

SPECIFICATIONS:

<u>SECTION</u>	<u>TITLE</u>	<u>No. OF PAGES</u>
INDEX - Plans and Specifications		3
DIVISION 01 - General Requirements		
01 00 10 – General Instructions		6
01 14 25 – Designated Substances.....		6
01 33 00 – Submittal Procedures		4
01 35 29.06 – Health and Safety Requirements.....		3
01 45 00 – Quality Control		2
01 61 00 – Common Product Requirements		4
01 73 00 – Execution		2
01 74 00 – Cleaning.....		2
01 74 19 – Waste Management and Disposal.....		8
01 78 00 – Closeout Submittals		7
DIVISION 02 - Existing Conditions		
02 41 99 - Demolition for Minor Works		9
02 89 00 – Silica Precautionary Measures		3
DIVISION 07 - Thermal and Moisture Protection		
07 21 16 - Blanket Insulation.....		2
07 84 00 – Fire Stopping.....		5
07 92 00 - Joint Sealants		6
DIVISION 08 - Openings		
08 11 00 - Metal Doors And Frames		6
08 71 00 - Door Hardware.....		9
DIVISION 09 - Finishes		
09 21 16 - Gypsum Board Assemblies		5
09 22 16 - Non-Structural Metal Framing		4
09 51 13 - Acoustical Panel Ceilings		3
09 91 23 - Interior Painting		10
DIVISION 10 – Specialties		
10 26 00 - Wall And Door Protection		3
10 44 16.19 – Fire Extinguishers		2
DIVISION 21 – Fire Suppression		
21 13 13 – Wet Pipe Sprinklers Systems		6

DIVISION 23 - Heating, Ventilating and Air-Conditioning (HVAC)

23 05 00 – Common Work Results For HVAC 4

23 05 01 – Use of HVAC Systems During Construction 1

23 05 29 – Hangers and Support for HVAC Piping and Equipment 7

23 05 48 – Vibration and Seismic Controls for HVAC Piping and Equipment 4

23 05 49.01 – Seismic Restraint System (SRS) – Type P2 Buildings 5

23 05 53.01 – Mechanical Identification 5

23 05 93 – Testing, Adjusting and Balancing for HVAC 6

23 05 94 – Pressure Testing of Ducted Air Systems 3

23 07 13 – Duct Insulation 7

23 09 33 – Electric and Electronic Control System for HVAC 2

23 31 13.01 – Metal Ducts – Low Pressure to 500 PA 4

23 33 00 – Air Duct Accessories 4

23 33 14 – Dampers – Balancing 2

23 33 16 – Dampers – Fire and Smoke 3

23 33 46 – Flexible Ducts 3

23 33 53 – Duct Liners 4

23 37 13 – Diffusers, Registers and Grilles 2

DIVISION 25 – Integrated Automation

25 01 11 – EMCS: Start-up, Verification and Commissioning 4

25 05 01 – EMCS: General Requirements 5

25 05 02 – EMCS: Submittals and Review Process 3

25 05 54 – EMCS: Identification 2

25 90 01 – EMCS: Site Requirements Applications and Systems Sequences of Operation 1

DIVISION 26 – Electrical

26 05 00 – Common Work Results for Electrical 7

26 05 20 – Wire and Box Connectors (0-1000 V) 2

26 05 21 – Wires and Cables (0-1000 V) 3

26 05 22 – Connectors and Terminations 2

26 05 28 – Grounding – Secondary 2

26 05 29 – Hangers and Supports for Electrical Systems 2

26 05 31 – Splitters, Junction, Pull Boxes and Cabinets 2

26 05 32 – Outlet Boxes, Conduit Boxes, and Fittings 2

26 05 34 – Conduits, Conduit Fastenings, and Conduit Fittings 3

26 05 48 – Vibration Isolation and Seismic Restraint 7

26 24 16.01 – Panelboards, Breaker Type 3

26 28 16.02 – Moulded Case Circuit Breakers 3

26 28 18 – Gound Fault Equipment Protection 3

26 52 00 – Emergency Lighting 3

DIVISION 28 – Electronic Safety and Security

28 14 00 – Access Control Systems 6

28 31 00 – Intrusion Detection 6

PLANS

ARCHITECTURAL

A000 KEY PLAN, SCHEDULES, OBC MATRIX, & LEGENDS
AD100 EXISTING / DEMOLITION – FLOOR PLAN
AD200 EXISTING / DEMOLITION – REFLECTED CEILING PLAN
A100 CONSTRUCTION - FLOOR PLAN
A200 CONSTRUCTION - REFLECTED CEILING PLAN
A300 CONSTRUCTION - FLOOR PLAN DETAILS

MECHANICAL

M100 MECHANICAL HVAC NEW LAYOUT

ELECTRICAL

E000 ELECTRICAL SINGLE LINE, PANEL SCHEDULES, AND LEGENDS
E100 ELECTRICAL GENERAL POWERS MODIFICATIONS
E101 ELECTRICAL FURNITURE MODIFICATIONS
E200 ELECTRICAL NEW LIGHTING LAYOUT

SECURITY

SEC100 SECURITY PLAN
SEC200 SECURITY DETAILS

INTERIOR DESIGN

ID-01 FURNITURE PLAN SHOWING EXISTING AND DEMOLITION
ID-02 FURNITURE PLAN SHOWING EXISTING AND NEW

END OF SECTION

1 GENERAL

1.1 TAXES

- .1 Pay all taxes properly levied by law (including Federal, Provincial and Municipal).

1.2 FEES, PERMITS, AND CERTIFICATES

- .1 Pay all fees and obtain all permits, unless otherwise noted. Provide authorities with plans and information for acceptance certificates. Provide inspection certificates as evidence that work conforms to requirements of Authority having jurisdiction.

1.3 CONSTRUCTION PROGRESS SCHEDULE

- .1 On award of contract submit bar chart construction schedule for work, indicating anticipated progress stages within time of completion. When the Departmental Representative has approved schedule, take necessary measures to complete work within scheduled time. Do not change schedule without notifying Departmental Representative.
- .2 Carry out work during "off hours", defined as:
 - .1 Monday to Friday from 18:00 to 06:00.
 - .2 Saturdays, Sundays and Statutory holidays - all day to 06:00 on the next regular working day.
- .3 Provide minimum 72 hours notice (excluding Saturdays and Sundays) for work extending beyond 06:00 Monday to Friday.
- .4 Provide minimum 72 hours advance notice (excluding Saturdays and Sundays) of noise generating work to the Departmental Representative and receive acknowledgement prior to proceeding. Comply with Municipal bylaws related to time limitations for noise generating.

1.4 REGULATORY REQUIREMENTS

- .1 References and Codes:
 - .1 Materials shall be new, and work shall conform to the minimum applicable standards of the "References" indicated in the specification sections, the National Building Code of Canada 2015 (NBC) and all applicable Provincial and Municipal codes. In the case of conflict or discrepancy the most stringent requirement shall apply.
- .2 Building Smoking Environment:
 - .1 Smoking is not permitted on the building site, or in the building. Obey smoking restrictions on the campus at all times.

