Standards Association (CSA International).
 - .1 CSA G40.20/G40.21-04, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
- .2 Health Canada/Workplace Hazardous Materials Information System (WHMIS).
 - .1 Material Safety Data Sheets (MSDS).
- .3 National Research Council Canada (NRC-CNRC).
 - .1 National Building Code of Canada (NBC) - 2015.
- .4 American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE).
 - .1 ASHRAE, Applications Handbook (SI).
- .5 American Society for Testing and Materials International (ASTM).
 - .1 ASTM E488-10, Standard Test Methods for Strength of Anchors in Concrete and Masonry Elements.
- .6 Sheet Metal and Air-Conditioning Contractors' National Association (SMACNA).
 - .1 SMACNA, Addendum No. 1, September 2000 to Seismic Restraint Manual, Guidelines for Mechanical Systems.
 - .2 SMACNA, Seismic Restraint Manual, Guidelines for Mechanical Systems.

1.3 DEFINITIONS

- .1 SRS: Acronym for Seismic Restraint System.

1.4 DESCRIPTION

- .1 SRS fully integrated into, and compatible with:
 - .1 Noise and vibration controls specified.
 - .2 Structural, mechanical, electrical design of project.
- .2 Systems, equipment not required to be operational during and after seismic event.
- .3 During seismic event, SRS to prevent systems and equipment from causing personal injury and from moving from normal position.
- .4 Designed by a Professional Engineer specializing in design of SRS and registered in Province of Quebec.

1.5 ACTION AND INFORMATIONAL 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 design data including:
 - .1 Full details of design criteria.
 - .2 Design calculations, including restraint loads resulting from seismic forces in accordance with National Building Code (detailed work sheets and tables).
 - .3 Separate shop drawings for each SRS and devices for each system, equipment.
 - .4 Identification of location of devices.
 - .5 Schedules of types of SRS equipment and devices, and related items.
 - .6 Details of fasteners and attachments to structure, anchorage loadings, attachment methods.
 - .7 Installation procedures and instructions.
 - .8 Design calculations including restraint loads to NBC and Supplement.
 - .3 Quality Assurance Submittals:
 - .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.

1.6 RESPONSABILITIES

- .1 Each contractor is responsible for the seismic measures undertaken and required by his trade.
- .2 The conception of each seismic device must be designed by an engineer that is registered to practice in Quebec, Canada, mandated by the Contractor. The engineer must sign and seal the design plans.

1.7 ANCHORING DEVICES

- .1 Install the anchoring devices and the seismic stabilizers for the conduits and equipment according to the prescriptions in the "ASHRAE, A Practical Guide to Seismic Restraint" book, the ANSI-SMACNA 001 Standard and according to the building classification.

Part 2 Products**2.1 GENERAL**

- .1 All electrical equipment mounted on suspended ceilings must be attached directly to the building structure.
- .2 Seismic devices must prevent permanent displacement and damage caused by the horizontal and vertical movements, and overturning.
- .3 Seismic devices must be compatible with the electromechanical design. They should not interfere with normal operation of electromechanical systems.
- .4 SRS to provide gentle and steady cushioning action and avoid high impact loads. The latter must not interfere with any sound or vibration treatment elements.
- .5 Fasteners and attachment points to resist same load as seismic restraints.
- .6 Fasteners installed with a nail gun or in holes made to this effect are prohibited.
- .7 No device or related support nor any plot should yield before the structure or the structure breaks.
- .8 SRS utilizing cast iron or threaded pipe is not permitted.
- .9 Seismic control measures not to interfere with integrity of firestopping.
- .10 Accessories, such as speakers and lighting fixtures installed in suspended ceilings, do not have to be stabilized, except in exit corridors or if the ceiling is specifically designed to withstand earthquakes.

2.2 SRS DEVICES

- .1 The supports must be complete with longitudinal and transverse bracings. They can be rigid or cable types.
- .2 Do not stabilize material if the length of the suspension rods is less than 300 mm.
- .3 Stabilize the channels and electrical conduits of 35 mm nominal diameter and more, located in mechanical rooms.
- .4 Stabilize the channels and electrical conduits of 63 mm nominal diameter and more, located outside of mechanical rooms.
- .5 Install mechanical restraint devices at the following frequency:
 - .1 For transversal restraint:
 - .1 SHL-A: every 6.1 m linear meters;
 - .2 SHL-B: every 10 linear meters;
 - .3 SHL-C: every 12.2 linear meters.
 - .2 For longitudinal restraint:
 - .1 SHL-A: every 12 linear meters;
 - .2 SHL-B: every 20 linear meters;

.3 SHL-C: every 24.4 linear meters.

- .6 A transversal bracing can serve as a longitudinal brace, if the latter is installed 600 mm away from a channel/conduit direction change.

2.3 SRS FOR STATIC EQUIPMENT, SYSTEMS

- .1 The material must be fixed to the suspension supports that must be installed to the structure.
- .2 Use of or many of the following methods below or as per indications on drawings:
- .1 Anchor equipment supports to structure;
 - .2 Stabilize the equipment mechanically using cables;
 - .3 Brace suspensions in each plane;
 - .4 Brace the suspensions to the structure.
- .3 SCS to prevent sway in horizontal plan, “rocking” in vertical plane, sliding and buckling in axial direction.
- .4 Hanger rods to withstand compressive loading and buckling.

2.4 EQUIPMENT HUNG WITH ISOLATORS

- .1 The material must be fixed to suspension supports that in turn, must be fixed using cables to the structure.
- .2 The devices must act continuously and in a supple manner.
- .3 The SRS must not constrain the soundproofing and antivibration properties of any element. In normal exploitation, a 6 to 12 mm gap between the equipment and the SRS must be maintained.

2.5 EQUIPMENT SUPPORTED WITH ISOLATORS

- .1 In cases where SRS are used, the latter must be designed and installed to resist minimal acceleration forces.
- .2 The devices must never be compressed to the point of losing their efficiency.
- .3 When standard isolators are used, the SRS must be incorporated to the antivibration elements to resist “toppling” of the latter.
- .4 The SRS must not constrain the soundproofing and antivibration properties of any element. In normal exploitation, a 6 to 12 mm gap between the equipment and the SRS must be maintained.

Part 3 Execution

3.1 INSTALLATION

- .1 To withstand same maximum load that seismic restraint is to resist and in every direction.

- .2 Confirm that the connection to the conduits and channels will not diminish the flexibility of the antivibration elements, and the conduits and channels will not transmit vibrations.
- .3 For equipment with no integrated attach points, provide attach points with “belt” systems.
- .4 The structural base of any equipment must be stabilized to prevent toppling.
- .5 A 25-mm clearance must be respected between a SRS and any service element.

3.2 ANCHORS

- .1 Check that anchor bolts, diameters of the ankles, depth of the indentations in the concrete and length of the welds are done according to the drawings submitted for approval.
- .2 Bolt all the material that is not insulated to vibration transmission to the structure.
- .3 Oblong openings for adjustment bolts are prohibited.
- .4 To improve seismic resistance, smaller conduits and channels can be attached to larger conduits and channels that will retain them. The inverse practice is prohibited.
- .5 Anchors in the concrete slabs should be removed from the edges following the standard ASTM E488 and recommendations of the manufacturer of the anchors.

3.3 SLACK CABLE SYSTEMS (SCS)

- .1 Connect to suspended equipment so that axial projection of wire passes through centre of gravity of equipment.
- .2 Use appropriate grommets, shackles, other hardware to ensure alignment of restraints and to avoid bending of cables at connection points.
- .3 Orient restraint wires on ceiling hung equipment at approximately 90° to each other (in plan), tie back to structure at maximum of 45° to structure.
- .4 Tighten cable to reduce slack to 19 mm under thumb pressure. Cable not to support weight during normal operation.

3.4 INSTALLATION VERIFICATION FROM MANUFACTURER

- .1 The engineer that designed the SRS must be on-site to verify the conformity of the installation. Then, the latter must supply a report containing deficiency resolving recommendations (if any) to the Departmental Representative.
- .2 If applicable, the Contractor must make the necessary corrections and adjustments based on the written report submitted by the supplier.

END OF SECTION

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Part 1 General**1.1 RELATED REQUIREMENTS**

- .1 Section 26 05 00 - Common Work Results for Electrical.

1.2 REFERENCE STANDARDS

- .1 CSA Group (CSA).
 - .1 CSA C22.1-F-15, Canadian Electrical Code, Part 1, 23rd Edition.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Provide manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish, and limitations.
- .3 Provide Shop Drawings: In accordance with Section 01 33 00 - Submittal Procedures.
 - .1 Submit drawings stamped and signed by professional engineer registered or licensed in the Province of Quebec.

1.4 DELIVERY, STORAGE, AND HANDLING

- .1 Waste Management and Disposal:
 - .1 Separate waste materials for recycling in accordance with Section 01 74 19 - Waste Management and Disposal.

Part 2 Products**2.1 SPLITTERS**

- .1 Construction: Sheet metal enclosure, welded corners, and formed hinged cover suitable for locking in closed position.
- .2 Terminations: Connection blocks or main and branch lugs to match required size and number of incoming and outgoing conductors, as indicated.
- .3 Spare Terminals: Minimum three spare terminals spare or lugs on each connection or lug block sized less than 400 A.

2.2 JUNCTION AND PULL BOXES

- .1 Construction: Welded steel enclosure.

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- .2 Covers Flush Mounted: 25 mm minimum extension all around.
- .3 Covers Surface Mounted: Screw-on flat covers.

Part 3 Execution**3.1 SPLITTER INSTALLATION**

- .1 Mount plumb, true, and square to building lines.
- .2 Extend splitters full length of equipment arrangement, except where indicated otherwise.

3.2 JUNCTION, PULL BOXES, AND CABINETS INSTALLATION

- .1 Install pull boxes in inconspicuous, but accessible locations.
- .2 The main junction and pull boxes are not indicated. Install additional pull boxes in order to ensure the conduits between each box have a length inferior to 30 m and in such a way to not have more than three 90° bends, or the equivalent between distribution boxes and two 90° bends, or the equivalent for other empty network conduits.
- .3 All the junction or pull boxes must be of appropriate size, according to the number of conductors and the associated conduit diameter.

3.3 IDENTIFICATION

- .1 Equipment Identification: To Section 26 05 00 - Common Work Results for Electrical.
- .2 Identification Labels: Size 2, indicating the name of the network, the power source, the allowable current, the tension, and the number of phases.

END OF SECTION

Part 1 General**1.1 RELATED REQUIREMENTS**

- .1 Section 26 05 00 - Common Work Results for Electrical.

1.2 REFERENCE STANDARDS

- .1 CSA Group (CSA).
 - .1 CSA C22.1-F15, Canadian Electrical Code, Part 1, 23rd Edition.
 - .2 CSA C22.2 No.40 (R2009), Short Circuit, Junction and pull Boxes.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

1.4 DELIVERY, STORAGE, AND HANDLING

- .1 Deliver, store, and handle materials in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Waste Management and Disposal:
 - .1 Separate waste materials for recycling in accordance with Section 01 74 19 - Waste Management and Disposal.

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.
- .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 CONDUIT BOXES

- .1 Cast FS or FD aluminum boxes with factory-threaded hubs and mounting feet for surface wiring of devices.

2.3 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 35 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. Do not install reducing washers.
- .5 Vacuum clean interior of outlet boxes before installation of wiring devices.
- .6 Identify systems for outlet boxes as required.

END OF SECTION

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Part 1 General**1.1 RELATED REQUIREMENTS**

- .1 Section 26 05 00 - Common Work Results for Electrical.

1.2 REFERENCE STANDARDS

- .1 CSA Group (CSA).
 - .1 CAN/CSA C22.2 No. 18-98(R2003), Outlet Boxes, Conduit Boxes, Fittings and Associated Hardware, A National Standard of Canada.
 - .2 CSA C22.2 No. 45-M1981(R2003), Rigid Metal Conduit.
 - .3 CSA C22.2 No. 56-04, Flexible Metal Conduit and Liquid-Tight Flexible Metal Conduit.
 - .4 CSA C22.2 No. 83-M1985(R2003), Electrical Metallic Tubing.
 - .5 CSA C22.2 No. 211.2-M1984(R2003), Rigid PVC (Unplasticized) Conduit.
 - .6 CAN/CSA C22.2 No. 227.3-05, Nonmetallic Mechanical Protection Tubing (NMPT), A National Standard of Canada (February 2006).

1.3 ACTION AND INFORMATIONAL 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.

1.4 QUALITY INSURANCE

- .1 Test Report: Submit the testing reports delivered by independent and well-known laboratories.
- .2 Certification: Submit the signed documents from the manufacturer, certifying that the products and materials satisfy the required physical characteristics and performance criteria.
- .3 Instructions: Submit installation instructions supplied by the manufacturer.

1.5 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate waste materials for recycling in accordance with Section 01 74 19 - Waste Management and Disposal.
- .2 Place materials defined as hazardous or toxic waste in designated containers.
- .3 Ensure emptied containers are sealed and stored safely for disposal away from children.

1.6 GENERAL

- .1 All the conduits, tubes, and their paths are not necessarily on the drawings. Those that are present are represented schematically.
- .2 For communications and fire alarm, the entire length of all the cables must be painted in the factory. The color required per cable is as specified in Section 26 05 00.

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 Rigid Metal Conduit: To CSA C22.2 No. 45, hot dipped galvanized steel threaded.
- .2 Epoxy Coated Conduit: To CSA C22.2 No. 45, with zinc coating and corrosion resistant epoxy finish inside and outside.
- .3 Electrical Metallic Tubing (EMT): To CSA C22.2 No. 83, with couplings, surface mounted, and interior use only.
- .4 Flexible Metal Conduit: To CSA C22.2 No. 56, liquid-tight flexible metal.
- .5 Conduits and tubes to have a minimal nominal diameter of 21 mm, unless noted otherwise.

2.3 CONDUIT FASTENINGS

- .1 One-hole galvanized 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 "U"-Channel type supports for two or more conduits at 1.5-m intervals.
- .4 Threaded rods, 6 mm diameter, to support suspended channels.
- .5 Metallic fasteners only. Plastic fasteners are strictly prohibited.

2.4 CONDUIT FITTINGS

- .1 Fittings: To CAN/CSA C22.2 No. 18, manufactured for use with conduit specified.
Coating: Same as conduit.

.2 Ensure factory "ells" where 90° bends for 25 mm and larger conduits.

.3 Watertight connectors and couplings for EMT.

.1 Set-screws are not acceptable.

2.5 EXPANSION FITTINGS FOR RIGID CONDUIT

.1 Weatherproof expansion fittings with internal bonding assembly suitable for 100 mm linear expansion.

.2 Watertight expansion fittings with integral bonding jumper suitable for linear expansion and 19 mm deflection.

.3 Weatherproof expansion fittings for linear expansion at entry to panel.

2.6 FISH CORD

.1 Polypropylene, length in accordance to each conduit and to exceed each conduit by 3 m.

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 unfinished areas, in mechanical and electrical service rooms.

.3 Use rigid galvanized steel threaded conduit, in explosion proof locations or when they risk undergoing mechanical damage.

.4 Use epoxy coated conduit in corrosive areas.

.5 Use electrical metallic tubing (EMT) when not subjected to mechanical damage, except in cast concrete.

.6 It is prohibited to use EMT conduits in dangerous locations where corrosive vapours can form.

.7 Use liquid tight flexible metal conduit for connection to vibrating motors or transformers.

.1 Unless otherwise indicated, the maximum length of this type of conduit is 1 m.

.8 Minimum conduit size for lighting and power circuits: 21 mm.

.9 Bend conduit cold:

.1 Replace conduit if kinked or flattened more than $\frac{1}{10}$ th of its original diameter.

- .10 Mechanically bend steel conduit over 21 mm diameter.
- .11 Field threads on rigid conduit must be of enough length to draw conduits up tight.
- .12 Install fish cord in empty conduits.
- .13 Use firestop paste around ducts passing through fire separations.
- .14 Run 2-27 mm spare conduits up to ceiling space and 2-27 mm spare conduits down to ceiling space from each panel.
 - .1 Terminate these conduits in 152 x 152 x 102 mm junction boxes in ceiling space or in case of an exposed concrete slab, terminate each conduit in flush concrete type box.
- .15 Remove and replace blocked conduit sections.
 - .1 Do not use liquids to clean out conduits.
- .16 Dry conduits out before installing wire.
- .17 Install metal supports that insert into ceiling grid's "T's" for installation of the exit signage and fire/smoke detectors.
- .18 Install an expansion connection on all the conduits that go through a building expansion joint.

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, if required.
- .4 Group conduits wherever possible on suspended or 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 in accordance with Section 01 74 00 - Cleaning.
- .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 REQUIREMENTS**

- .1 Section 26 05 00 - Common Work Results for Electrical.

1.2 REFERENCE STANDARDS

- .1 CSA Group (CSA)
 - .1 CSA C22.2 No.26-1952 (R2009), Construction and Test of Wireways, Auxiliary Gutters and Associated Fittings.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature, and data sheets for wireways and auxiliary gutters, and include product characteristics, performance criteria, physical size, finish, and limitations.

1.4 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.

1.5 DELIVERY, STORAGE, AND HANDLING

- .1 Deliver, store, and handle materials in accordance with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: Deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect wireways and auxiliary gutters from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.

Part 2 Products**2.1 WIREWAYS**

- .1 Wireways and fittings: to CSA C22.2 No.26.
- .2 103 mm x 103 mm sheet steel wireways with hinged cover to give uninterrupted access. Wireway with wire separating barriers between 120/200 V and Control/Telecom systems.

- .3 Finish: Baked grey enamel in accordance with Section 26 05 00 - Common Work Results for Electrical.
- .4 Elbows, tees, couplings and hanger fittings manufactured as accessories to wireway supplied.

Part 3 Execution

3.1 EXAMINATION

- .1 Verification of Conditions: Verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for wireways and auxiliary gutters installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate in presence of Departmental Representative.
 - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
 - .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 INSTALLATION

- .1 Install wireways and auxiliary gutters in accordance with manufacturer's written recommendations.
- .2 Keep number of elbows, offsets, connections to minimum.
- .3 Install supports, elbows, tees, connectors, fittings.
- .4 Install barriers where required.
- .5 Install gutter to full length of equipment.
- .6 Ground metallic wireways and gutters with a #6 AWG bare copper.
- .7 The gutter must be installed with the door facing inside the building. Sufficient space must be left between the gutter and the wall and the ceiling to allow passage of the ducts of the other systems and the connection of the loads from the gutter.

3.3 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 00 - Cleaning.
 - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: Upon completion remove surplus materials, rubbish, tools, and equipment in accordance with Section 01 74 00 - Cleaning.

END OF SECTION

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Part 1 General**1.1 RELATED REQUIREMENTS**

- .1 Section 26 05 00 - Common Work Results for Electrical.

1.2 REFERENCE STANDARDS

- .1 Insulated Cable Engineers Association, Inc. (ICEA).

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and datasheets for cables, and include product characteristics, performance criteria, physical size, finish, and limitations.

1.4 DELIVERY, STORAGE, AND HANDLING

- .1 Deliver, store, and handle materials in accordance with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: Deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials off ground and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect cables from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.
- .4 Packaging Waste Management: Remove for reuse in accordance with Section 01 74 19 - Waste Management and Disposal.

Part 2 Products**2.1 CABLE PROTECTION**

- .1 Yellow indicator cable to locate conduits that are buried in the soil or other protection as per indications on drawing.

Part 3 Execution**3.1 EXAMINATION**

- .1 Verification of Conditions: Verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for cable installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate.
 - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
 - .3 Proceed with installation only after unacceptable conditions have been remedied.

3.2 CABLE INSTALLATION IN DUCTS

- .1 Install cables in ducts as indicated.
- .2 Do not pull spliced cables inside ducts.
- .3 Install multiple cables in duct simultaneously.
- .4 Use CSA approved lubricants of type compatible with cable jacket to reduce pulling tension.
- .5 To facilitate matching of colour coded multiconductor control cables reel off in same direction during installation.
- .6 Before pulling cable into ducts and until cables are properly terminated, seal ends of lead covered cables with wiping solder; seal ends of non-leaded cables with moisture seal tape.
- .7 After installation of cables, seal duct ends with duct sealing compound.

3.3 FIELD QUALITY CONTROL

- .1 Perform tests in accordance with Section 26 05 00 - Common Work Results for Electrical.
- .2 Perform tests using qualified personnel.
 - .1 Include necessary instruments and equipment.
- .3 Check phase rotation and identify each phase conductor of each feeder.
- .4 Check each feeder for continuity, short circuits and grounds.
 - .1 Ensure resistance to ground of circuits is not less than 50 megohms.
- .5 Pre-acceptance tests:
 - .1 After installing cable but before splicing and terminating, perform insulation resistance test with 1,000 V megger on each phase conductor.
 - .2 Check insulation resistance after each splice and/or termination to ensure that cable system is ready for acceptance testing.

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- .6 Provide Departmental Representative with list of test results showing location at which each test was made, circuit tested, and result of each test.
- .7 Remove and replace entire length of cable if cable fails to meet any of test criteria.

3.4 CLEANING

- .1 Progress Cleaning: Clean in accordance with Section 01 74 00 - Cleaning.
 - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: Upon completion remove surplus materials, rubbish, tools, and equipment in accordance with Section 01 74 00 - Cleaning.
- .3 Waste Management: Separate waste materials for recycling in accordance with Section 01 74 19 - Waste Management and Disposal.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.5 PROTECTION

- .1 Repair damage to adjacent materials caused by cables installation.

END OF SECTION

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Part 1 General**1.1 RELATED REQUIREMENTS**

- .1 Section 26 05 00 - Common Work Results for Electrical.
- .2 Section 26 50 00 - Lighting.

1.2 REFERENCE STANDARDS

- .1 CSA Group (CSA).
 - .1 CSA C22.1-15, Canadian Electrical Code, Part 1 (23rd Edition), Safety Standard for Electrical Installations.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for photoelectric devices, and include product characteristics, performance criteria, physical size, finish, and limitations.

1.4 DELIVERY, STORAGE, AND HANDLING

- .1 Deliver, store, and handle materials in accordance with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: Deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials off ground, indoors, in dry location, and in accordance with manufacturer's recommendations.
 - .2 Store and protect photoelectric devices from nicks, scratches, and blemishes.
 - .3 Protect metal accessories and trim from being bent or damaged.
 - .4 Replace defective or damaged materials with new.
- .4 Packaging Waste Management: Remove for reuse as specified in Section 01 74 19 - Waste Management and Disposal.

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Part 2 Products**2.1 PHOTOELECTRIC LIGHTING CONTROL**

- .1 Photoelectric Lighting Controls: To CSA C22.1.
 - .1 Wall-mounting.
 - .2 Capable of commanding a lighting contactor.
 - .3 Voltage variation: $\pm 10\%$.
 - .4 Temperature range: -40°C to $+70^{\circ}\text{C}$.
 - .5 Rated for 5,000 operations.
 - .6 Delayed start-up.
 - .7 Wall-mounting bracket.
 - .8 Switching time delay of 30 s.

Part 3 Execution**3.1 EXAMINATION**

- .1 Verification of Conditions: Verify conditions of substrates previously installed under other Sections or Contracts are acceptable for lighting control device installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate.
 - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
 - .3 Proceed with installation only after unacceptable conditions have been remedied.

3.2 INSTALLATION

- .1 Install photoelectric controls in accordance with manufacturer's written instructions and to CSA C22.1.

3.3 CLEANING

- .1 Progress Cleaning: Clean in accordance with Section 01 74 00 - Cleaning.
 - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: Upon completion remove surplus materials, rubbish, tools, and equipment in accordance with Section 01 74 00 - Cleaning.
- .3 Waste Management: Separate waste materials for recycling in accordance with Section 01 74 19 - Waste Management and Disposal.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.4

PROTECTION

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by lighting control devices installation.

END OF SECTION

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Part 1 General**1.1 RELATED REQUIREMENTS**

- .1 Section 26 05 00 - Common Work Results for Electrical.

1.2 REFERENCE STANDARDS

- .1 CSA Group (CSA).
 - .1 CAN/CSA-C22.2 No.47-M90(R2007), Air-Cooled Transformers (Dry Type).
 - .2 CSA C9-02(R2007), Dry-Type Transformers.
 - .3 CAN/CSA-C802.2-06, Minimum Efficiency Values for Dry Type Transformers.
- .2 National Research Council Canada (NRC).
 - .1 National Energy Code of Canada for Buildings 2015.
- .3 National Electrical Manufacturers Association (NEMA).

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - Submit manufacturer's instructions, printed product literature, and data sheets for dry type transformers, and include product characteristics, performance criteria, physical size, finish, and limitations.

1.4 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Operation and Maintenance Data: Submit operation and maintenance data for dry-type transformers for incorporation into manual.

1.5 DELIVERY, STORAGE, AND HANDLING

- .1 Deliver, store, and handle materials in accordance with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: Deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials indoors, off ground, and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

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- .2 Store and protect dry type transformers from nicks, scratches, and blemishes.
- .3 Replace defective or damaged materials with new.
- .4 Packaging Waste Management: In accordance with Section 01 74 19 - Waste Management and Disposal.

Part 2 Products

2.1 DESIGN DESCRIPTION

- .1 All the required transformers must come from a unique manufacturer.
- .2 General characteristics:
 - .1 Type: ANN.
 - .2 Single or three-phase according to indications.
 - .3 Power: According to indications
 - .4 Primary and secondary voltages: According to indications, 60 Hz.
 - .5 Three-phase transformer with three primary coils (triangle) and three secondary coils (star).
 - .6 Four tension taps: $\pm 2\frac{1}{2}\%$, $\pm 5\%$.
 - .7 Insulation: Class H and temperature delta of 150°C.
 - .8 Rating: To CSA C802.2.
 - .9 Basic Impulse Level (BIL): Standard.
 - .10 Hipot: Standard.
 - .11 Average sound level: Standard.
 - .12 Impedance at 170°C: Standard.
 - .13 Enclosure: NEMA 1, removable metal front panel, sprinkler proof.
 - .14 Mounting: Wall or floor.
 - .15 Finish: In accordance with Section 26 05 00 - Common Work Results for Electrical.
 - .16 Copper windings.
 - .17 K-Rated transformers as indicated on drawings.
 - .18 Voltage Regulation to be 4 % or better.
 - .19 Antivibration supports such as Novibra or accepted equivalent.

2.2 EQUIPMENT IDENTIFICATION

- .1 Provide equipment identification in accordance with Section 26 05 00 - Common Work Results for Electrical.
- .2 Label size 7 to indicate the primary and secondary voltage, as well as the power.

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Part 3 Execution**3.1 EXAMINATION**

- .1 Verification of Conditions: Verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for dry type transformers installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate.
 - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
 - .3 Proceed with installation only after unacceptable conditions have been remedied.

3.2 INSTALLATION

- .1 Mount dry type transformers up to 75 kVA on wall.
- .2 Mount dry type transformers above 75 kVA on floor under a concrete base.
- .3 Ensure adequate clearance around transformer for ventilation.
- .4 Install transformers in level upright position.
- .5 Remove shipping supports only after transformer is installed and just before putting into service.
- .6 Loosen isolation pad bolts until no compression is visible.
- .7 Make primary and secondary connections in accordance with wiring diagram.
- .8 Energize transformers after installation is complete.
- .9 Make conduit entry into bottom $\frac{1}{3}$ of transformer enclosure.
- .10 Install the vibration insulators at the base between the supports and the concrete base.
- .11 Comply with applicable seismic measures.
- .12 Equipment commissioning to be executed as per Section 01 91 13 - General Commissioning (Cx) Requirements.

3.3 CLEANING

- .1 Progress Cleaning: Clean in accordance with Section 01 74 00 - Cleaning.
 - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: Upon completion remove surplus materials, rubbish, tools, and equipment, in accordance with Section 01 74 00 - Cleaning.

3.4 PROTECTION

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by dry-type transformers installation.