1.5 FIRE SAFETY REQUIREMENTS

- .1 Comply with both the National Building Code of Canada 2015 and the National Fire Code of Canada 2015 for safety of persons in buildings in the event of a fire and the protection of buildings from the effects of fire, as follows:
 - .1 The National Building Code (NBC): for fire safety and fire protection features that are required to be incorporated in a building during construction.
 - .2 The National Fire Code (NFC):

GENERAL INSTRUCTIONS

- .1 The on-going maintenance and use of the fire safety and fire protection features incorporated in buildings.
 - .2 The conduct of activities that might cause fire hazards in and around buildings.
 - .3 Limitations on hazardous contents in and around buildings.
 - .4 The establishment of fire safety plans.
 - .5 Fire safety at construction and demolition sites.
- .2 Welding and cutting:
- .1 Before welding, soldering, grinding and/or cutting work, obtain a permit as directed by the Departmental Representative. Store flammable liquids in approved CSA containers.
 - .2 At least one week prior to commencing cutting, welding or soldering procedure, provide to Departmental Representative:
 - .1 Notice of intent, indicating devices affected, time and duration of isolation or bypass.
 - .2 Completed welding permit as defined in NFC.
 - .3 Return welding permit to Departmental Representative immediately upon completion of procedures for which permit was issued.
 - .3 "Fire Watchers" as described in NFC shall be assigned when welding or cutting operations are carried out in areas where combustible materials within 15m may be ignited by conduction or radiation.
- .3 Where work requires interruption or cause activation of fire alarms or fire suppression, extinguishing or protection systems:
- .1 Provide "Watchman Service" as described in NFC; In general, watchman service is defined as an individual conversant with "Fire Emergency Procedures", performing fire picket duty within an unprotected and unoccupied (no workers) area once per hour.
 - .2 Retain services of manufacturer for fire protection systems on daily basis or as approved by Departmental Representative, to isolate and protect all devices relating to:
 - .1 modification of fire alarms, fire suppression, extinguishing or protection systems; and/or
 - .2 cutting, welding, soldering or other construction activities that might activate fire protection systems
 - .3 Immediately upon completion of work, restore fire protection systems to normal operation and verify that all devices are fully operational.
 - .4 Inform fire alarm system monitoring agency and local Fire Department immediately prior to isolation and immediately upon restoration of normal operation.

1.6 FIELD QUALITY CONTROL

- .1 Carry out Work using qualified licensed workers or apprentices in accordance with Provincial Act respecting manpower vocational training and qualification.
- .2 Permit employees registered in Provincial apprenticeship program to perform specific tasks only if under direct supervision of qualified licensed workers.
- .3 Determine permitted activities and tasks by apprentices, based on level of training attended and demonstration of ability to perform specific duties.

1.7 HAZARDOUS MATERIALS

- .1 Hazardous Materials: product, substance, or organism that may cause adverse impact to environment or adversely affect health of persons, animals, or plant life when released into the environment.
- .2 Comply with the requirements of the Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of hazardous materials; and regarding labelling and the provision of Material Safety Data Sheets (MSDS).

1.8 TEMPORARY UTILITIES

- .1 Existing services required for work, excluding power required for space temporary heating, may be used by the Contractor without charge. Ensure capacity is adequate prior to imposing additional loads. Connect and disconnect at own expense and responsibility.
- .2 Connect to existing power supply in accordance with Canadian Electrical Code.
- .3 Notify the Departmental Representative and utility companies of intended interruption of services and obtain requisite permission.
- .4 Give the Departmental Representative 10 working days notice related to each necessary interruption of any mechanical or electrical service throughout the course of the work. Keep duration of these interruptions to a minimum. Carry out all interruptions after normal working hours of the occupants, preferably on weekends.

1.9 SERVICE INTERRUPTIONS

- .1 Provide Schedule to Departmental Representative within 7 days of contract award identifying all shut downs or service interruptions that could affect the occupants of the building. Prepare schedule covering the entire period of the Contract. Update and maintain schedule to approval of Departmental Representative and ensure schedule includes all interruption of Services.
- .2 Provide 10 working days written advance notice to the Departmental Representative for all "Major" shutdowns or interruptions that would affect the building occupants. Provide 2 working days written advance notice to the Departmental Representative for all interruptions of any mechanical or electrical service or fire protection system throughout the course of the work. Keep duration of these interruptions to a minimum. Schedule all interruptions after normal working hours of the occupants, preferably on weekends. Obtain approval of Departmental Representative for all interruptions.
- .3 Sprinkler System and Fire Alarm Shut downs. Carry out any work affecting existing sprinkler systems and fire alarm systems only with express written permission of Departmental Representative and designated Fire Commissioner. Sprinkler system and fire alarm system shut downs are to be performed by the current sprinkler system and fire alarm system maintenance contractor and are to be coordinated and scheduled by the Departmental Representative.

1.10 EXECUTION

- .1 Cut, Patch and Make Good:
 - .1 Cut existing surfaces as required to accommodate new work.
 - .2 Remove all items so shown or specified.

- .3 Patch and make good surfaces cut, damaged or disturbed, to Departmental Representative's approval. Match existing material, colour, finish and texture.
- .2 Sleeves, Hangers and Inserts: co-ordinate setting and packing of sleeves and supply and installation of hangers and inserts. Obtain Departmental Representative's approval before cutting into structure.
- .3 Unless otherwise specified, materials for removal become the Contractor's property and shall be taken from site.

1.11 SECURITY CHECK

- .1 Personnel will be checked daily at start of work shift and given a pass, which must be worn at all times. Pass must be returned at end of work shift and personnel checked out.
- .2 Use of Electronic devices, (cell phones, cameras) will be prohibited on site except for authorized personnel with appropriate security clearance.

1.12 SECURITY ESCORT

- .1 All personnel employed on this project will be under the observation of a security escort and or remote surveillance by means of CCTV.
- .2 Departmental Representative will provide and pay for Security escorts during normal working hours Monday to Friday 18:00 to 6:00, all day Saturday and Sunday. Contractor to advise minimum 72 hours in advance (excluding Saturdays and Sundays) for planned work outside of normal hours. For requests submitted within the time mentioned above, the Departmental Representative will pay for the costs of the security escort. The cost incurred by a late request will be charged to the Contractor.
- .3 Any escort request may be cancelled free of charge if notification of cancellation is given at least 24 hours before the scheduled time of the escort. The cost incurred by a late cancellation will be charged to the Contractor.
- .4 The calculation of costs will be based on the average hourly rate of a security officer for a minimum of 8 hours per day for a late service request and 4 hours for late cancellations.

1.13 DUST CONTROL

- .1 Provide dust tight gypsum board partitions to localize dust generating activities, and for protection of workers, finished areas of work.
- .2 Maintain and relocate protection until such work is complete.
- .3 For sprinkler work in occupied laboratories, provide temporary dust protection for all equipment, and remove before start of regular business hours.

1.14 COST BREAKDOWN

- .1 Before submitting first progress claim, submit breakdown of Contract Amount in detail as directed by Departmental Representative and aggregating the Contract Amount. After approval

by Departmental Representative cost breakdown will be used as the basis of progress payments.

- .2 On acceptance of cost breakdown and approved construction schedule submit estimated monthly cash flow for the duration of the work.