END OF SECTION

Part 1 General**1.1 RELATED REQUIREMENTS**

- .1 Section 26 05 00 - Common Work Results for Electrical.
- .2 Section 26 28 16.02 - Moulded Case Circuit Breakers

1.2 REFERENCE STANDARDS

- .1 CSA Group (CSA).
 - .1 CSA C22.2 No.29-11, Panelboards and Enclosed Panelboards.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature, and data sheets for panelboards, and include product characteristics, performance criteria, physical size, finish, and limitations.
- .3 Shop Drawings:
 - .1 Submit drawings stamped and signed by professional engineer registered or licensed in the Province of Quebec.
 - .2 Include on drawings:
 - .1 Electrical detail of panel, branch breaker type, quantity, ampacity, and enclosure dimension.

1.4 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Operation and Maintenance Data: Submit operation and maintenance (O&M) data for panelboards for incorporation into O&M Manual.

1.5 DELIVERY, STORAGE, AND HANDLING

- .1 Deliver, store, and handle materials in accordance with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: Deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials off ground, indoors, and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

- .2 Store and protect panelboard from nicks, scratches, and blemishes.
- .3 Replace defective or damaged materials with new.
- .4 Packaging Waste Management: Remove for reuse in accordance with Section 01 74 19 - Waste Management and Disposal.

Part 2 Products

2.1 PANELBOARDS

- .1 Panelboards: To CSA C22.2 No.29 and product of one manufacturer.
 - .1 Install circuit breakers in panelboards before shipment.
 - .2 In addition to CSA requirements manufacturer's nameplate must show fault current that panel including breakers has been built to withstand.
- .2 250 and 600-V panelboards: Bus and breakers rated for 14 kA (symmetrical) minimally for the 600-V panelboards and 10 kA (symmetrical) minimally for the 250-V panelboards, unless otherwise indicated.
- .3 Sequence phase bussing with odd numbered breakers on left and even on right, with each breaker identified by permanent number identification as to circuit number and phase.
- .4 Panelboards: Mains, number of circuits, and number and size of branch circuit breakers as indicated.
- .5 Minimum of two flush locks for each panelboard.
- .6 Two keys for each panelboard and key panelboards alike.
- .7 Copper bus with neutral of same ampere rating of mains.
- .8 Mains: Suitable for bolt-on breakers.
- .9 Trim with concealed front bolts and hinges.
- .10 Trim and door finish, grey color baked enamel, type to be "door-in-door" to ease maintenance.
- .11 Ground bus.
- .12 Where the word "Espace" (Space) is used to denominate a circuit, no breaker should be installed, in addition of a removable cover plate. The word "Libre" (Vacant) means to supply and install a breaker.

2.2 BREAKERS

- .1 Breakers: to Section 26 28 16.02 - Moulded Case Circuit Breakers.
- .2 Breakers with thermal and magnetic tripping in panelboards, except indicated otherwise.
- .3 Main Breaker: Separately mounted on top or bottom of panel to suit cable entry. When mounted vertically, down position should open breaker.

- .4 Lock-on devices for fire alarm, life safety lighting, door supervision, intercom, stairway lighting, and exit lighting circuits.
 - .1 Additional locking devices: Ten for each circuit breaker rating, to be provided to the Departmental Representative.

2.3 EQUIPMENT IDENTIFICATION

- .1 Provide equipment identification in accordance with Section 26 05 00 - Common Work Results for Electrical.
- .2 Nameplate for each panelboard, size 4 engraved as indicated.
- .3 Complete circuit directory with typewritten legend showing location and load of each circuit, mounted in plastic envelope at inside of panel door.

Part 3 Execution

3.1 EXAMINATION

- .1 Verification of Conditions: Verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for panelboards installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate.
 - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
 - .3 Proceed with installation only after unacceptable conditions have been remedied.

3.2 INSTALLATION

- .1 Locate panelboards as indicated and mount securely, plumb, true and square, to adjoining surfaces.
- .2 Install surface mounted panelboards on plywood backboards in accordance with Section 06 08 99 - Rough Carpentry for Minor Works. Where practical, group panelboards on common backboard.
- .3 Mount panelboards to height specified in Section 26 05 00 - Common Work Results for Electrical or as indicated.
- .4 Connect loads to circuits.
- .5 Connect neutral conductors to common neutral bus with respective neutral identified.
- .6 For each built-in panel, install three empty 53 mm conduits between the panel and the ceiling space. Terminate each conduit with 450 mm x 450 mm x 150 mm pull boxes in the nearest accessible ceiling space.

3.3 CLEANING

- .1 Progress Cleaning: Clean in accordance with Section 01 74 00 - Cleaning.
 - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: Upon completion remove surplus materials, rubbish, tools, and equipment, in accordance with Section 01 74 00 - Cleaning.
- .3 Waste Management: Separate waste materials in accordance with Section 01 74 19 - Waste Management and Disposal.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.4 PROTECTION

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by panelboard installations.

END OF SECTION

Part 1 General**1.1 RELATED REQUIREMENTS**

- .1 Section 26 05 00 - Common Work Results for Electrical.

1.2 REFERENCE STANDARDS

- .1 CSA Group (CSA).
 - .1 CSA C22.2 No.42-10, General Use Receptacles, Attachment Plugs and Similar Devices.
 - .2 CAN/CSA C22.2 No.42.1-F00(R2009), Cover Plates for Flush-Mounted Wiring Devices (Bi-national Standard, with UL 514D).
 - .3 CSA C22.2 No.55-FM1986(R2008), Special Use Switches.
 - .4 CSA C22.2 No.111-10, General-Use Snap Switches (Bi-national Standard, with UL 20).

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature, and data sheets for wiring devices, and include product characteristics, performance criteria, physical size, finish, and limitations.
- .3 Shop Drawings:
 - .1 Submit drawings stamped and signed by professional engineer registered or licensed in the Province of Quebec.
 - .1 Indicate on drawings:
 - .1 The details surrounding the integration in the architectural elements.

1.4 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Operation and Maintenance Data: Submit operation and maintenance(O&M) data for wiring devices for incorporation into O&M Manual.

1.5 DELIVERY, STORAGE, AND HANDLING

- .1 Deliver, store, and handle materials in accordance with manufacturer's written instructions.

- .2 Delivery and Acceptance Requirements: Deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect wiring devices from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.
- .4 Packaging Waste Management: Remove for reuse in accordance with Section 01 74 19 - Waste Management and Disposal.

Part 2 Products

2.1 SWITCHES

- .1 15 A, 120 V, single-pole, switches of "Industrial" specified grade.
- .2 switches with following features:
 - .1 Terminal holes approved for No. 10 AWG wire;
 - .2 Silver alloy contacts;
 - .3 Urea or melamine moulding for parts subject to carbon tracking;
 - .4 Suitable for back and side wiring;
 - .5 Toggle;
 - .6 Ivory.
- .3 Other Switches: Rated for voltage and allowable current of the downstream device, according to indications on drawings.
- .4 Toggle operated fully rated for tungsten filament and fluorescent lamps, and up to 120% of rated capacity of motor loads.
- .5 Switches of one manufacturer throughout project.

2.2 RECEPTACLES

- .1 Duplex receptacles of specified "Industrial" grade type, CSA type 5-15 R, 125 V, 15 A, "U" ground, with following features:
 - .1 Ivory urea moulded housing;
 - .2 Suitable for No. 10 AWG for back and side wiring;
 - .3 Break-off links for use as split receptacles;
 - .4 Eight back wired entrances, four side wiring screws;
 - .5 Triple wipe contacts and rivetted grounding contacts.
- .2 Single outlet receptacles for maintenance, specified "Industrial" quality allowing 15 and 20 A inputs, type CSA 5-20R, 125 V, 20 A.

- .3 Single outlet receptacles, twist-lock, specified "Industrial" quality, type CSA L5-20R, 125 V, 20 A.
- .4 Other outlets designed for allowable tension and ampacity: according to indications on drawings.
- .5 Receptacles of one manufacturer throughout project.

2.3 COVER PLATES

- .1 Stainless steel utility box cover for wiring devices installed in surface-mounted utility boxes.
- .2 All the cover plates must originate from a single and same manufacturer.
- .3 Stainless steel cover plates must be installed according to the specifications for the secured areas, mounted in built-in pull boxes.
- .4 Cast cover plates for wiring devices mounted in surface-mounted FS or FD type conduit boxes.
- .5 Weatherproof during use, double lift spring-loaded cast aluminum cover plates, complete with gaskets for outdoor-rated duplex receptacles, as indicated.
- .6 All installations must be provided by a single manufacturer.

Part 3 Execution

3.1 EXAMINATION

- .1 Verification of Conditions: Verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for wiring devices installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate.
 - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
 - .3 Proceed with installation only after unacceptable conditions have been remedied.

3.2 INSTALLATION

- .1 Switches:
 - .1 Install single throw switches with handle in "UP" position when switch closed.
 - .2 Install switches in gang type outlet box when more than one switch is required in one location.
 - .3 Mount toggle switches at height in accordance with Section 26 05 00 - Common Work Results for Electrical.

.2 Receptacles:

- .1 Install receptacles in gang type outlet box when more than one receptacle is required in one location.
- .2 Mount receptacles at height in accordance with Section 26 05 00 - Common Work Results for Electrical.
- .3 Where split receptacle has one portion switched, mount vertically and switch upper portion.
- .4 Install GFI type receptacles as indicated.

.3 Cover Plates:

- .1 Install suitable common cover plates where wiring devices are grouped.
- .2 Do not use cover plates meant for flush outlet boxes on surface-mounted boxes.

3.3 CLEANING

- .1 Progress Cleaning: Clean in accordance with Section 01 74 00 - Cleaning.
 - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: Upon completion remove surplus materials, rubbish, tools, and equipment, in accordance with Section 01 74 00 - Cleaning.
- .3 Waste Management: Separate waste materials for recycling in accordance with Section 01 74 19 - Waste Management and Disposal.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.4 PROTECTION

- .1 Protect installed products and components from damage during construction.
- .2 Protect stainless-steel cover plate finish with paper or plastic film until painting and other work is finished.
- .3 Repair damage to adjacent materials caused by wiring device installation.

END OF SECTION

Part 1 General**1.1 RELATED REQUIREMENTS**

- .1 Section 26 05 00 - Common Work Results for Electrical.

1.2 REFERENCE STANDARDS

- .1 CSA Group (CSA).
 - .1 CSA C22.2 No.106-05(R2010), HRC-Miscellaneous Fuses.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Provide fuse performance data characteristics for each fuse type and size above 200 A. The supplied characteristics should also include the average fusion time at a given current.
- .3 Shop Drawings:
 - .1 Provide shop drawings in accordance with Section 01 33 00 - Submittal Procedures.
 - .2 Submit drawings stamped and signed by professional engineer registered or licensed in the Province of Quebec.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Ship fuses in original containers.
- .2 Do not ship fuses installed in switchboard.
- .3 Store fuses in original containers in storage cabinet.
- .4 Waste Management and Disposal:
 - .1 Separate waste materials in accordance with Section 01 74 19 - Waste Management and Disposal.

1.5 EXTRA MATERIALS

- .1 Provide maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Three spare fuses of each type and size installed above 600 A.
- .3 Six spare fuses of each type and size installed up to and including 600 A.

Part 2 Products**2.1 FUSES - GENERAL**

- .1 Fuse type references L1, L2, J1, R1, etc., have been adopted for use in this specification.
- .2 Fuses: Product of one manufacturer.

2.2 FUSE TYPES

- .1 Class L fuses, 200 kA interruption capacity.
 - .1 Type L1: Time delay, capable of carrying 500% of its rated current for 10 s minimum.
 - .2 Type L2: Fast acting.
- .2 Class J fuses, 200 kA interruption capacity.
 - .1 Type J1, time delay, capable of carrying 500% of its rated current for 10 s minimum.

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.
- .4 Install spare fuses in fuse storage cabinet.

END OF SECTION

Part 1 General**1.1 RELATED REQUIREMENTS**

- .1 Section 26 05 00 - Common Work Results for Electrical.
- .2 Section 26 24 16.01 - Panelboards Breaker Type.
- .3 Section 26 28 20 - Ground Fault Circuit Interrupters – Class A.

1.2 REFERENCE STANDARDS

- .1 CSA Group (CSA).
 - .1 CSA C22.2 No. 5-09, Molded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures (Tri-national Standard with UL 489, and NMX-J-266-ANCE-2010).

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for circuit breakers and include product characteristics, performance criteria, physical size, finish, and limitations.
- .3 Include time-current characteristic curves for breakers with interrupting capacity of 22,000 A symmetrical (rms) and over at system voltage and with an allowable ampacity of 200 A and more.
- .4 Certificates:
 - .1 Prior to installation of circuit breakers in either new or existing installation, Contractor must submit three copies of a production certificate of origin from the manufacturer. Production certificate of origin must be duly signed by factory and local manufacturer's representative certifying that circuit breakers come from this manufacturer and are new and meet Standards and Regulations.
 - .1 Production certificate of origin must be submitted to Departmental Representative for approval.
 - .2 Delay in submitting production of certificate of origin will not justify any extension of contract and additional compensation.
 - .3 Any work of manufacturing, assembly, or installation to begin only after acceptance of production certificate of origin by Departmental Representative. Unless complying with this requirement, Departmental Representative reserves the right to mandate manufacturer listed on circuit breakers to authenticate new circuit breakers under the contract, and to Contractor's expense.

- .4 Production certificate of origin must contain the following information:
 - .1 Manufacturer's name and address and person responsible for authentication. Person responsible must sign and date certificate;
 - .2 Licensed dealer's name and address and person of distributor responsible for Contractor's account;
 - .3 Contractor's name and address, as well as person responsible for project;
 - .4 Local manufacturer's representative name and address. Local manufacturer's representative must sign and date certificate;
 - .5 Name and address of building where circuit breakers will be installed:
 - .1 Project title.
 - .2 End user's reference number.
 - .3 List of circuit breakers.

1.4 DELIVERY, STORAGE, AND HANDLING

- .1 Deliver, store, and handle materials in accordance with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: Deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store circuit breakers in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect circuit breaker from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.
- .4 Packaging Waste Management: Remove for reuse as specified in Section 01 74 19 - Waste Management and Disposal.