1.15 TEMPORARY HEATING AND VENTILATION

- .1 Provide temporary heating required during construction period, including attendance, maintenance and fuel.
- .2 Construction heaters used inside building must be vented to outside or be non-flameless type. Solid fuel salamanders are not permitted.
- .1 Provide temporary heat and ventilation in enclosed areas as required to:
 - .1 Facilitate progress and protect Work against dampness and cold.
 - .2 Prevent moisture condensation on surfaces.
 - .3 Provide ambient temperatures and humidity levels for storage, installation and curing of materials.
 - .4 Provide adequate ventilation to meet health regulations for safe working environment.
- .2 Maintain temperatures of minimum 10 degrees C where construction is in progress.
- .3 Ventilating:
 - .1 Prevent accumulations of dust, fumes, mists, vapours or gases in areas occupied during construction.
 - .2 Provide local exhaust ventilation to prevent harmful accumulation of hazardous substances into atmosphere of occupied areas.
 - .3 Dispose of exhaust materials in manner that will not result in harmful exposure to persons.
 - .4 Ventilate storage spaces containing hazardous or volatile materials.
 - .5 Ventilate temporary sanitary facilities.
 - .6 Continue operation of ventilation and exhaust system for time after cessation of work process to assure removal of harmful contaminants.
- .4 Permanent heating system of building not to be used unless written permission is provided from Departmental Representative. Be responsible for damage to heating system if use is permitted. Pay costs for maintaining temporary heat when using permanent heating system.
- .5 On completion of Work for which permanent heating system is used, replace filters and clean all equipment, ductwork, and plenums to "as new" condition.
- .6 Ensure Date of Substantial Performance and Warranties for heating system do not commence until entire system is in as near original condition as possible and is certified by Departmental Representative.
- .7 Pay costs for maintaining temporary heat. When building is fully enclosed and permanent heating system is available for use, Departmental Representative will pay for utility charges.
- .8 Maintain strict supervision of operation of temporary heating and ventilating equipment to:

- .1 Conform with applicable codes and standards.
 - .2 Enforce safe practices.
 - .3 Prevent abuse of services.
 - .4 Prevent damage to finishes.
 - .5 Vent direct-fired combustion units to outside.
- .9 Be responsible for damage to Work due to failure in providing adequate heat and protection during construction.

1.16 PRECEDENCE

- .1 For Federal Government projects, Division 01 Sections take precedence over technical specification sections in other Divisions of this Project Manual.

2 PRODUCTS

2.1 NOT USED

- .2 Not used.

3 EXECUTION

3.1 NOT USED

- .3 Not Used.

END OF SECTION

1 GENERAL

1.1 REFERENCES

1. Federal Legal Requirements
 1. *Canada Labour Code, Part II, section 124 and 125.*
 1. *Canada Occupational Health and Safety Regulations (SOR/86-304, as amended).*
 2. *Transportation of Dangerous Goods Act, 1992 (TDGA), as amended*
 3. *Canada Consumer Product Safety Act*
 1. *Surface Coating Materials Regulations SOR/2005-109, as amended.*
 4. *Canadian Environmental Protection Act, 1999 (CEPA)*
 1. *PCB Regulations (SOR/2008-273), as amended*
 2. *Federal Halocarbon Regulations, 2003 (SOR/2003-289), as amended.*
2. Provincial Legal Requirements
 1. *Ontario Occupational Health and Safety Act, R.S.O. 1990, as amended.*
 1. *Ontario Regulation 490/09 – Designated Substances (O.Reg. 490/09), as amended*
 2. *Ontario Regulation 278/05 – Designated Substance - Asbestos on Construction Projects and in Buildings and Repair Operations, (O.Reg. 278/05), as amended*
 3. *Ontario Regulation 213/91 for Construction Projects (O.Reg. 213/91), as amended.*
 2. *Ontario Environmental Protection Act, R.R.O. 1990,*
 1. *Ontario Regulation 347/09, General – Waste Management (O.Reg. 347/09), as amended.*
 2. *Ontario Regulations 362/90 – Waste Management, PCBs (O.Reg. 362/90), as amended*
 3. *Ontario Regulation 463/10, Ozone Depleting Substances and Other Halocarbons (O.Reg. 463/10), as amended.*
3. Canadian General Standards Board (CGSB).
4. Canadian Standards Association (CSA International). CAN/CSA-Z94.4-11 - Respiratory Protection
5. Underwriters' Laboratories of Canada (ULC).

1.2 DEFINITIONS

Asbestos-Containing Materials (ACMs): means material that contains 1 per cent or more asbestos by dry weight as per Canada Occupational Health and Safety Regulations or 0.5 per cent or more asbestos by dry weight as per Ontario Regulation 278/05. For the purpose of this project, Asbestos-Containing Material means a material that contains 0.5 per cent or more asbestos by dry weight.

Friable Material: means material that, (i) when dry, it can be crumbled, pulverized or powdered by hand pressure, or (ii) is crumbled, pulverized or powdered.

Time-Weighted Average Exposure Limit (TWAEEL): the time-weighted average airborne concentration of a biological or chemical agent to which a worker may be exposed in a work day or work week as prescribed by *Canada Occupational Health and Safety Regulations* and by *Ontario Regulation 490/09 Designated Substances*, as amended.

1.3 RELATED SECTIONS

1. Section 02 89 00 – Silica Precautionary Measures

1.4 DESIGNATED SUBSTANCES

Refer to Designated Substances Summary Report “Designated Substances Report, Mapping and Charting Establishment Wall Installation, DND Data Centre, 101 Goldenrod Driveway, Ottawa, Ontario”.

Prior to the commencement of any work activities, confirm with the Departmental Representative that no additional designated substances have been introduced or identified to the project area.

Note that additional designated substances and hazardous materials may exist outside the accessible survey area but are beyond the scope of this project.

In the event that additional material suspected to contain designated substances or hazardous materials is encountered within the project area, the Departmental Representative must be notified immediately and any disturbance of such material must be stopped and precautionary measures taken. Do not proceed further until written instructions have been received.

1. ACRYLONITRILE: Not Identified
2. ARSENIC: Not Identified
3. ASBESTOS: Not Identified

3.1 Confirmed non-Asbestos-Containing Materials

Bulk material sampling and subsequent laboratory analysis has determined that the following materials do not contain regulated concentrations of asbestos:

- Drywall joint compound on the perimeter columns;
- Sprayed-on fireproofing on deck and beams throughout;
- Concrete Block Mortar under plaster on all columns;
- Smooth over rough plaster on perimeter columns;
- Textured wall plaster on all interior columns;
- Drywall joint compound along bulkhead;
- Drywall joint compound on interior walls
- Carpet mastic;
- Black caulking above ceiling tile outside room G009;
- Rough troweled-on fireproofing on perimeter walls and columns; and
- Ceiling tiles.

If any suspect materials are discovered in areas that were not accessed during the survey, then they should be presumed to be asbestos-containing materials unless proven otherwise through sampling and subsequent laboratory analysis.

4. BENZENE: Not Identified
5. COKE OVEN EMISSIONS: Not Identified
6. ETHYLENE OXIDE: Not Identified
7. ISOCYANATES: Not Identified
8. LEAD: Not Identified

Analytical results indicate that lead content in the following paint matrices is below the 90 ppm threshold outlined in the *Canada Consumer Product Safety Act's Surface Coating Materials Regulations SOR/2005-109* (as amended), and therefore are considered to be trace lead-containing paints:

- Light beige paint on perimeter walls and columns
- Cream paint on interior columns

Lead is also suspected to be present in the following:

- Copper piping with lead solder,
- Bell joints on cast iron piping systems,
- Lead piping systems or shielding.

9. MERCURY: **Identified**

Mercury is suspected to be present in the following:

- Fluorescent light tubes contained within fluorescent light fixtures.

10. SILICA: **Identified**

Free crystalline silica is expected to be present in the following:

- Concrete
- Drywall,
- Plaster,
- Masonry and mortar,
- Ceiling tiles and
- Fireproofing

11. VINYL CHLORIDE MONOMER: Not Identified

12. POLYCHLORINATED BIPHENYLS (PCBs): **Suspected**

PCBs are assumed to be present in the following equipment:

- Electromagnetic ballasts contained within fluorescent light fixtures.

Light fixtures with T12 lamps are more likely to contain ballasts that were manufactured prior to 1981. T8 lamps are associated with light fixtures that were manufactured after the phase-out of PCB-containing ballasts. The letter “T” denotes the shape of the light fixture (e.g. tubular) and the number which follows indicates the diameter in eighths of an inch.

Light fixtures in the project areas were not disassembled to identify the presence of ballasts. Based on limited visual observations, T12 were observed throughout the project area(s). Light fixtures with T12 light ballasts are suspected to contain PCBs unless proven otherwise.

13. OZONE DEPLETING SUBSTANCES (ODS): Not Identified

14. OTHER HAZARDOUS MATERIALS: Not Identified

1.5 RECOMMENDATIONS

1. LEAD

1. All work involving disturbance of lead-containing materials must be done in accordance with *O.Reg 490/09*.
2. Follow recommendations provided in the Ontario Ministry of Labour (MoL) Guideline entitled “Guideline: Lead on Construction Projects”. This guideline classifies all lead disturbances as Type 1, Type 2a, Type 2b, Type 3a or Type 3b work, and assigns different levels of respiratory protection and work procedures for each classification.
 1. Work procedures and personal protective equipment must be used to ensure that workers are not exposed to airborne lead levels that exceed the TWAEEL of 0.05 milligram per cubic metre (mg/m³) prescribed by *O.Reg 490/09*.
 2. The use of mechanically-powered tools or torches on lead-containing materials increases the concentration of airborne lead dust or fumes requiring more stringent respiratory protection and controlled work procedures.
3. Disposal of construction waste containing lead must be done in accordance with *O.Reg 347/90 “General – Waste Management”* (as amended) under the *Ontario Environmental Protection Act* and the federal *Transportation of Dangerous Goods Act*.

2. MERCURY

1. All work involving the disturbance of mercury-containing equipment must be conducted in accordance with *O.Reg 490/09*.

2. Follow recommendations provided in the MoL Guideline entitled "*The Safe Handling of Mercury: A Guide for the Construction Industry*". This document provides advice on how to reduce the risk of mercury exposure, and outlines clean-up methods for spills.
3. When removal of fluorescent light tubes is required, the tubes should be removed intact from the fixtures. Other sources of liquid mercury should be removed intact to prevent worker exposure.
4. Disposal of waste containing mercury must be done in accordance with *O.Reg 347/90 "General – Waste Management"* (as amended) under the *Ontario Environmental Protection Act* and the federal *Transportation of Dangerous Goods Act*.

3. SILICA

1. Any work activities that may disturb silica-containing materials must comply with Ontario Regulations *O.Reg 490/09*. The regulation sets guidelines for maximum allowable exposure levels.
2. Silica dust can be generated through such processes as blasting, grinding, crushing, and sandblasting silica-containing material. As silica is present in concrete, drywall, plaster, masonry and mortar, ceiling tiles and fireproofing within the project area, appropriate respiratory protection and ventilation must be donned during the demolition and modifications of these structures.
3. Recommendations provided in the MoL Guideline entitled "*Guideline: Silica on Construction Projects*" are to be followed. This document classifies all silica disturbances as Type 1, Type 2 or Type 3 work, and assigns different levels of respiratory protection and work procedures for each classification. These work procedures should be followed when performing work involving the disturbance of silica-containing materials. Disposal of waste should be conducted in accordance with local, municipal, provincial, and/or federal jurisdictions having authority.

4. POLYCHLORINATED BIPHENYLS (PCBs)

1. Comply with *PCB Regulations (SOR/2008-273)*, as amended, made pursuant to the *Canadian Environmental Protection Act, 1999 (CEPA 1999)*.
2. Follow recommendations provided in the Environment Canada guideline "*Identification of Lamp Ballasts Containing PCBs*" to determine whether or not the fluorescent light fixture ballasts contain PCBs.
3. Disposal of waste containing PCBs must be done in accordance with *O.Reg 347/90 "General – Waste Management"* (as amended) under the *Ontario Environmental Protection Act* and the federal *Transportation of Dangerous Goods Act*.

2 PRODUCTS

Not used

3 **EXECUTION**

Not used

END OF SECTION

1 GENERAL

1.1 ADMINISTRATIVE

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

1.2 SHOP DRAWINGS AND PRODUCT DATA

- .1 Prepare a shop drawing log and maintain the log during the complete construction period. Submit draft Shop Drawing log within 14 working days of contract award and update log weekly or more frequently as directed by Departmental Representative. Present updated log at each project meeting.
- .2 Log to include a comprehensive schedule for the submission of all shop drawings required for the execution of the work. Provide for a review time by Departmental Representative for each submission as appropriate for construction element and as approved by Departmental Representative.
- .3 The term "shop drawings" means drawings, diagrams, illustrations, schedules, performance charts, brochures and other data which are to be provided by Contractor to illustrate details of a portion of Work.

SUBMITTAL PROCEDURES

- .4 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Ontario.
- .5 Indicate materials, methods of construction and attachment or anchorage, erection diagrams, connections, explanatory notes and other information necessary for completion of Work. Where articles or equipment attach or connect to other articles or equipment, indicate that such items have been coordinated, regardless of Section under which adjacent items will be supplied and installed. Indicate cross references to design drawings and specifications.
- .6 Allow 10 working days for Departmental Representative's review of each submission.
- .7 Adjustments made on shop drawings by Departmental Representative are not intended to change Contract Price. If adjustments affect value of Work, state such in writing to Departmental Representative prior to proceeding with Work.
- .8 Make changes in shop drawings as Departmental Representative may require, consistent with Contract Documents. When resubmitting, notify Departmental Representative in writing of revisions other than those requested.
- .9 Accompany submissions with transmittal letter containing:
 - .1 Date.
 - .2 Project title and number.
 - .3 Contractor's name and address.
 - .4 Identification and quantity of each shop drawing, product data and sample.
 - .5 Other pertinent data.
- .10 Submissions include:
 - .1 Date and revision dates.
 - .2 Project title and number.
 - .3 Name and address of:
 - .1 Subcontractor.
 - .2 Supplier.
 - .3 Manufacturer.
 - .4 Contractor's stamp, signed by Contractor's authorized representative certifying approval of submissions, verification of field measurements and compliance with Contract Documents.
 - .5 Details of appropriate portions of Work as applicable:
 - .1 Fabrication.
 - .2 Layout, showing dimensions, including identified field dimensions, and clearances.
 - .3 Setting or erection details.
 - .4 Capacities.
 - .5 Performance characteristics.
 - .6 Standards.
 - .7 Operating weight.
 - .8 Wiring diagrams.
 - .9 Single line and schematic diagrams.
 - .10 Relationship to adjacent work.
- .11 After Departmental Representative's review, distribute copies.