Part 2 Products

2.1 GENERAL REQUIREMENTS

- .1 Moulded-case circuit breakers, circuit breakers, accessory high-fault protectors and ground-fault circuit-interrupters: To CSA C22.2 No. 5
- .2 Bolt-on Moulded Case Circuit Breaker: Quick-make, quick-break type, for manual and automatic operation with temperature compensation for 40°C ambient.
- .3 Common-trip Breakers: With single handle for multi-pole applications.
- .4 Magnetic instantaneous trip elements in circuit breakers to operate only when value of current reaches setting.
 - .1 Trip settings on breakers with adjustable trips to range from 3-8 times current rating.

- .5 Circuit breakers to have minimally the same current interruption capacity as the panel it is installed in.

2.2 THERMAL MAGNETIC BREAKERS (DESIGN A)

- .1 Moulded case circuit breaker to operate automatically by means of thermal and magnetic tripping devices to provide inverse time current tripping and instantaneous tripping for short-circuit protection.

2.3 MAGNETIC BREAKERS (DESIGN B)

- .1 Moulded case circuit breaker to operate automatically by means of magnetic tripping devices to provide instantaneous tripping for short-circuit protection.

2.4 OPTIONAL FEATURES

- .1 Include:
 - .1 "On-Off" locking device for each breaker.

Part 3 Execution

3.1 EXAMINATION

- .1 Verification of Conditions: Verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate.
 - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
 - .3 Proceed with installation only after unacceptable conditions have been remedied.

3.2 INSTALLATION

- .1 Install circuit breakers as indicated.

3.3 CLEANING

- .1 Progress Cleaning: Clean in accordance with Section 01 74 00 - Cleaning.
 - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: Upon completion remove surplus materials, rubbish, tools, and equipment in accordance with Section 01 74 00 - Cleaning.

- .3 Waste Management: Separate waste materials in accordance with Section 01 74 19 - Waste Management and Disposal.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

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Part 1 General**1.1 RELATED REQUIREMENTS**

- .1 Section 26 05 00 - Common Work Results for Electrical.
- .2 Section 26 24 16.01 - Panelboards Breaker Type.
- .3 Section 26 28 16.02 - Moulded Case Circuit Breakers.

1.2 REFERENCE STANDARDS

- .1 CSA Group (CSA).
 - .1 CAN/CSA C22.2 No.144-M91(R2006), Ground Fault Circuit Interrupters.
- .2 National Electrical Manufacturers Association (NEMA).
 - .1 NEMA PG 2.2-1999(R2009), Application Guide for Ground Fault Protection Devices for Equipment.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for ground fault circuit interrupters and include product characteristics, performance criteria, physical size, finish, and limitations.
- .3 Shop Drawings:
 - .1 Submit drawings stamped and signed by professional engineer registered or licensed in the Province of Quebec.
- .4 Test and Evaluation Reports: Submit test report for field testing of ground fault equipment to Departmental Representative and certificate that system as installed meets criteria specified.

1.4 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Operation and Maintenance Data: Submit operation and maintenance (O&M) data for ground fault circuit interrupters for incorporation into O&M Manual.

1.5 DELIVERY, STORAGE, AND HANDLING

- .1 Deliver, store, and handle materials in accordance with manufacturer's written instructions.

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- .2 Delivery and Acceptance Requirements: Deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect ground fault circuit interrupters from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.
- .4 Packaging Waste Management: Remove for reuse in accordance with Section 01 74 19 - Waste Management and Disposal.

Part 2 Products**2.1 MATERIALS**

- .1 Equipment and components for ground fault circuit interrupters (GFCI): To CAN/CSA C22.2 No.144.
- .2 Components comprising ground fault protective system to be of same manufacturer.

2.2 BREAKER TYPE GROUND FAULT INTERRUPTER

- .1 Two-pole ground fault circuit interrupter for 15 A or 20 A, 120 V, single-phase, with testing and reset devices, as indicated.
 - .1 Transition device to detect ground faults, Class A.

2.3 GROUND FAULT PROTECTOR UNIT

- .1 Self-contained with 15 A or 20 A, 120 V circuit interrupter and duplex or single receptacle complete with:
 - .1 Solid state ground sensing device.
 - .2 Facility for testing and reset.
 - .3 CSA Enclosure 1, flush-mounted with stainless steel face plate.

Part 3 Execution**3.1 EXAMINATION**

- .1 Verification of Conditions: Verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for ground fault circuit interrupters installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate.

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- .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
- .3 Proceed with installation only after unacceptable conditions have been remedied.

3.2 INSTALLATION

- .1 Do not ground neutral on load side of ground fault relay.
- .2 Pass phase conductors, including neutral, through zero sequence transformers.
- .3 Connect supply and load wiring to equipment in accordance with manufacturer's recommendations.

3.3 FIELD QUALITY CONTROL

- .1 Perform tests in accordance with Section 26 05 00 - Common Work Results for Electrical and co-ordinate with Section 01 45 00 - Quality Control, if required.
- .2 Arrange for field testing of ground fault equipment by the Contractor before commissioning service.
- .3 Demonstrate simulated ground fault tests.

3.4 CLEANING

- .1 Progress Cleaning: Clean in accordance with Section 01 74 00 - Cleaning.
 - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: Upon completion remove surplus materials, rubbish, tools, and equipment in accordance with Section 01 74 00 - Cleaning.
- .3 Waste Management: Separate waste material in accordance with Section 01 74 19 - Waste Management and Disposal.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

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Part 1 General**1.1 RELATED REQUIREMENTS**

- .1 Section 26 05 00 - Common Work Results for Electrical.
- .2 Section 26 28 13.01 - Fuses - Low Voltage

1.2 REFERENCE STANDARDS

- .1 CSA Group.
 - .1 CAN/CSA-C22.2 No.4-04(R2009), Enclosed and Dead-Front Switches (Tri-National Standard, with ANCE NMX-J-162-2004 and UL 98).
 - .2 CSA C22.2 No.39-13, Fuseholder Assemblies.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for disconnect switches - fused and non-fused, and include product characteristics, performance criteria, physical size, finish, and limitations.

1.4 DELIVERY, STORAGE, AND HANDLING

- .1 Deliver, store, and handle materials in accordance with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: Deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect disconnect switches - fused and non-fused from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.
- .4 Packaging Waste Management: Remove for reuse in accordance with Section 01 74 19 - Waste Management and Disposal.

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Part 2 Products**2.1 SWITCHES**

- .1 Fused, and without fuse disconnect switch in NEMA 1 enclosure for interior use and NEMA 3R for exterior use.
- .2 Provision for padlocking in open position, by three locks.
- .3 Mechanically interlocked door to prevent opening when handle in "ON" (closed) position.
- .4 Fuses: Size as indicated, in accordance with Section 26 28 13.01 - Fuses - Low Voltage.
- .5 Fuseholders: To CSA C22.2 No.39, relocatable and suitable without adaptors, for type and size of fuse indicated.
- .6 Quick-make, quick-break action.
- .7 "ON-OFF" switch position indication on switch enclosure cover.
- .8 Construction to allow intensive use.
- .9 The switches installed on circuits for variable frequency drives and motors, as well as switches for elevator motors, must be equipped with an electrical lock with a N.O. and N.F. contact allowing to open the command circuit before the switch contacts open.

2.2 EQUIPMENT IDENTIFICATION

- .1 Provide equipment identification in accordance with Section 26 05 00 - Common Work Results for Electrical.
- .2 Indicate name of load controlled on size 4 nameplate as well as the type and rating of the fuse.

Part 3 Execution**3.1 EXAMINATION**

- .1 Verification of Conditions: Verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for disconnect switches - fused and non-fused installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate.
 - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
 - .3 Proceed with installation only after unacceptable conditions have been remedied.

3.2 INSTALLATION

- .1 Install disconnect switches complete with fuses if applicable.

3.3 CLEANING

- .1 Progress Cleaning: Clean in accordance with Section 01 74 00 - Cleaning.
 - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: Upon completion remove surplus materials, rubbish, tools, and equipment in accordance with Section 01 74 00 - Cleaning.
- .3 Waste Management: Separate waste materials in accordance with Section 01 74 19 - Waste Management and Disposal.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

Part 1 General**1.1 RELATED REQUIREMENTS**

- .1 Section 26 05 00 - Common Work Results for Electrical.
- .2 Section 26 29 03 - Control Devices.

1.2 REFERENCE STANDARDS

- .1 CSA Group (CSA).
 - .1 CSA C22.2 No.14-10, Industrial Control Equipment.
- .2 National Electrical Manufacturers Association (NEMA).
 - .1 NEMA ICS 2-2000 (R2005), Controllers, Contactors and Overload Relays Rated 600 V.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for contactors, and include product characteristics, performance criteria, physical size, finish, and limitations.

1.4 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Operation and Maintenance Data: Submit operation and maintenance data for contactors for incorporation into manual.

1.5 DELIVERY, STORAGE, AND HANDLING

- .1 Deliver, store, and handle materials in accordance with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: Deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect contactors from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.

- .4 Packaging Waste Management: Remove for reuse in accordance with Section 01 74 19 - Waste Management and Disposal.

Part 2 Products

2.1 CONTACTORS

- .1 Contactors: To CSA C22.2 No.14.
- .2 Electrically held controlled by pilot devices as indicated and rated for type of load controlled.
- .3 Mount in NEMA 1 enclosure, unless otherwise indicated.
- .4 Include following options in cover:
 - .1 Red LED indicating lamp (pilot lamp);
 - .2 "Manual-Off-Auto" rotative selector switch.
- .5 Control Transformer: Installed in the contactor's enclosure, command voltage as indicated on drawing (secondary voltage).
- .6 Unless otherwise indicated, the contactors shall be equipped of two N.O. contacts and two N.C. contacts.
- .7 Control Transformer: In accordance with Section 26 29 03 - Control Devices, factory wired and installed in contactor enclosure.

2.2 EQUIPMENT IDENTIFICATION

- .1 Identify equipment in accordance with Section 26 05 00 - Common Work Results for Electrical.
- .2 Size 4 nameplate indicating name of load controlled.

Part 3 Execution

3.1 INSTALLATION

- .1 Install contactors and connect power wires and auxiliary control devices.
- .2 Identify contactors with nameplates or labels indicating panel and circuit number.
- .3 Test contactors in accordance with 26 05 00 - Common Work Results for Electrical.

3.2 CLEANING

- .1 Progress Cleaning: Clean in accordance with Section 01 74 00 - Cleaning.
 - .1 Leave Work area clean at end of each day.

- .2 Final Cleaning: Upon completion remove surplus materials, rubbish, tools, and equipment, in accordance with Section 01 74 00 - Cleaning.
- .3 Waste Management: Separate waste materials in accordance with Section 01 74 19 - Waste Management and Disposal.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.3 PROTECTION

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by contactor installation.

END OF SECTION

Part 1 General**1.1 RELATED REQUIREMENTS**

- .1 Section 26 05 00 - Common Work Results for Electrical.
- .2 Section 26 29 01 - Contactors.

1.2 REFERENCE STANDARDS

- .1 CSA Group (CSA).
 - .1 CSA C22.2 No.14-10, Industrial Control Equipment.
- .2 National Electrical Manufacturers Association (NEMA).
 - .1 NEMA ICS 1-2000(R2008), Industrial Control and Systems: General Requirements.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature, and data sheets for control devices, and include product characteristics, performance criteria, physical size, finish, and limitations.
- .3 Shop Drawings:
 - .1 Submit drawings stamped and signed by professional engineer registered or licensed in the Province of Quebec.
 - .2 Include schematic, wiring, and interconnection diagrams.

1.4 QUALITY ASSURANCE

- .1 Conduct tests in accordance with Section 26 05 00 - Common Work Results for Electrical.

1.5 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Operation and Maintenance Data: Submit operation and maintenance (O&M) data for control devices for incorporation into O&M Manual.

1.6 DELIVERY, STORAGE, AND HANDLING

- .1 Deliver, store, and handle materials in accordance with manufacturer's written instructions.

- .2 Delivery and Acceptance Requirements: Deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect control devices from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.
- .4 Packaging Waste Management: Remove for reuse in accordance with Section 01 74 19 - Waste Management and Disposal.

Part 2 Products

2.1 THERMOSTAT (LINE VOLTAGE)

- .1 Wall-mounted.
- .2 Full Load Rating: 8 A at 120 VAC.
- .3 Temperature Setting Range: From 0°C to 30°C.
- .4 Markings in 5° increments.

2.2 THERMOSTAT PROTECTION

- .1 Install plastic protectors for the thermostats located in public spaces. The protectors must be equipped with a keyed lock.

2.3 LOW VOLTAGE RELAYS

- .1 Silent, thermal action.
- .2 Power Ratings:
 - .1 3,000 W at 120 V.
 - .2 5,000 W at 208 V.
 - .3 6,000 W at 240 V.
 - .4 6,000 W at 347 V.
- .3 Integrated transformer where required.
- .4 Use a transformer of enough capacity, independently, and installed in an appropriate space, when many relays are controlled from a single thermostat.

2.4 ELECTRONIC RELAYS

- .1 Triac type relays.
- .2 Integrated transformer when required.

- .3 Capacity: 25 A at 200 V or 347 V, as required on drawings.

Part 3 Execution

3.1 EXAMINATION

- .1 Verification of Conditions: Verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for control devices installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate.
 - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
 - .3 Proceed with installation only after unacceptable conditions have been remedied.

3.2 INSTALLATION

- .1 Install control devices and interconnect.

3.3 FIELD QUALITY CONTROL

- .1 Perform tests in accordance with Section 26 05 00 - Common Work Results for Electrical.
- .2 Depending upon magnitude and complexity, divide control system into convenient sections, energize one section at time, and check out operation of section.
- .3 Upon completion of sectional test, undertake group testing.
- .4 Check out complete system for operational sequencing.

3.4 CLEANING

- .1 Progress Cleaning: Clean in accordance with Section 01 74 00 - Cleaning.
 - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: Upon completion remove surplus materials, rubbish, tools, and equipment in accordance with Section 01 74 00 - Cleaning.
- .3 Waste Management: Separate waste materials in accordance with Section 01 74 19 - Waste Management and Disposal.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

Part 1 General**1.1 RELATED REQUIREMENTS**

- .1 Section 26 05 00 - Common Work Results for Electrical.
- .2 Section 26 29 03 - Control Devices.