SUBMITTAL PROCEDURES

-
- .12 Submit electronic copy of shop drawings for each requirement requested in specification Sections and as Departmental Representative may reasonably request.
 - .13 Submit electronic copy of product data sheets or brochures for requirements requested in specification Sections and as requested by Departmental Representative where shop drawings will not be prepared due to standardized manufacture of product.
 - .14 Submit electronic copy of test reports for requirements requested in specification Sections and as requested by Departmental Representative.
 - .1 Report signed by authorized official of testing laboratory that material, product or system identical to material, product or system to be provided has been tested in accord with specified requirements.
 - .2 Testing must have been within 3 years of date of contract award for project.
 - .15 Submit electronic copy of certificates for requirements requested in specification Sections and as requested by Departmental Representative.
 - .1 Statements printed on manufacturer's letterhead and signed by responsible officials of manufacturer of product, system or material attesting that product, system or material meets specification requirements.
 - .2 Certificates must be dated after award of project contract complete with project name.
 - .16 Submit electronic copy of manufacturer's instructions for requirements requested in specification Sections and as requested by Departmental Representative.
 - .1 Pre-printed material describing installation of product, system or material, including special notices and Material Safety Data Sheets concerning impedances, hazards and safety precautions.
 - .17 Submit electronic copy of Manufacturer's Field Reports for requirements requested in specification Sections and as requested by Departmental Representative.
 - .18 Documentation of the testing and verification actions taken by manufacturer's representative to confirm compliance with manufacturer's standards or instructions.
 - .19 Submit electronic copy of Operation and Maintenance Data for requirements requested in specification Sections and as requested by Departmental Representative.
 - .20 Delete information not applicable to project.
 - .21 Supplement standard information to provide details applicable to project.
 - .22 If upon review by Departmental Representative, no errors or omissions are discovered or if only minor corrections are made, a marked up electronic copy will be returned and fabrication and installation of Work may proceed. If shop drawings are rejected, noted copy will be returned and resubmission of corrected shop drawings, through same procedure indicated above, must be performed before fabrication and installation of Work may proceed.
 - .23 The review of shop drawings by Departmental Representative is for sole purpose of ascertaining conformance with general concept.
 - .1 This review shall not mean that Departmental Representative approves detail design inherent in shop drawings, responsibility for which shall remain with Contractor submitting same, and such review shall not relieve Contractor of responsibility for errors or omissions in shop drawings or of responsibility for meeting requirements of construction and Contract Documents.

- .2 Without restricting generality of foregoing, Contractor is responsible for dimensions to be confirmed and correlated at job site, for information that pertains solely to fabrication processes or to techniques of construction and installation and for co-ordination of Work of sub-trades.

1.3 SAMPLES

- .1 Submit for review samples in duplicate as requested in respective specification Sections. Label samples with origin and intended use.
- .2 Deliver samples prepaid to Departmental Representative's business address.
- .3 Notify Departmental Representative in writing, at time of submission of deviations in samples from requirements of Contract Documents.
- .4 Where colour, pattern or texture is criterion, submit full range of samples.
- .5 Adjustments made on samples by Departmental Representative are not intended to change Contract Price. If adjustments affect value of Work, state such in writing to Departmental Representative prior to proceeding with Work.
- .6 Make changes in samples which Departmental Representative may require, consistent with Contract Documents.
- .7 Reviewed and accepted samples will become standard of workmanship and material against which installed Work will be verified.

1.4 MOCK-UPS

- .1 Erect mock-ups in accordance with 01 45 00 - Quality Control.

2 PRODUCTS

2.1 NOT USED

- .1 Not Used.

3 EXECUTION

3.1 NOT USED

- .1 Not Used.

END OF SECTION

1 GENERAL

1.1 REFERENCE STANDARDS

- .1 Province of Ontario
 - .1 Occupational Health and Safety Act and Regulations for Construction Projects, R.S.O. 1990, c.O.1, as amended and O. Reg. 213/91 as amended - Updated 2017.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit site-specific Health and Safety Plan: Within 7 days after date of Notice to Proceed and prior to commencement of Work. Health and Safety Plan 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 electronic copy of Contractor's authorized representative's work site health and safety inspection reports to Departmental Representative, weekly.
- .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 Departmental Representative will review Contractor's site-specific Health and Safety Plan and provide comments to Contractor within 5 working days after receipt of plan. Revise plan as appropriate and resubmit plan to Departmental Representative within 3 working days after receipt of comments from Departmental Representative.
- .8 Departmental Representative's 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 Departmental Representative.
- .10 Departmental Representative will provide details of on-site Contingency and Emergency Response Plan. Address standard operating procedures to be implemented during emergency situations as directed by Departmental Representative.

1.3 FILING OF NOTICE

- .1 File Notice of Project with Provincial authorities prior to beginning of Work.

HEALTH AND SAFETY REQUIREMENTS

- .2 Contractor shall agree to install proper site separation and identification in order to maintain time and space at all times throughout life of project.

1.4 SAFETY ASSESSMENT

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

1.5 MEETINGS

- .1 Schedule and administer Health and Safety meeting with Departmental Representative prior to commencement of Work.

1.6 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 Departmental Representative may respond in writing, where deficiencies or concerns are noted and may request re-submission with correction of deficiencies or concerns.

1.7 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 Contractor will be responsible and assume the role Constructor as described in the Ontario Occupational Health and Safety Act and Regulations for Construction Projects.
- .3 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.

1.8 COMPLIANCE REQUIREMENTS

- .1 Comply with Ontario Occupational Health and Safety Act, R.S.O. 1990, c. 0.1 and Ontario Regulations for Construction Projects, O. Reg. 213/91.

1.9 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 of Province of Ontario and advise Departmental Representative verbally and in writing.

1.10 HEALTH AND SAFETY CO-ORDINATOR

- .1 Employ and assign to Work, competent and authorized representative as Health and Safety Co-ordinator. Health and Safety Co-ordinator must:
 - .1 Have site-related working experience specific to activities associated with hazardous materials as identified.

HEALTH AND SAFETY REQUIREMENTS

- .2 Have working knowledge of occupational safety and health regulations.
- .3 Be responsible for completing Contractor's Health and Safety Training Sessions and ensuring that personnel not successfully completing required training are not permitted to enter site to perform Work.
- .4 Be responsible for implementing, enforcing daily and monitoring site-specific Contractor's Health and Safety Plan.
- .5 Be on site during execution of Work.

1.11 POSTING OF DOCUMENTS

- .1 Ensure applicable items, articles, notices and orders are posted in conspicuous location on site in accordance with Acts and Regulations of Province of Ontario, and in consultation with Departmental Representative.

1.12 CORRECTION OF NON-COMPLIANCE

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

1.13 POWDER ACTUATED DEVICES

- .1 Use powder actuated devices only after receipt of written permission from Departmental Representative.

1.14 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.

2 PRODUCTS

2.1 NOT USED

- .1 Not used.

3 EXECUTION

3.1 NOT USED

- .1 Not used.

END OF SECTION

1 GENERAL

1.1 INDEPENDENT INSPECTION AGENCIES

- .1 Independent Inspection/Testing Agencies will be engaged by Departmental Representative for purpose of inspecting and/or testing portions of Work. Cost of such services will be borne by Departmental Representative, unless indicated otherwise.
- .2 Provide equipment required for executing inspection and testing by appointed agencies.
- .3 Employment of inspection/testing agencies does not relax responsibility to perform Work in accordance with Contract Documents.
- .4 If defects are revealed during inspection and/or testing, appointed agency will request additional inspection and/or testing to ascertain full degree of defect. Correct defect and irregularities as advised by Departmental Representative at no cost to Departmental Representative. Pay costs for retesting and reinspection.

1.2 ACCESS TO WORK

- .1 Allow inspection/testing agencies access to Work, off site manufacturing and fabrication plants.
- .2 Co-operate to provide reasonable facilities for such access.