1.2 REFERENCE STANDARDS

- .1 CSA/CSA International.
 - .1 CSA C22.2 No. 60947-4-1 - Low-Voltage Switchgear and Control Gear.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Provide manufacturer's printed product literature, specifications, and data sheets, and include product characteristics, performance criteria, physical size, finish, and limitations.
- .3 Shop Drawings:
 - .1 Provide shop drawings: In accordance with Section 01 33 00 - Submittal Procedures.
 - .1 Submit drawings stamped and signed by professional engineer registered or licensed in the Province of Quebec.
 - .2 Provide shop drawings for each type of starter to indicate:
 - .1 Mounting method and dimensions.
 - .2 Starter size and type.
 - .3 Layout and components.
 - .4 Enclosure types.
 - .5 Wiring diagram.
 - .6 Interconnection diagrams.
 - .7 The list of materials.

1.4 CLOSEOUT SUBMITTALS

- .1 Provide maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Submit operation and maintenance data for each type and style of motor starter for incorporation into maintenance manual.

- .3 Extra Materials:
 - .1 Provide listed spare parts for each different size and type of starter.
 - .1 Three contacts, stationary.
 - .2 Three contacts, movable.
 - .3 One contact, auxiliary.
 - .4 One control transformer.
 - .5 One operating coil.
 - .6 Two fuses.
 - .7 10% indicating lamp bulbs used.

1.5 DELIVERY, STORAGE, AND HANDLING

- .1 Deliver, store, and handle in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.
- .3 Packaging Waste Management: Remove for reuse in accordance with Section 01 74 19 - Waste Management and Disposal.

Part 2 Products

2.1 MATERIALS

- .1 Starters: To CSA C22.2 No. 60947-4-1.
 - .1 Half-power starters are not accepted.
 - .2 Obtain the motor's current from its identification plate to choose the ampacity of the overload heater.

2.2 MANUAL MOTOR STARTERS

- .1 Three or single-phase manual motor starters of size, NEMA type, rating, and enclosure type as indicated, with components as follows:
 - .1 Switching mechanism, quick-action and break;
 - .2 One overload heater, manual reset, trip indicating handle.
- .2 Accessories:
 - .1 Toggle switch: Standard labelled as indicated.
 - .2 Indicating light: LED type and colour as indicated.
 - .3 Locking tab to permit padlocking in "ON" or "OFF" position.

2.3 FULL VOLTAGE MAGNETIC STARTERS

- .1 Magnetic and combination magnetic starters of size, NEMA type, rating, and enclosure type as indicated with components as follows:
 - .1 Contactor solenoid operated, rapid action type;
 - .2 Motor overload protective device in each phase, manually reset from outside enclosure;
 - .3 Circuit terminals for command and electrical supply circuits;
 - .4 Wiring and schematic diagram inside starter enclosure in visible location;
 - .5 Identify each wire and terminal for external connections, within starter, with permanent number marking identical to diagram.
- .2 Combination type starters to include fused or not fused disconnect switch with operating lever on outside of enclosure to control and provision for:
 - .1 Locking in "OFF" position with up to 3 padlocks.
 - .2 Independent locking of enclosure door.
 - .3 Provision for preventing switching to "ON" position while enclosure door open.
- .3 Accessories:
 - .1 Rotative selector switches: Heavy duty, "MAN-OFF-AUTO".
 - .2 Indicating lights: Green LED to indicate functioning and red LED to indicate emergency operation.
 - .3 2-N/O and 2-N/C spare auxiliary contacts unless otherwise indicated.

2.4 CONTROL TRANSFORMER

- .1 Single-phase, dry type, control transformer with primary voltage as indicated and 120 V secondary, complete with secondary fuse, installed in with starter as indicated.
- .2 Size control transformer for control circuit load plus 20% spare capacity.

2.5 FINISHES

- .1 Apply finishes to enclosure in accordance with Section 26 05 00 - Common Work Results for Electrical.

2.6 EQUIPMENT IDENTIFICATION

- .1 Provide equipment identification in accordance with Section 26 05 00 - Common Work Results for Electrical.
- .2 Manual starter designation label, white plate, black letters, size 1, engraved as indicated.

Part 3 Execution**3.1 INSTALLATION**

- .1 Install starters and control devices in accordance with manufacturer's instructions. Complete the wiring for power and command circuits according to indications.
- .2 Install and wire, starters and controls as indicated.
- .3 Ensure correct fuses installed.
- .4 When the motor is not in plane of sight of the manual starter or the disconnect switch preceding the magnetic starter or the contactor, supply and install a disconnect switch within 1,500 mm from the motor.
- .5 Confirm motor nameplate and adjust overload device to suit.

3.2 FIELD QUALITY CONTROL

- .1 Perform tests in accordance with Section 26 05 00 - Common Work Results for Electrical and manufacturer's instructions.
- .2 Operate switches and contactors to verify correct functioning.
- .3 Perform starting and stopping sequences of contactors and relays.
- .4 Check that sequence controls, interlocking with other separate related starters, equipment, control devices, operate as indicated.

3.3 CLEANING

- .1 Clean in accordance with Section 01 74 00 - Cleaning.
 - .1 Remove surplus materials, excess materials, rubbish, tools, and equipment.
- .2 Waste Management: Separate waste materials in accordance with Section 01 74 19 - Waste Management and Disposal.

END OF SECTION

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Part 1 General**1.1 RELATED REQUIREMENTS**

- .1 Section 26 50 00 - Common Work Results for Electrical.

1.2 REFERENCE STANDARDS

- .1 CSA Group (CSA).
 - .1 CSA B139-09, Installation Code for Oil-Burning Equipment.
 - .2 CSA C282-09, Emergency Electrical Power Supply for Buildings.
- .2 U.S. Coast Guard Equipment List (USCG).
 - .1 164.009-May 2002, Non-Combustible Materials.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature, and data sheets for generating equipment, and include product characteristics, performance criteria, physical size, finish, and limitations.
 - .2 Provide an elevation view of the generator with tank, muffler, and exhaust pipe, and indicate clearances with the ceiling.
- .3 Submit verification of diesel electric technician qualification.
- .4 Submit commissioning report.

1.4 QUALIFICATIONS

- .1 Use qualified diesel electric technician.

1.5 SUPPORT

- .1 The generator set and transfer switches with and without bypass device are provided by the Owner.
- .2 The Contractor must take charge of the generator set, the fuel tank, and the transfer switches at 101 Champlain Blvd., Quebec City, QC.
- .3 The Contractor must inspect the equipment and obtain a support slip certifying the condition of the generator and transfer switches. The voucher must be signed by the Owner's Representative.
- .4 The Contractor must load, transport, and unload to the site the equipment. The Contractor must install the equipment at the appropriate time.

Part 2 Products**2.1 BRAND AND MODEL**

- .1 The generator is Cummins C60D6C branded with QSB5 series engine. The approximate dimensions are: 2,482 (L) X 965 (W) X 1,321 (H). The weight is about 1,006 kg.

2.2 MATERIALS

- .1 Include materials as follows:
 - .1 Conduits and boxes, as required;
 - .2 Copper fuel lines and fittings as required;
 - .3 Primary fuel filter/water separator;
 - .4 Insulation for exhaust system;
 - .5 Electrical components as indicated;
 - .6 Wiring material;
 - .7 Ethylene-glycol based antifreeze;
 - .8 Diesel fuel; tank initial fill, plus top-up after testing;
 - .9 Wiring and materials, including necessary rigid steel conduits and fittings for making connections;
 - .10 The power circuit cables will be, RW90 (-40°C) cross link polyethylene, single conductor;
 - .11 The control circuit cables will not be less than No. 14, RW90, multiple single conductors, colour or number coded;
 - .12 Electronic governor control cable shall be minimum size No. 18 stranded copper conductor, shielded complete with drain wire and overall PVC jacket;
 - .13 Battery cable must be welding cable type, extra flexible, rope stranded copper conductor with neoprene oil-resistant insulation, sized to limit voltage drop to 5% at time of peak load.
 - .14 Steel conduit, stainless-steel flexible conduit, and critical type muffler.

2.3 INSULATION

- .1 Removable fibreglass jacket insulation rated for 650°C minimum with stainless lacing hooks and wires.
 - .1 Enclose jacket on inside by stainless steel mesh with outside cover silicone coated or aluminized fibreglass cloth: to USCG approved Non-Combustible Materials No. 164.009.
- .2 Calcium silicate removable insulation rated for 650°C with exterior stainless-steel protective cover and fastenings.

Part 3 Execution**3.1 EXAMINATION**

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for generating equipment installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate in presence of Departmental Representative.
 - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
 - .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 MOUNTING

- .1 Locate unit as indicated.
- .2 Fit and adjust isolators in accordance with manufacturer's installation and adjustment instruction bulletin contained in generating equipment manual.

3.3 ALIGNMENT CHECK

- .1 Since engine-generator shaft alignment is factory-adjusted, check to ensure that no change has occurred due to shipment and handling.
- .2 Where engine and generator housings are close coupled and instruments at hand are not suitable for measuring alignment within confines of housings, just loosen engine and generator hold down bolts and ensure that each foot is carrying proportionate amount of weight and feet are level on base plate.

3.4 FUEL SUPPLY SYSTEM

- .1 Install fuel tank to CSA B139 and anchor it to the floor as per manufacturer's specifications.
- .2 Inspect thoroughly fuel tank and lines to confirm they are clean and free of foreign material before connecting fuel system.
- .3 Install primary fuel filter/water separator and servicing shut-off valves as indicated. Provide three spare filter elements.
- .4 Install ULC automatic fire shut-off valve. Locate upstream of any combustible fuel system component.
- .5 Install supply and return fuel lines between engine and fuel day tank. Install flexible sections between the engine and fixed end of fuel lines from fuel tank.
- .6 Braze or silver solder hard drawn copper pipe joints.
- .7 Brazing or soldering alloys melting point: 450°C minimum.

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- .8 Neatly install fuel lines, parallel or perpendicular to building lines, with no kinks or dents.
- .9 Install soft drawn copper fuel lines using brass 45° flare and pipe fittings as required and bend with correct size lever type bending tool. Entirely replace leaking fuel lines.
- .10 Fill up the diesel tank.

3.5 BATTERIES AND CHARGER

- .1 For dry charged batteries: Activate in accordance with manufacturer's instructions manual prior to installation.
- .2 For wet batteries: Inspect individually each battery cell and check electrolyte level.
 - .1 Check charge condition by measuring temperature and specific gravity of electrolyte.
 - .2 Consult manufacturer's instructions for recommended readings.
 - .3 If readings are lower, give batteries freshening charge until readings are reached.
- .3 Locate batteries as indicated and ensure batteries are accessible for service. Route the cables supplied with the generator set to the starter motor and ensure that the cables are adequately protected.
 - .1 Run and protect cables to starting motor using cables supplied with unit.
- .4 Install battery charger on wall, adjacent to batteries and make connection to batteries.
- .5 Clean connections and tighten securely.
- .6 Install removable plexiglass cover on batteries.

3.6 EXHAUST SYSTEM

- .1 Supply and install exhaust pipe, the flexible conduits, and critical type silencer (25 and 32 dBA).
- .2 Arrange silencer above and approximately in line with engine exhaust manifold with exhaust tail pipe protruding through thimble in wall.
- .3 Extend tail pipe 2 m minimum beyond outside wall.
- .4 Support silencer with hangers so no weight or stress is applied to engine exhaust manifold or turbocharger.
- .5 Install flexible exhaust pipe between silencer and manifold.
- .6 Install exhaust system fireproof insulating material, after test run.

3.7 COOLING AND VENTILATION

- .1 Install air outlet and inlet louvres and hoods in their respective openings.
- .2 Install louver motors and linkages, adjust to ensure louvres are tight in closed position and give free damper movements from fully closed to fully open.

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- .3 Where canvas boot is not provided, maintain 13 mm clearance between radiator and air outlet duct.
- .4 Mount thermostat in strategic position, away from inlet louver.
- .5 Install conduits and junction boxes and make connections from louver motors to thermostat and to 120/24 VAC transformer.
- .6 Fill engine radiator with water/ethylene glycol antifreeze mix good for -40°C.
- .7 Install remote radiator including piping, valves, fittings, and pumps as indicated.

3.8 CONTROL AND TRANSFER PANEL

- .1 Locate panels as indicated.
- .2 Make control and power circuit connections as indicated.
- .3 Identify cables at both ends.
- .4 Tag with slip-on wire marker, each wire end with number corresponding to number in panel.
- .5 Make terminations with self-insulated terminals of flanged fork or ring type.

3.9 ADDITIONAL WORKS

- .1 Complete any additional work as instructed by Departmental Representative to:
 - .1 Ensure equipment is safe to operate.
 - .2 Provide complete and operating system.

3.10 FIELD QUALITY CONTROL

- .1 Qualified diesel electric technician to: Inspect and verify that installation of interruptible power unit is acceptable and complete. Provide inspection report to the Departmental Representative.
- .2 Commissioning: Do site commissioning of diesel electric generator unit by qualified diesel electric technician.
- .3 Develop and submit commissioning report including time delay settings, operational set points and adjustment ranges.

3.11 SYSTEM START-UP

- .1 Preparation: Before starting unit, carry out thorough mechanical and electrical inspection of equipment, and perform following checks and adjustments:
 - .1 Disconnect battery cables from batteries to prevent accidental starting.
 - .2 Turn engine several revolutions by means of hand-barring devices to ensure parts are free and there are no obstructions to its running.
 - .3 Check engine/generator alignment readings to ensure they match readings attained at time of manufacture.

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- .4 Check fluid levels and top up as necessary. Pre-lubricate engine and turbochargers as recommended by engine manufacturer. Install drip pan beneath engine.
- .5 Confirm cooling system antifreeze is effective to at least minus 40°C.
- .6 Check belts for correct tension and adjust as necessary.
- .7 Check and grease points.
- .8 Check and tighten properly nuts, bolts.
- .9 Confirm safety guards are in place and properly secured.
- .10 Check linkages for damage and freedom of movement.
- .11 Check fuel supply system for leakage.
- .12 Ensure fuel supply and fuel injection systems are properly primed.
- .13 Check and tighten properly electrical connections.
- .14 Check starting battery electrolyte level specific gravity and for proper installation.
- .15 Check battery charger for proper operation and adjust as necessary.
- .16 Carry out generator winding insulation resistance test. If reading is unacceptable, carry out recognized drying procedure. Do not start unit until satisfactory reading has been achieved.
- .17 Check jacket coolant heater for proper operation.
- .18 Complete additional preparations deemed necessary.
- .2 Performance Verification: On completion of start-up preparations, take following action:
 - .1 Have at hand, during initial start-up, means for choking off air supply to engine air induction manifold in event of engine run away or other emergency;
 - .2 Reconnect starting battery cables to starting battery;
 - .3 Start unit only in presence of Departmental Representative and allow to warm up. Stop unit if abnormal conditions are encountered;
 - .4 Check for and correct leakage from exhaust system, fuel system, cooling system, and lubricating oil system;
 - .5 Adjust vibration isolators;
 - .6 Observe and confirm lubricating oil pressure and coolant temperature are within limits and no harmful vibration or sounds are evident;
 - .7 Ensure voltage is within operating parameters and automatic voltage regulator is operating correctly;
 - .8 Ensure manual voltage control is operating correctly;
 - .9 Ensure frequency is within operating parameters and electronic governor is operating correctly;
 - .10 Check engine air ventilation system for proper operation;
 - .11 Check operation of engine-mounted protective sensing devices and adjust as necessary;

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- .12 Check phase sequence of normal power supply and ensure emergency power supply are in same sequence;
- .13 Check operation of electronic controller protection, transfer, timing, metering, and annunciator functions and adjust as necessary;
- .14 Check operation and calibration of analog metering and adjust as necessary;
- .15 Apply electrical load, read the metres, and correlate these readings;
- .16 Demonstrate:
 - .1 Unit start, transfer to load, retransfer to normal power, unit shutdown, on "automatic" control.
 - .2 Unit start, transfer to load, retransfer to normal power, unit shutdown, on "test control".
 - .3 Unit cranking, start, and shutdown by means of engine-mounted key switch.
 - .4 Run unit on full (nameplate) load for minimum period of 8 hours to show load-carrying capability, stability of voltage and frequency, and satisfactory performance of engine ventilating system to provide adequate cooling, exhaust system.
 - .5 Every ½ hour carry out and record readings on Test Chart.
- .17 Supply and connect a 60-kW load bench and test the generator for a continuous time of 4 hours.
- .18 Perform additional tests as required by Departmental Representative to confirm unit is operating satisfactorily.

3.12 CLEANING

- .1 Progress Cleaning: Clean in accordance with Section 01 74 11 - Cleaning.
 - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: Upon completion remove surplus materials, rubbish, tools, and equipment, in accordance with Section 01 74 11 - Cleaning.
- .3 Waste Management: Separate waste materials for recycling reuse.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.13 DEMONSTRATION AND TRAINING

- .1 As directed by Departmental Representative and in accordance with Section 01 79 00 - Demonstration and Training carry out demonstrations of complete interruptible power unit for Project Acceptance Board.
- .2 Deliver familiarization training of operating and maintenance staff.
 - .1 Include instruction to site operation and maintenance staff for proper care, operation, and maintenance of equipment.

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- .2 Maintain services for such period, and for as many visits as necessary to put equipment in operation, and confirm that operating personnel are conversant with aspects of its care and operation.
- .3 Contractor to include fuel required for performing diesel-generator site test and top-up after acceptance test completion.

3.14 PROTECTION

- .1 Protect installed products and components from damage during construction.
- .2 Protect fuel lines from mechanical damage.
- .3 Repair damage to adjacent materials caused by electric power generating equipment installation.

END OF SECTION

Part 1 General**1.1 RELATED REQUIREMENTS**

- .1 Section 26 05 00 - Common Work Results for Electrical.
- .2 Section 26 09 23.01 - Metering and Switchboard Instruments.

1.2 REFERENCE STANDARDS

- .1 CSA Group (CSA).
 - .1 CSA C22.2 No.5-09, Moulded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures (Tri-national Standard with UL 489, NMX-J-266-ANCE-2010).
 - .2 CSA C22.2 No.178.1-2007, Automatic Transfer Switches.
 - .3 CAN/CSA C60044-1-07, Instrument Transformers.
- .2 National Electrical Manufacturers Association (NEMA).
 - .1 NEMA ICS 2-1996(R2009), Controllers, Contactors, and Overload Relays, Rated Not More Than 2000 Volts AC or 750 Volts DC, Part 8: Disconnect Devices for Use in Industrial Control Equipment.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature, and data sheets for transfer switches, and include product characteristics, performance criteria, physical size, finish, and limitations.
- .3 Shop Drawings:
 - .1 Submit drawings stamped and signed by professional engineer registered or licensed in the Province of Quebec.
 - .1 Indicate on drawings:
 - .1 Make, model, and type.
 - .2 Load classification:
 - .1 Tungsten lamp loading kW;
 - .2 Ballast lamp load in kW;
 - .3 Motor load in kW;
 - .4 Restricted use: Resistance and general loads, 0.8 pf or higher in kW.
 - .3 Single line diagram showing controls and relays.

- .4 Description of equipment operation including:
 - .1 Automatic starting and transfer to standby unit and back to normal power.
 - .2 Test control.
 - .3 Manual control.
 - .4 Automatic shutdown.

1.4 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Operation and Maintenance Data: Submit operation and maintenance data for transfer switches for incorporation into manual.
- .3 Detailed instructions to permit effective operation, maintenance, and repair.
- .4 Technical Data:
 - .1 Schematic diagram of components, controls, and relays.
 - .2 Illustrated parts lists with parts catalogue numbers.
 - .3 Certified copy of factory test results.

1.5 DELIVERY, STORAGE, AND HANDLING

- .1 Deliver, store, and handle materials in accordance with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: Deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect transfer switches from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.
- .4 Packaging Waste Management: Remove in accordance with Section 01 74 19 - Waste Management and Disposal.

1.6 SUPPORT

- .1 The generator set and transfer switches with and without bypass device are provided by the Owner.
- .2 The Contractor must take charge of the generator set and the transfer switches at 101 Champlain Blvd., Quebec City, QC.
- .3 The Contractor must inspect the equipment and obtain a support slip certifying the condition of the generator and transfer switches. The voucher must be signed by the Owner's Representative.

- .4 The Contractor must load, transport, and unload to the site the equipment. The Contractor must install the equipment at the appropriate time.

Part 2 Products

2.1 SYSTEM DESCRIPTION

- .1 One automatic load transfer unit with bypass and one automatic load transfer unit without bypass are supplied by the Departmental Representative and are installed by the Contractor:
 - .1 Dedicated building emergency power supply for the building and integrated to the transfer cabinet;
 - .2 Supply for life and safety loads.
- .2 Automatic load transfer equipment to:
 - .1 Monitor voltage on phases of normal power supply.
 - .2 Initiate cranking of standby generator unit on normal power failure or abnormal voltage on any one phase below, preset, adjustable limits for adjustable period.
 - .3 Transfer load from normal supply to standby unit when standby unit reaches rated frequency and voltage pre-set adjustable limits.
 - .4 Transfer load from standby unit to normal power supply when normal power restored, confirmed by sensing of voltage on phases above adjustable pre-set limit for adjustable period.
 - .5 Shutdown stand-by unit after running unloaded to cool down using adjustable time delay relay.

2.2 MATERIALS

- .1 Instrument Transformers: To CAN/CSA C60044-1.
- .2 Contactors: To NEMA ICS2.

2.3 CONTACTOR TYPE TRANSFER EQUIPMENT

- .1 Contact Type Transfer Equipment: To CSA C22.2 No.178.1.
- .2 Two 3-pole contactors mounted on common frame, in double throw arrangement, mechanically and electrically interlocked, with CSA enclosure, solenoid operated.
 - .1 The switch must be locked and must not be affected by temporary outages, in such a way that the contact pressure is maintained to a constant value and that the contact temperature elevation is reduced to the minimum, for maximal reliability and a life cycle optimisation.
- .3 Rated: 600V, 60 Hz, 1,600 A, or 150 A according to indications on drawings, 4 wires, continuous neutral.
- .4 Main Contacts: Silver surfaced, protected by arc disruption means.

- .1 The opening capacity and contact interruption: Respectively, 20 times and 6 times their capacity.
- .5 Switch and relay contacts, coils, spring, and control elements accessible for inspection and maintenance from front of panel without removal of switch panel or disconnection of drive linkages and power conductors.
- .6 Auxiliary Contact: Silver plated, to initiate emergency generator start-up on failure of normal power.
- .7 Fault Withstand Rating: 35 kA symmetrical, for three-cycles, that can attain a peak value of 50 kA.
- .8 Lever to operate switch manually when switch is isolated.
- .9 Neutral overlapping bar, with a rating to match the nominal current of the phase bars.
- .10 Overlapping neutral contacts on contactor type transfer equipment.
- .11 Sprinkler-proof enclosure.

2.4 ISOLATING DERIVATION SWITCH

- .1 Each automatic transfer device will have a two-way derivation isolation switch that will insure a manual transfer of the load to each source and allow the isolation of the automatic transfer switch of each sources and load. All the principal contacts must be triggered manually.
- .2 Electrical interconnections on a silver surface copper bar.
- .3 Separated handles for the insulation and derivation to give a clear distinction between both functions. The handles must be shut permanently and can be operated without opening the cabinet's door.
- .4 The derivation supplying this load must be ensured without interruption of the charging supply ("Make-Before-Break"). The derivation handle must possess three operation modes: "Derivation to Normal", "Automatic" and "Derivation to Emergency". The functioning speed if the derivation contacts must be the same as the associated transfer switch and be independent of the speed at which the manual handle is maneuvered. In "Automatic" mode, the derivation contacts must be turned off to protect them from fault currents to which they can be subjected to.
- .5 The isolating handle must be provided with three functioning modes: "Closed", "Test" and "Open". The "Test" mode must allow tests on the emergency supply grid, comprising the automatic transfer switches, with no interruption of the charging supply. The "Open" mode must allow the complete isolation of the automatic transfer switch of all supply and charging cables. In "Open" mode, it must be possible to completely remove the automatic transfer switch for inspection or maintenance according to the code requirements, without removing the power conductors and without requiring use of tools.
- .6 When the isolation switch is in "Test" or "Open" mode, the derivation switch must operate like a manual transfer switch.

2.5 CONTROLS

- .1 Selector Switch - 4-position "Test", "Auto", "Manual", "Engine start".
 - .1 Test position - Normal power failure simulated. Engine starts and transfer takes place. Return switch to "Auto" to stop engine.
 - .2 Auto position - Normal operation of transfer switch on failure of normal power; retransfers on return of normal voltage and shuts down engine.
 - .3 Manual position - Transfer switch may be operated by manual handle, but transfer switch will not operate automatically, and engine will not start.
 - .4 Engine start position - Engine starts but unit will not transfer unless normal power supply fails. Switch must be returned to "Auto" to stop engine.
- .2 Control Transformers: Dry type with 120 V secondary to isolate control circuits from:
 - .1 Normal power supply.
 - .2 Emergency power supply.
- .3 Relays: Continuous duty, industrial control type, with wiping action contacts rated 10 A minimum:
 - .1 Voltage sensing: 3-phase for normal power and on one phase only for emergency, solid state type, adjustable drop out and pick up, close differential, 2 V minimum undervoltage protection.
 - .2 Time delay: Normal power to standby, adjustable solid state, 0 to 60 s.
 - .3 Time delay on engine starting to override momentary power outages or dips, adjustable solid state, 0 to 60 s delay.
 - .4 Time delay on retransfer from standby to normal power, adjustable 5 to 180 s.
 - .5 Time delay for engine cool-off to permit standby set to run unloaded after retransfer to normal power, adjustable solid state, 20 s intervals to 10 minutes.
 - .6 Time delay during transfer to stop transfer action in neutral position to prevent fast transfer, adjustable, 5 s intervals to 180 s.
 - .7 Frequency sensing, to prevent transfer from normal power supply until frequency of standby unit reaches preset adjustable values.
 - .8 Neutral position delay: Allow time for motors to delay between live sources, adjustable, 0 to 5 s.
- .4 Solid-state electronic in-phase monitor.
- .5 N.O. dry contact entry for "Shunt trip" (return to normal source).

2.6 ACCESSORIES

- .1 Ensure pilot lights indicate power availability normal and standby, switch position, green for normal, red for standby, mounted on panel.
- .2 Plant Exerciser: 168-hour timer to start standby unit once each week for selected interval, but does not transfer load from normal supply. Timer adjustable 0-168 hours in 15-minute intervals.

- .3 Auxiliary relay to provide:
 - .1 Four contacts indicating the transfer switch position.
 - .2 Two contacts indicating the derivation position.
- .4 Instruments:
 - .1 Digital true RMS, indicating type 2% accuracy, flush panel mounting:
 - .1 Voltmeter: AC.
 - .2 Ammeter: AC.
 - .3 Frequency meter.
- .5 Potential transformers - Dry type for indoor use:
 - .1 Ratio: 600 to 120.
 - .2 Rating: 600 V, 60 Hz, 10 kV choc resistance.
 - .3 Accuracy rating: 1%.
- .6 Current transformers - Dry type for indoor use:
 - .1 Ratio: 100 to 5, or 300 to 5 according to the switch capacity.
 - .2 Rating: 600 V, 60 Hz, 10 kV choc resistance.
 - .3 Accuracy rating: 1 %.
 - .4 Positive action automatic short-circuiting device in secondary terminals.
- .7 Manual by-pass and isolator: To emergency and normal supply.

2.7 EQUIPMENT IDENTIFICATION

- .1 Identify equipment in accordance with Section 26 05 00 - Common Work Results for Electrical.
- .2 Control Panel:
 - .1 For selector switch and manual switch: Size 4 nameplates.
 - .2 For meters, indicating lights, minor controls: Use size 2 nameplates.

2.8 SOURCE QUALITY CONTROL

- .1 Complete equipment, including transfer mechanism, controls, relays and accessories to be factory-assembled and tested.
- .2 Notify Departmental Representative 5 days minimum in advance of date of factory test.
- .3 Tests:
 - .1 Operate equipment both mechanically and electrically to ensure proper performance.
 - .2 Check selector switch, in modes of operation "Test", "Auto", "Manual", "Engine Start", and record results.
 - .3 Check voltage sensing and time delay relay settings.