1.3 PROCEDURES

- .1 Notify appropriate agency and Departmental Representative in advance of requirement for tests, in order that attendance arrangements can be made.
- .2 Submit samples and/or materials required for testing, as specifically requested in specifications. Submit with reasonable promptness and in orderly sequence to not cause delays in Work.
- .3 Provide labour and facilities to obtain and handle samples and materials on site. Provide sufficient space to store and cure test samples.

1.4 REPORTS

- .1 Submit electronic copy of inspection and test reports to Departmental Representative.
- .2 Provide copy to subcontractor of work being inspected or tested, or manufacturer or fabricator of material being inspected or tested.

1.5 TESTS AND MIX DESIGNS

- .1 Furnish test results and mix designs as requested.

1.6 MOCK-UPS

- .1 Prepare mock-ups for Work specifically requested in specifications. Include for Work of Sections required to provide mock-ups.

- .2 Construct in locations acceptable to Departmental Representative and as specified in specific Section.
- .3 Prepare mock-ups for Departmental Representative review with reasonable promptness and in orderly sequence, to not cause delays in Work.
- .4 Failure to prepare mock-ups in ample time is not considered sufficient reason for extension of Contract Time and no claim for extension by reason of such default will be allowed.
- .5 Specification section identifies whether mock-up may remain as part of Work or if it is to be removed and when.

1.7 MILL TESTS

- .1 Submit mill test certificates as required of specification Sections.

1.8 EQUIPMENT AND SYSTEMS

- .1 Submit adjustment and balancing reports for mechanical, electrical and building equipment systems.
- .2 Refer to appropriate specification sections for definitive requirements.

2 PRODUCTS

2.1 NOT USED

- .1 Not Used.

3 EXECUTION

3.1 NOT USED

- .1 Not Used.

END OF SECTION

1 GENERAL

1.1 REFERENCE STANDARDS

- .1 Within text of each specifications section, reference may be made to reference standards.
- .2 Conform to these reference standards, in whole or in part as specifically requested in specifications.

1.2 QUALITY

- .1 Products, materials, equipment and articles incorporated in Work shall be new, not damaged or defective, and of best quality for purpose intended. If requested, furnish evidence as to type, source and quality of products provided.
- .2 Acquire, in cost effective manner, items containing highest percentage of recycled and recovered materials practicable consistent with maintaining satisfactory levels of competition. Make reasonable efforts to use recycled and recovered materials and in otherwise utilizing recycled and recovered materials in execution of work.
- .3 Unless otherwise indicated in specifications, maintain uniformity of manufacture for any particular or like item throughout building.
- .4 Permanent labels, trademarks and nameplates on products are not acceptable in prominent locations, except where required for operating instructions, or when located in mechanical or electrical rooms.

1.3 STORAGE, HANDLING AND PROTECTION

- .1 Handle and store products in manner to prevent damage, adulteration, deterioration and soiling and in accordance with manufacturer's instructions when applicable.
- .2 Store packaged or bundled products in original and undamaged condition with manufacturer's seal and labels intact. Do not remove from packaging or bundling until required in Work.
- .3 Store products subject to damage from weather in weatherproof enclosures.
- .4 Store cementitious products clear of earth or concrete floors, and away from walls.
- .5 Keep sand, when used for grout or mortar materials, clean and dry. Store sand on wooden platforms and cover with waterproof tarpaulins during inclement weather.
- .6 Store sheet materials, lumber and moisture sensitive materials on flat, solid supports and keep clear of ground. Slope to shed moisture.
- .7 Store and mix paints in heated and ventilated room. Remove oily rags and other combustible debris from site daily. Take every precaution necessary to prevent spontaneous combustion.
- .8 Remove and replace damaged products at own expense and to satisfaction of Departmental Representative.

- .9 Touch-up damaged factory finished surfaces to Departmental Representative's satisfaction. Use touch-up materials to match original. Do not paint over name plates.

1.4 TRANSPORTATION

- .1 Pay costs of transportation of products required in performance of Work.
- .2 Unload, handle and store products supplied by Departmental Representative.

1.5 MANUFACTURER'S INSTRUCTIONS

- .1 Unless otherwise indicated in specifications, install or erect products in accordance with manufacturer's instructions. Do not rely on labels or enclosures provided with products. Obtain written instructions directly from manufacturers.
- .2 Notify Departmental Representative in writing, of conflicts between specifications and manufacturer's instructions, so that Departmental Representative will establish course of action.

1.6 CO-ORDINATION

- .1 Ensure co-operation of workers in laying out Work. Maintain efficient and continuous supervision.
- .2 Be responsible for coordination and placement of openings, sleeves and accessories.

1.7 CONCEALMENT

- .1 In finished areas conceal pipes, ducts and wiring in floors, walls and ceilings, except where indicated otherwise.
- .2 Before installation inform Departmental Representative if there is interference. Install as directed by Departmental Representative.

1.8 REMEDIAL WORK

- .1 Perform remedial work required to repair or replace parts or portions of Work identified as defective or unacceptable. Co-ordinate adjacent affected Work as required.
- .2 Perform remedial work by specialists familiar with materials affected. Perform in a manner to neither damage nor put at risk any portion of Work.

1.9 LOCATION OF FIXTURES

- .1 Consider location of fixtures, outlets, and mechanical and electrical items indicated as approximate.
- .2 Inform Departmental Representative of conflicting installation. Install as directed.

1.10 FASTENINGS

- .1 Provide metal fastenings and accessories in same texture, colour and finish as adjacent materials, unless indicated otherwise.

COMMON PRODUCT REQUIREMENTS

- .2 Prevent electrolytic action between dissimilar metals and materials.
- .3 Use non-corrosive hot dip galvanized steel fasteners and anchors for securing exterior work, unless stainless steel or other material is specifically requested in affected specification Section.
- .4 Space anchors within individual load limit or shear capacity and ensure they provide positive permanent anchorage. Wood, or any other organic material plugs are not acceptable.
- .5 Keep exposed fastenings to a minimum, space evenly and install neatly.
- .6 Fastenings which cause spalling or cracking of material to which anchorage is made are not acceptable.

1.11 FASTENINGS - EQUIPMENT

- .1 Use fastenings of standard commercial sizes and patterns with material and finish suitable for service.
- .2 Use heavy hexagon heads, semi-finished unless otherwise specified. Use No. 304 stainless steel for exterior areas.
- .3 Bolts may not project more than one diameter beyond nuts.
- .4 Use plain type washers on equipment, sheet metal and soft gasket lock type washers where vibrations occur. Use resilient washers with stainless steel.

1.12 PROTECTION OF WORK IN PROGRESS

- .1 Prevent overloading of parts of building. Do not cut, drill or sleeve load bearing structural member, unless specifically indicated without written approval of Departmental Representative.

1.13 EXISTING UTILITIES

- .1 When breaking into or connecting to existing services or utilities, execute Work at times directed by local governing authorities, with minimum of disturbance to Work, to occupants of adjacent buildings and to pedestrian and vehicular traffic.
- .2 Protect, relocate or maintain existing active services. When services are encountered, cap off in manner approved by authority having jurisdiction. Stake and record location of capped service.

2 PRODUCTS**2.1 NOT USED**

- .1 Not Used.

3 EXECUTION**3.1 NOT USED**

.1 Not Used.