- .4 Check the following:
 - .1 Automatic starting and transfer of load on failure of normal power.
 - .2 Retransfer of load when normal power supply resumed.
 - .3 Automatic shutdown.
 - .4 In-phase monitor operation.

Part 3 Execution

3.1 EXAMINATION

- .1 Verification of Conditions: Verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for transfer switches installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate.
 - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
 - .3 Proceed with installation only after unacceptable conditions have been remedied.

3.2 INSTALLATION

- .1 Locate, install, and connect transfer equipment as indicated.
- .2 Connect emergency power generator panel relays and verify adequate function for ensuring starting and stopping operations groups, as planned.
- .3 Check relays and solid-state monitors; adjust as required to ensure correct operation.

3.3 FIELD QUALITY CONTROL

- .1 Perform tests in accordance with Section 26 05 00 - Common Work Results for Electrical.
- .2 Energize transfer equipment from normal power supply.
- .3 Set selector switch in "Test" position to ensure proper standby start, running, transfer, retransfer. Return selector switch to "Auto" position to ensure standby shuts down.
- .4 Set selector switch in "Manual" position and check to ensure proper performance.
- .5 Set selector switch in "Engine start" position and check to ensure proper performance. Return switch to "Auto" to stop engine.
- .6 Set selector switch in "Auto" position and open normal power supply disconnect. Standby should start, come up to rated voltage and frequency, and then load should transfer to standby. Allow to operate for 10 minutes, then close main power supply disconnect. Load should transfer back to normal power supply and standby should shutdown.

- .7 Repeat tests completely twice in a row, at one-hour intervals. At each test, the selector must be successively placed at each position.

3.4 CLEANING

- .1 Progress Cleaning: Clean in accordance with Section 01 74 00 - Cleaning.
 - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: Upon completion remove surplus materials, rubbish, tools, and equipment, in accordance with Section 01 74 00 - Cleaning.
- .3 Waste Management: Separate waste materials for recycling in accordance with Section 01 74 19 - Waste Management and Disposal.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

Part 1 General**1.1 RELATED REQUIREMENTS**

- .1 Section 26 05 00 - Common Works Results for Electrical.
- .2 Section 26 24 16.01 - Panelboards Breaker Type.

1.2 REFERENCE STANDARDS

- .1 Institute of Engineering and Electronic Engineers (IEEE):
 - .1 IEEE C62.41.2-02, Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and Less) AC Power Circuits.
 - .2 IEEE C62.45-03, Recommended Practice on Surge Testing for Equipment Connected to Low-Voltage (1000 V and Less) AC Power Circuits.
- .2 Underwriters Laboratories, Inc. (UL):
 - .1 UL 1283-05, Electromagnetic Interference Filters
 - .2 UL 1449-06, Surge Protective Devices

1.3 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Operation and Maintenance Data: Submit operation and maintenance data for surge protective devices for incorporation into O&M Manual.

1.4 DELIVERY, STORAGE, AND HANDLING

- .1 Deliver, store, and handle materials in accordance with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: Deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials off ground, indoors, and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect switchboard from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.

1.5 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate waste materials for recycling in accordance with Section 01 74 19 - Waste Management Disposal.

1.6 DEVICES

- .1 Devices are existing and must be connected to the electrical distribution.

Part 2 Products**2.1 NOT APPLICABLE**

- .1 Not Applicable.

Part 3 Execution**3.1 EXAMINATION**

- .1 Verification of Conditions: Verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for switchboard installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate.
 - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
 - .3 Proceed with installation only after unacceptable conditions have been remedied.

3.2 INSTALLATION

- .1 Field-installed SPD: Install SPD with conductors or buses between SPD and points of attachment as short and straight as possible. Do not exceed manufacturer's recommended lead length. Do not bond neutral and ground.
- .2 Connect SPD to circuit breaker as a dedicated disconnecting means for SPD, as indicated, and lock the circuit breaker in the closed position.
- .3 Do not perform insulation resistance tests on switchgear, switchboards, panelboards, or feeders with the SPD connected. Disconnect SPD before conducting insulation resistance tests and reconnect SPD immediately after insulation resistance tests are complete.

3.3 CLEANING

- .1 Progress Cleaning: Clean in accordance with Section 01 74 00 - Cleaning.
 - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: Upon completion remove surplus materials, rubbish, tools, and equipment in accordance with Section 01 74 00 - Cleaning.

3.4 ACTIVITIES ON WORK COMPLETION

- .1 Demonstration and training.
 - .1 Provide necessary training to familiarize the operating and maintenance personnel with the operation of the SPD.
 - .1 Training to be 2 hours.

END OF SECTION

Part 1 General**1.1 RELATED REQUIREMENTS**

- .1 Section 26 05 00 - Common Work Results for Electrical.

1.2 REFERENCE STANDARDS

- .1 American National Standards Institute (ANSI)
 - .1 ANSI C82.1-04, Lamp Ballasts-Line Frequency Fluorescent Lamp Ballast.
- .2 American National Standards Institute/Institute of Electrical and Electronics Engineers (ANSI/IEEE)
 - .1 ANSI/IEEE C62.41-1991, Recommended Practice for Surge Voltages in Low-Voltage AC Power Circuits.
- .3 ASTM International Inc.
 - .1 ASTM F1137-00(2006), Standard Specification for Phosphate/Oil and Phosphate/Organic Corrosion Protective Coatings for Fasteners.
- .4 CSA Group (CSA).
- .5 ICES-005-07, Radio Frequency Lighting Devices.
- .6 Underwriters Laboratories of Canada (ULC).

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Provide manufacturer's printed product literature, specifications, and data sheets, and include product characteristics, performance criteria, physical size, finish, and limitations.
 - .2 Provide complete photometric data prepared by independent testing laboratory for luminaires where specified, for review and approval by Departmental Representative.
 - .3 Photometric data to include:
 - .1 Polarity diagram for light intensity distribution;
 - .2 Light efficacy;
 - .3 Utilization coefficient;
 - .4 Type of louver and lens finish;
 - .5 Luminaire spacing criteria;
 - .6 Photometric calculation from a software, if required.

- .3 Quality Assurance Submittals: Provide following in accordance with Section 01 45 00 - Quality Control.

- .1 Manufacturer's instructions: provide manufacturer's written installation instructions and special handling criteria, installation sequence, cleaning, and procedures.

1.4 QUALITY ASSURANCE

- .1 Provide mock-ups in accordance with Section 01 45 00 - Quality Control.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.
- .3 Packaging Waste Management: Remove for reuse in accordance with Section 01 74 19 - Waste Management and Disposal.
- .4 Divert unused metal materials from landfill to metal recycling facility.
- .5 Disposal and recycling of fluorescent lamps as per local regulations.

Part 2 Products

2.1 LUMINAIRES

- .1 As indicated in luminaire schedule.

2.2 MOUNTING ACCESSORIES

- .1 Supply the necessary mounting accessories to install the light fixtures, including hooks, clamps, rods, posts, chains, miscellaneous appropriate material for the specified mounting method. The suspended light fixtures must be equipped with seismic restraint supports.

Part 3 Execution

3.1 INSTALLATION

- .1 Locate and install luminaires as indicated.
- .2 Provide adequate support to suit ceiling system.

3.2 WIRING

- .1 Connect luminaires to lighting circuits:
 - .1 Install flexible or rigid conduit for luminaires, as indicated.

3.3 LUMINAIRE SUPPORTS

- .1 For suspended ceiling installations support luminaires independently of ceiling, in compliance with the requirements of the local inspection organization.
- .2 In mechanical rooms, the light fixture suspension must be done with suspension chains at the exact location determined on site.

3.4 LUMINAIRE ALIGNMENT

- .1 Align luminaires mounted in continuous rows to form straight uninterrupted line.
- .2 Align luminaires mounted individually parallel or perpendicular to building grid lines.

3.5 CLEANING

- .1 Clean in accordance with Section 01 74 00 - Cleaning.
 - .1 Remove surplus materials, excess materials, rubbish, tools, and equipment.
- .2 Waste Management: Separate waste materials in accordance with Section 01 74 19 - Waste Management and Disposal.

END OF SECTION

Part 1 General**1.1 RELATED REQUIREMENTS**

- .1 Section 26 05 00 - Common Work Results for Electrical.
- .2 Section 26 05 21 - Wires and Cables (0-1000 V).
- .3 Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings.

1.2 REFERENCE STANDARDS

- .1 CSA Group (CSA).
 - .1 CSA C22.2 No.141-10, Emergency Lighting Equipment.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature, and data sheets for emergency lighting, and include product characteristics, performance criteria, physical size, finish, and limitations.

1.4 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Operation and Maintenance Data: Submit operation and maintenance (O&M) data for emergency lighting for incorporation into O&M Manual.

1.5 DELIVERY, STORAGE, AND HANDLING

- .1 Deliver, store, and handle materials in accordance with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: Deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials off ground, indoor, and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect emergency lighting from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.
- .4 Packaging Waste Management: Remove for recycling in accordance with Section 01 74 19 - Waste Management and Disposal.

1.6 WARRANTY

- .1 For batteries in this Section, the 12-month warranty period is extended to 120 months. Replacements must be carried-out without any costs during the first 5 years and with calculated prorated fees during the following 5 years.

1.7 TENSION DROP

- .1 The lighting conductors must be copper, of appropriate caliber so that the tension drop does not exceed 5% of the nominal tension, in accordance with the manufacturer's recommendations.

Part 2 Products**2.1 EQUIPMENT**

- .1 Emergency Lighting Equipment: To CSA C22.2 No.141.
- .2 Supply Voltage: 120 VAC.
- .3 Output Voltage: 24 VDC.
- .4 Operating Time: Minimally 120 minutes.
- .5 Minimal Power: 350 W.
- .6 Battery: Sealed, maintenance free, and with an expected life of 10 years.
- .7 Charger: Solid state, multi-rate, voltage/current regulated, inverse temperature compensated, short circuit protected with regulated output of plus or minus 0.01 V for plus or minus 10% input variations.
- .8 Solid-state transfer circuit.
- .9 Low-Voltage Disconnect: Solid-state, modular, operates at 80% battery output voltage.
- .10 Signal Lights: Solid-state, for "AC Power ON" and "High Charge".
- .11 Lamp Heads: Integral on unit and remote, 345° horizontal and 180° vertical adjustment. Lamp type: Two 4 W, 24 V LED lamps, with no reflection, integrated in a polycarbonate enclosure.
- .12 LED Lighting:
 - .1 LED lighting components must be in accordance with ANSI C78-377, NEMA SSL 3, and IES LM 79 and LM 80.
 - .2 Power: According to indications.
 - .3 Initial luminous flux: According to indications.
 - .4 CRI indicator: 86.
 - .5 Color temperature: 4,000 K.

- .6 Minimal life span: 50,000 h.
 - .1 Luminous flux after 50,000 hours: No less than 70% of the initial luminous flux.
- .13 Cabinet: Suitable for direct or shelf mounting to wall and c/w knockouts for conduit. Removable or hinged front panel for easy access to batteries.
- .14 Finish: Beige, 18 caliber steel.
- .15 Auxiliary Equipment:
 - .1 Ammeter.
 - .2 Voltmeter.
 - .3 Test switch.
 - .4 Time delay relay.
 - .5 Battery disconnect device.
 - .6 AC input and DC output terminal blocks inside cabinet.
 - .7 Shelf.
 - .8 Cord and single twist-lock plug connection for AC.
 - .9 RFI suppressors.
 - .10 Two fuse circuits.

2.2 WIRING OF REMOTE HEADS

- .1 Conduit: Type EMT according to Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings.
- .2 Conductors: RW 90, according to Section 26 05 21 - Wires and Cables (0-1000 V) and in accordance with manufacturer's recommendations.

Part 3 Execution

3.1 EXAMINATION

- .1 Verification of Conditions: Verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for emergency lighting installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate.
 - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
 - .3 Proceed with installation only after unacceptable conditions have been remedied.

3.2 INSTALLATION

- .1 Install unit equipment and remote mounted fixtures.
- .2 Direct heads.

- .3 Connect exit lights to unit equipment.

3.3 CLEANING

- .1 Progress Cleaning: Clean in accordance with Section 01 74 00 - Cleaning.
 - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: Upon completion remove surplus materials, rubbish, tools, and equipment in accordance with Section 01 74 00 - Cleaning.
- .3 Waste Management: Separate waste materials in accordance with Section 01 74 19 - Waste Management and Disposal.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.4 PROTECTION

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by emergency lighting installation.

END OF SECTION

Part 1 General**1.1 RELATED REQUIREMENTS**

- .1 Section 26 05 00 - Common Work Results for Electrical.
- .2 Section 26 05 21 - Wires and Cables (0-1000 V).
- .3 Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings.

1.2 REFERENCE STANDARDS

- .1 CSA Group.
 - .1 CSA C22.2 No.141-15, Emergency Lighting Equipment.
 - .2 CSA C860-11(R2016), Performance of Internally-Lighted Exit Signs.
- .2 International Organization for Standardization (ISO).
 - .1 ISO 3864-1 2011, Graphical Symbols - Safety Colours and Safety Signs - Part 1: Design Principles for Safety Signs and Safety Markings.
 - .2 ISO 7010 2011, Safety Colours and Safety Signs - Registered Safety Signs.
- .3 National Fire Protection Association (NFPA).
 - .1 NFPA 101-2015, Life Safety Code.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications, and data sheets, and include product characteristics, performance criteria, physical size, finish, and limitations.
- .3 Quality Assurance Submittals: Submit following in accordance with Section 01 45 00 - Quality Control.
 - .1 Instructions: Submit manufacturer's installation instructions and special handling criteria, installation sequence and cleaning procedures.

1.4 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate waste materials in accordance with Section 01 74 19 - Waste Management and Disposal.

Part 2 Products

- .1 Housing: Aluminum border profile.