END OF SECTION

1 GENERAL

1.1 RELATED REQUIREMENTS

- .1 Section 07 84 00 - Firestopping

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit written request in advance of cutting or alteration which affects:
 - .1 Structural integrity of elements of project.
 - .2 Integrity of weather-exposed or moisture-resistant elements.
 - .3 Efficiency, maintenance, or safety of operational elements.
 - .4 Visual qualities of sight-exposed elements.
 - .5 Work of Departmental Representative or separate contractor.
- .3 Include in request:
 - .1 Identification of project.
 - .2 Location and description of affected Work.
 - .3 Statement on necessity for cutting or alteration.
 - .4 Description of proposed Work, and products to be used.
 - .5 Alternatives to cutting and patching.
 - .6 Effect on Work of Departmental Representative or separate contractor.
 - .7 Written permission of affected separate contractor.
 - .8 Date and time work will be executed.

1.3 MATERIALS

- .1 Required for original installation.

1.4 PREPARATION

- .1 Inspect existing conditions, including elements subject to damage or movement during cutting and patching.
- .2 After uncovering, inspect conditions affecting performance of Work.
- .3 Beginning of cutting or patching means acceptance of existing conditions.
- .4 Provide supports to assure structural integrity of surroundings; provide devices and methods to protect other portions of project from damage.
- .5 Provide protection from elements for areas which are to be exposed by uncovering work; maintain excavations free of water.

1.5 EXECUTION

- .1 Execute cutting, fitting, and patching, including excavation and fill, to complete Work.
- .2 Fit several parts together, to integrate with other Work.

EXECUTION

- .3 Uncover Work to install ill-timed Work.
- .4 Remove and replace defective and non-conforming Work.
- .5 Provide openings in non-structural elements of Work for penetrations of mechanical and electrical Work.
- .6 Execute Work by methods to avoid damage to other Work, and which will provide proper surfaces to receive patching and finishing.
- .7 Employ original installer to perform cutting and patching for weather-exposed and moisture-resistant elements, and sight-exposed surfaces.
- .8 Cut rigid materials using masonry saw or core drill. Pneumatic or impact tools not allowed on masonry work without prior approval.
- .9 Restore work with new products in accordance with requirements of Contract Documents.
- .10 Fit Work airtight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.
- .11 At penetration of fire rated wall, ceiling, or floor construction, completely seal voids with firestopping material in accordance with Section 07 84 00 - Firestopping, full thickness of the construction element.
- .12 Refinish surfaces to match adjacent finishes: Refinish continuous surfaces to nearest intersection. Refinish assemblies by refinishing entire unit.
- .13 Conceal pipes, ducts and wiring in floor, wall and ceiling construction of finished areas except where indicated otherwise.

1.6 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate waste materials in accordance with Section 01 74 19 - Waste Management and Disposal.

2 PRODUCTS

2.1 NOT USED

- .1 Not Used.

3 EXECUTION

3.1 NOT USED

- .1 Not Used.

END OF SECTION

1 GENERAL

1.1 CLEANING

- .1 Maintain Work in tidy condition, free from accumulation of waste products and debris, other than that caused by Departmental Representative.
- .2 Remove waste materials from site at daily regularly scheduled times or dispose of as directed by Departmental Representative. Do not burn waste materials on site.
- .3 Clear snow and ice from access to building and from adjacent staging area site (kitty corner to building site) and access road, and remove from site.
- .4 Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris.
- .5 Provide on-site containers for collection of waste materials and debris.
- .6 Provide and use marked separate bins for recycling. Refer to Section 01 74 19 - Waste Management and Disposal.
- .7 Dispose of waste materials and debris at designated dumping areas off site.
- .8 Clean interior areas prior to start of finishing work and maintain areas free of dust and other contaminants during finishing operations.
- .9 Store volatile waste in covered metal containers and remove from premises at end of each working day.
- .10 Provide adequate ventilation during use of volatile or noxious substances. Use of building ventilation systems is not permitted for this purpose.
- .11 Use only cleaning materials recommended by manufacturer of surface to be cleaned, and as recommended by cleaning material manufacturer.
- .12 Schedule cleaning operations so that resulting dust, debris and other contaminants will not fall on wet, newly painted surfaces nor contaminate building systems.

1.2 FINAL CLEANING

- .1 When Work is Substantially Performed remove surplus products, tools, construction machinery and equipment not required for performance of remaining Work.
- .2 Remove waste products and debris other than that caused by others, and leave Work clean and suitable for occupancy.
- .3 Prior to final review remove surplus products, tools, construction machinery and equipment.
- .4 Remove waste products and debris other than that caused by Departmental Representative.

CLEANING

- .5 Remove waste materials from site at regularly scheduled times or dispose of as directed by Departmental Representative. Do not burn waste materials on site.
- .6 Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris.
- .7 Clean and polish glass, mirrors, hardware, wall tile, stainless steel, chrome, porcelain enamel, baked enamel, plastic laminate, and mechanical and electrical fixtures. Replace broken, scratched or disfigured glass.
- .8 Remove stains, spots, marks and dirt from decorative work, electrical and mechanical fixtures, furniture fitments, walls, and floors.
- .9 Clean lighting reflectors, lenses, and other lighting surfaces.
- .10 Vacuum clean and dust building interiors, behind grilles, louvres and screens.
- .11 Wax, seal, shampoo or prepare floor finishes, as recommended by manufacturer.
- .12 Inspect finishes, fitments and equipment and ensure specified workmanship and operation.
- .13 Remove dirt and other disfiguration from exterior surfaces.
- .14 Sweep and wash clean paved areas.
- .15 Clean equipment and fixtures to sanitary condition; replace filters of mechanical equipment.
- .16 Remove debris and surplus materials from crawl areas and other accessible concealed spaces.

1.3 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate waste materials in accordance with Section 01 74 19 - Waste Management And Disposal.

2 PRODUCTS

2.1 NOT USED

- .1 Not Used.

3 EXECUTION

3.1 NOT USED

- .1 Not Used.

END OF SECTION

1 GENERAL

1.1 WASTE MANAGEMENT GOALS

- .1 Departmental Representative's waste management goal: to divert a minimum 85 percent of total Project Waste from landfill sites. Prior to project completion provide Departmental Representative documentation certifying that waste management, recycling, reuse of recyclable and reusable materials have been extensively practiced. Minimize amount of non-hazardous solid waste generated by project and accomplish maximum source reduction, reuse and recycling of solid waste produced by CRD activities.
- .3 Protect environment and prevent environmental pollution damage.

1.2 DEFINITIONS

- .1 Approved/Authorized recycling facility: waste recycler approved by applicable provincial authority or other users of material for recycling approved by the Departmental Representative.
- .2 Class III: non-hazardous waste - construction renovation and demolition waste.
- .3 Construction, Renovation and/or Demolition (CRD) Waste: Class III solid, non-hazardous waste materials generated during construction, demolition, and/or renovation activities
- .4 Cost/Revenue Analysis Workplan (CRAW): based on information from Waste Reduction Workplan, and intended as financial tracking tool for determining economic status of waste management practices (Schedule E).
- .5 Inert Fill: inert waste - exclusively asphalt and concrete.
- .6 Waste Source Separation Program (WSSP): implementation and co-ordination of ongoing activities to ensure designated waste materials will be sorted into pre-defined categories and sent for recycling and reuse, maximizing diversion and potential to reduce disposal costs.
- .7 Recyclable: ability of product or material to be recovered at end of its life cycle and re-manufactured into new product for reuse.
- .8 Recycle: process by which waste and recyclable materials are transformed or collected for purpose of being transferred into new products.
- .9 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.
- .10 Reuse: repeated use of product in same form but not necessarily for same purpose. Reuse includes:
 - .1 Salvaging reusable materials from re-modelling projects, before demolition stage, for resale, reuse on current project or for storage for use on future projects.
 - .2 Returning reusable items including pallets or unused products to vendors.
- .11 Salvage: removal of structural and non-structural materials from deconstruction/disassembly projects for purpose of reuse or recycling.