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- .2 Face and Back Plates: Cast aluminum alloy.
- .3 Luminous panel, white LED type with a life span of 10 years.
- .4 Green pictogram and white graphical symbol (Running Man) and directional arrows.
- .5 Housing Finish: Brushed aluminum.
- .6 Universal mounting unit, for wall mount, cantilevered or ceiling mounted, simple or double face.
- .7 Left or right arrows.
- .8 Protection grille according to indications on drawing.
- .9 Complying with CAN/CSA-C860-01 and CSA 22.2 No.141 Standards.
- .10 120 V and 347 V, universal power supply.

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 data sheets.

3.2 INSTALLATION

- .1 Install exit lights to manufacturer's recommendations, listing requirements, NFPA standard and local regulatory requirements.
- .2 Connect fixtures to exit light circuits.
- .3 Connect emergency lamp sockets to emergency circuits.
- .4 Lock exit light circuit breaker in on position.

3.3 CLEANING

- .1 Proceed in accordance with Section 01 74 00 - Cleaning.
- .2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools, and equipment.

END OF SECTION

DIVISION 28

Electronic Safety and Security

Part 1 General**1.1 RELATED REQUIREMENTS**

- .1 Section 26 05 00 - Common Work Results for Electrical.

1.2 REFERENCE STANDARDS

- .1 Health Canada/Workplace Hazardous Materials Information System (WHMIS).
 - .1 Material Safety Data Sheets (SDS).
- .2 National Research Council Canada (NRC)
 - .1 National Building Code of Canada 2015 (NBC).
- .3 Underwriters Laboratories of Canada (ULC).
 - .1 CAN/ULC-S524-2001, Standard for the Installation of Fire Alarm Systems.
 - .2 CAN/ULC-S525-1999, Audible Signal Device for Fire Alarm Systems.
 - .3 CAN/ULC-S526-2002, Visual Signal Devices for Fire Alarm Systems.
 - .4 CAN/ULC-S527-1999, Control Units.
 - .5 CAN/ULC-S528-1991, Manual Pull Stations for Fire Alarm Systems.
 - .6 CAN/ULC-S529-2002, Smoke Detectors for Fire Alarm Systems.
 - .7 CAN/ULC-S530-M1991, Heat Actuated Fire Detectors for Fire Alarm Systems.
 - .8 CAN/ULC-S531-2002, Standard for Smoke Alarms.
 - .9 CAN/ULC-S536-S537-2004, Burglar and Fire Alarm Systems and Components.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications, and data sheets in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Shop Drawings:
 - .1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.
 - .1 Shop drawings: Stamped and signed by professional engineer registered or licensed in Province of Quebec, Canada.
 - .2 Include:
 - .1 Layout of equipment.
 - .2 Zoning.
 - .3 Complete wiring diagram, including schematics of modules.

- .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.
 - .3 Manufacturer's Field Reports: Manufacturer's field reports specified.
- .4 Closeout Submittals:
 - .1 Submit maintenance and engineering data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals, in accordance with ANSI/NFPA 20.
 - .2 Submit to two sets of approved submittals and drawings immediately after approval, but no later than 15 working days to prior to final inspection.
 - .3 Submit following:
 - .1 Manufacturer's Data for:
 - .1 Manual pull stations.
 - .2 Heat detectors.
 - .3 Open-area smoke detectors.
 - .4 Alarm horns.
 - .5 Visible appliances.
 - .6 Wiring.
 - .7 Conduit.
 - .8 Outlet boxes.
 - .9 Fittings for conduit and outlet boxes.
 - .10 Mark data which describe more than one type of item to indicate which type will be provided.
 - .11 Submit one original for each item and clear, legible, first-generation photocopies for remainder of specified copies.
 - .2 System wiring diagrams:
 - .1 Submit complete wiring diagrams of system showing points of connection and terminals used for electrical connections in the system.
 - .2 Show modules, relays, switches and lamps in control panel.
 - .3 Test Reports:
 - .1 Preliminary testing:
 - .1 Final acceptance testing.
 - .2 Submit for inspections and tests specified under FIELD QUALITY CONTROL.

1.4 QUALITY ASSURANCE

- .1 Qualifications:
 - .1 Installer: Company or person specializing in fire alarm system installations approved by manufacturer with documented 5-year experience.
- .2 Provide services of representative or technician from manufacturer of system, experienced in installation and operation of type of system being provided, to supervise installation, adjustment, preliminary and final testing of system, and to provide instruction to project personnel.
- .3 Extra Materials:
 - .1 Provide maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.
- .4 Maintenance Service:
 - .1 Provide one year's free maintenance with two inspections by manufacturer during warranty period. Inspection tests to conform to CAN/ULC-S536. Submit inspection report to Departmental Representative.

1.5 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 Waste Management and Disposal: separate waste materials for recycling.

Part 2 Products**2.1 MATERIALS**

- .1 Equipment and Devices: ULC listed and labelled and supplied by single manufacturer.
- .2 Audible Signal Devices: To CAN/ULC-S525.
- .3 Visual Signal Devices: To CAN/ULC-S526.
- .4 Control Unit: To CAN/ULC-S527.
- .5 Manual Pull Stations: To CAN/ULC-S528.
- .6 Thermal Detectors: To CAN/ULC-S530.
- .7 Smoke Detectors: To CAN/ULC-S529.
- .8 Smoke Alarms: To CAN/ULC-S531.

2.2 EXISTING SYSTEM

- .1 The control panel of the existing system is ANSUL brand, model Z-20. The panel oversees the gas system, fire detectors, horns, bells, etc.

2.3 EXISTING SYSTEM OPERATION

- .1 Existing system, electrically supervised, code 3 temporal common coded, manual and automatic, zoned, annunciated, fire alarm system.
- .2 Provide separate circuits from control panel to each zone of initiating devices. Transmission of signals from more than one zone over common circuit to control panel is prohibited.
- .3 Single stage operation. Operation to actuation following:
 - .1 Manual station;
 - .2 Heat detector;
 - .3 Smoke detector;
 - .4 Automatic fire sprinkler system;
 - .5 Fire extinguishing system;
 - .6 Fire standpipe system.
- .4 Actuation of single operation device to initiate following:
 - .1 Building evacuation alarm devices to operate continuously;
 - .2 Transmit signal to fire department via fire alarm transmitter;
 - .3 Zone of alarm device to be indicated on control panel;
 - .4 Operations to remain in alarm mode (except alarm notification appliances if manually silenced) until system is manually restored to normal.

2.4 POWER SUPPLY

- .1 Feed the fire alarm system.

2.5 MANUAL ALARM STATIONS

- .1 Provide non-coded single action type with mechanical reset features.
 - .1 Non-coded single pole normally open contact for single stage.
- .2 Stations: Surface mounted and interior type as indicated.
 - .1 For surface mounting provide station manufacturer's approved back box.
 - .2 Back box finish to match station finish.
- .3 Equip each station with terminal strip with contacts of proper number and type to perform functions required.

- .4 Stations: Type not subject to operation by jarring or vibration.
 - .1 Break-glass-front stations are not permitted; pull-lever break-rod type is acceptable provided presence of rod is not required to reset station.
- .5 Station colour: Red.
- .6 Provide station with visible indication of operation.
- .7 Restoration to require use of key.
 - .1 Keys: Identical throughout system for stations and control panel(s).
- .8 Mount stations with operating lever not more than 1.2 m above finished floor.

2.6 AUTOMATIC ALARM INITIATING DEVICES

- .1 Heat detectors: Provide heat detectors designed for detection of fire by combination fixed temperature rate-of-rise.
- .2 Combination Fixed Temperature Rate-Of-Rise Detectors (Spot Type): Designed for surface outlet box mounting and supported independently of conduit, tubing or wiring connections.
 - .1 Contacts: self-resetting after response to rate-of-rise actuation
 - .2 Operation under fixed temperature actuation to result in external indication.
 - .3 Detector units located in boiler rooms, showers, or other areas subject to abnormal temperature changes to operate on fixed temperature principle only.
 - .4 Provide necessary control and power modules required for operation integral with control panel.
 - .5 Detectors and associated modules: Compatible with control panel and suitable for use in supervised circuit.
 - .6 Malfunction of electrical circuits to detector or its control or power units to result in operation of system trouble signals.
 - .7 Equip each detector with visible indicator lamp that will flash when detector is in normal standby mode and glow continuously when detector is activated.
 - .8 Each detector: Plug-in type with tab-lock or twist-lock, quick disconnect head and separate base in which detector base contains screw terminals for making wiring connections.
 - .9 Detector head: Removable from its base without disconnecting wires. Removal of detector head from its base to cause activation of system trouble signals.
 - .10 Screen each detector to prevent entrance of insects into detection chamber(s).

- .3 2-Wire Smoke Detectors: Detector circuits of 2-wire type capable of transmitting detector operating power over initiating circuit are permitted, provided detectors used are approved by control panel manufacturer for use with control panel provided and are ULC listed as being compatible with control panel.
 - .1 Total number of detectors on any detection circuit: Not exceed 80 % of maximum number of detectors allowed by control panel manufacturer for that circuit. Provide additional zones if required to meet this requirement.
- .4 Locate detectors in accordance with their listing by ULC and the requirements of NFPA 72, except provide at least two detectors in rooms of 54 sq.m. or larger in area.
- .5 Mount detectors at underside of ceiling or deck above, unless otherwise indicated.
 - .1 For mounting heights greater than 3 m above floor level, reduce actual detector linear spacing from listed spacing as required by NFPA 72.
 - .2 For heights greater than 9 m space detectors no farther apart than 34% of their listed spacing.
- .6 Temperature rating of detectors: In accordance with NFPA 72.
- .7 Locate detectors minimum 300 mm to lighting fixtures and not closer than 600 mm to air supply or return diffuser.
- .8 Ensure detectors, located in areas subject to moisture or exterior atmospheric conditions or hazardous locations as defined by NFPA 70, are approved for such locations.
- .9 Provide detectors with terminal screw type connections.
- .10 Removal of detector head from its base to cause activation of system trouble signals if detectors are provided with separable heads and bases.

2.7 ALARM INITIATING DEVICE SPACING AND LOCATION

- .1 Detector Spacing and Location: In accordance with manufacturer's recommendations and requirement of NFPA 72.

2.8 AUDIBLE SIGNAL DEVICES

- .1 Audible device(s):
 - .1 Bells: Surface mounted, single stroke, polarized, 24 VDC, 150 mm.
- .2 Do not exceed 80 percent of listed rating in amperes of notification appliance circuit. Provide additional circuits above those shown if required to meet this requirement.
- .3 Provide appliances specifically listed for outdoor use in locations exposed to weather.
- .4 Finish appliances in red enamel.
- .5 For surface mounting provide appliance manufacturer's approved back box. Back box finish to match appliance finish.

2.9 END-OF-LINE DEVICES

- .1 End-of-line devices to control supervisory current in alarm circuits and signalling circuits, sized to ensure correct supervisory current for each circuit. Open, short or ground fault in any circuit will alter supervisory current in that circuit, producing audible and visible alarm at main control panel.

2.10 CONDUIT

- .1 Electrical Metallic Tubing (EMT).

2.11 WIRING

- .1 Wire for 120 V circuits: No. 12 AWG minimum solid copper conductor, FAS105 type.
- .2 Wire for low voltage DC circuits: No. 14 AWG minimum solid copper conductor, FAS105 type.
- .3 Wire to remote annunciators: No. 18 AWG minimum solid copper conductor, FAS105 type.
- .4 Wire for connection to base telegraphic alarm loop: No. 12 10 AWG minimum solid copper conductor, FAS105 type.
- .5 Insulation 105°C minimum with nylon jacket.
- .6 Colour code wiring.

2.12 AS-BUILT RISER DIAGRAM

- .1 Fire alarm system riser diagram: In glazed frame minimum size 600 x 600 mm. The Contractor must complete a survey of the entire installation and incorporate it into the diagram.

2.13 NOVEC SYSTEMS

- .1 Add a 5-minute delay following an alarm before releasing the Novec 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 data sheets.

3.2 INSTALLATION

- .1 Install systems in accordance with CAN/ULC-S524.
- .2 Locate and install manual alarm stations and connect to alarm circuit wiring.

- .3 Locate and install detectors and connect to alarm circuit wiring. Do not mount detectors within 1 m of air outlets. Maintain at least 600 mm radius clear space on ceiling, below and around detectors. Locate duct type detectors in straight portions of ducts.
- .4 Connect alarm circuits to main control panel.
- .5 Locate and install bells and horns, and connect to signalling circuits.
- .6 Connect signalling circuits to main control panel.
- .7 Install end-of-line devices at end of alarm and signalling circuits.
- .8 Locate remote annunciator panels and connect to the main control panel.
- .9 Locate and connect existing detectors and signaling circuits as well as components to the main control panel.
- .10 Locate and install remote relay units to control fan shut down.
- .11 Connect Novec systems to control panel.
- .12 Integrate the ventilation stop function into the panel and remove enclosure No. 13.

3.3 FIELD QUALITY CONTROL

- .1 Site Tests:
 - .1 Perform tests in accordance with Section 26 05 00 - Common Work Results for Electrical and CAN/ULC-S537.
 - .2 Fire alarm system:
 - .1 Test each device and alarm circuit to ensure manual stations, detectors, smoke transmit alarm to control panel and actuate ancillary devices general alarm.
 - .2 Check annunciator panels to ensure zones are shown correctly.
 - .3 Simulate grounds and breaks on alarm and signalling circuits to ensure proper operation of system.
 - .4 Class B circuits.
 - .1 Test each conductor on circuits for capability of providing alarm signal on line side of single open-circuit fault condition imposed at electrically most remote device on circuit. Reset control unit after each alarm function and correct imposed fault after completion of each test.
 - .2 Test each conductor on circuits for capability of providing alarm signal during ground-fault condition imposed at electrically most remote device on circuit. Reset control unit after each alarm function and correct imposed fault after completion of each test.

- .2 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 The Contractor must provide a certificate that the fire alarm system complies with the S524 Standard and provide certification of the complete installation and operation according to S536 Standard.

3.4 TRAINING

- .1 Arrange and pay for on-site lectures and demonstrations by fire alarm equipment manufacturer to train operational personnel in use and maintenance of fire alarm system.

3.5 CLEANING

- .1 Proceed in accordance with Section 01 74 00 - Cleaning.
- .2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools, and equipment.

END OF SECTION