- .12 Separate Condition: refers to waste sorted into individual types.
- .13 Source Separation: act of keeping different types of waste materials separate beginning from the point they became waste.
- .14 Waste Audit (WA): detailed inventory of estimated quantities of waste materials that will be generated during construction, demolition, deconstruction and/or renovation. Involves quantifying by volume/weight amounts of materials and wastes that will be reused, recycled or landfilled. Refer to Schedule A.
- .15 Waste Diversion Report: detailed report of final results, quantifying cumulative weights and percentages of waste materials reused, recycled and landfilled over course of project. Measures success against Waste Reduction Workplan (WRW) goals and identifies lessons learned.
- .16 Waste Management Co-ordinator (WMC): contractor representative responsible for supervising waste management activities as well as co-ordinating required submittal and reporting requirements.
- .17 Waste Reduction Workplan (WRW): written report which addresses opportunities for reduction, reuse, or recycling of materials generated by project. Specifies diversion goals, implementation and reporting procedures, anticipated results and responsibilities. Waste Reduction Workplan (Schedule B) information acquired from Waste Audit.

1.3 DOCUMENTS

- .1 Post and maintain in visible and accessible area at job site, one copy of following documents:
 - .1 Waste Audit (Schedule A).
 - .2 Waste Reduction Workplan (Schedule B).
 - .3 Waste Source Separation Program.
 - .4 Schedules A, B, and E completed for project.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Waste management to be carried as a line item in the Cost Breakdown, and to be billed against as work progresses. Detailed submittals will be required as back-up.
- .3 Prepare and submit following prior to project start-up:
 - .1 1 electronic copy of completed Waste Audit (WA)
 - .2 1 electronic copy of completed Waste Reduction Workplan (WRW)
 - .3 1 electronic copy of Cost/Revenue Analysis Workplan (CRAW)
 - .4 1 electronic copy of Waste Source Separation Program (WSSP).
- .4 Submit prior to final payment the following:
 - .1 Waste Diversion Report, indicating final quantities in tones by material types salvaged for reuse, recycling or disposal in landfill and recycling centres, re-use depots, landfills and other waste processors that received waste materials.
 - .2 Provide receipts, scale tickets, waybills, waste disposal receipts that confirm quantities and types of materials reused, recycled or disposed of and destination.

1.5 WASTE AUDIT (WA)

- .1 Contractor to prepare WA 20 working days after contract award.
- .2 WA provides detailed inventory, estimated quantities and types of waste materials that will be generated as well as their potential to be reused and/or recycled and project's waste diversion goals and objectives.
- .3 After award of contract, contractor to review WA and confirm that anticipated quantities of waste generated are accurate and goals achievable.
- .4 If after review, contractor determines that indicated quantities or opportunities in WA are not accurate or achievable, contractor to provide written details of discrepancies and revised quantities for areas of concern. Contractor to meet with Departmental Representative to review and justify revisions.
- .5 Post on-site WA where contractor and sub-contractors are able to review content.

1.6 WASTE REDUCTION WORKPLAN (WRW)

- .1 Prepare and submit WRW at least 10 days prior to project start-up.
- .2 WRW identifies strategies to optimize diversion through reduction, reuse, and recycling of materials and comply with applicable regulations, based on information acquired from WA.
- .3 WRW should include but not limited to:
 - .1 Applicable regulations.
 - .2 Specific goals for waste reduction, identify existing barriers and develop strategies to overcome them.
 - .3 Destination of materials identified.
 - .4 Deconstruction/disassembly techniques and schedules.
 - .5 Methods to collect, separate, and reduce generated wastes.
 - .6 Location of waste bins on-site.
 - .7 Security of on-site stock piles and waste bins.
 - .8 Protection of personnel, sub-contractors.
 - .9 Clear labelling of storage areas.
 - .10 Training plan for contractor and sub-contractors.
 - .11 Methods to track and report results reliably.
 - .12 Details on materials handling and removal procedures.
 - .13 Recycler and reclaimer requirements.
 - .14 Quantities of materials to be salvaged for reuse or recycled and materials sent to landfill.
 - .15 Requirements for monitoring on-site wastes management activities.
- .4 Structure WRW to prioritize actions and follow 3R's hierarchy, with Reduction as first priority, followed by Reuse, then Recycle.
- .5 Post WRW or summary where workers at site are able to review content.
- .6 Monitor and report on waste reduction by documenting total volume (in tonnes) and cost of actual waste removed from project.

1.7 COST/REVENUE ANALYSIS WORKPLAN (CRAW)

- .1 Prepare CRAW and include the following:
 - .1 Cost of current waste management practices.

- .2 Implementation cost of waste diversion program.
- .3 Savings and benefits resulting from waste diversion program.

1.8 WASTE SOURCE SEPARATION PROGRAM (WSSP)

- .1 As part of Waste Reduction Workplan, prepare WSSP prior to project start-up.
- .2 WSSP will detail methodology and planned on-site activities for separation of reusable and recyclable materials from waste intended for landfill.
- .3 Provide list and drawings of locations that will be made available for sorting, collection, handling and storage of anticipated quantities of reusable and recyclable materials.
- .4 Provide sufficient on-site facilities and containers for collection, handling, and storage of anticipated quantities of reusable and recyclable materials.
- .5 Locate containers to facilitate deposit of materials without hindering daily operations.
- .6 Provide training for sub-contractors and workers in handling and separation of materials for reuse and/or recycling.
- .7 Locate separated materials in areas which minimizes material damage.
- .8 Clearly and securely label containers to identify types/conditions of materials accepted and assist sub-contractors and workers in separating materials accordingly.
- .9 Monitor on-site waste management activities by conducting periodic site inspections to verify: state of signage, contamination levels, bin locations and condition, personnel participation, use of waste tracking forms and collection of waybills, receipts and invoices.
- .10 On-site sale of salvaged materials is not permitted unless authorized in writing by Departmental Representative and provided that site safety regulations and security requirements are adhered to.

1.9 USE OF SITE AND FACILITIES

- .1 Execute Work with minimal interference and disturbance to normal use of premises.
- .2 Maintain security measures established by facility provide temporary security measures approved by Departmental Representative.

1.10 WASTE PROCESSING SITES

- .1 Contractor is responsible to research and locate waste diversion resources and service providers. Salvaged materials are to be transported off site to approved and/or authorized recycling facilities or to users of material for recycling.

1.11 QUALITY ASSURANCE

- .1 Waste Management Meeting: Waste Management Co-ordinator is to provide an update on status of waste diversion and management activities at each meeting. Written monthly Waste Diversion Report summary to be provided by Waste Management Coordinator.

1.12 STORAGE, HANDLING AND PROTECTION

- .1 Store, materials to be reused, recycled and salvaged in locations as directed by Departmental Representative.
- .2 Unless specified otherwise, materials for removal become Contractor's property.
- .3 Protect, stockpile, store and catalogue salvaged items.
- .4 Separate non-salvageable materials from salvaged items. Transport and deliver non-salvageable items to licensed disposal facility.
- .5 Protect structural components not removed and salvaged materials from movement or damage.
- .6 Support affected structures. If safety of building is endangered, cease operations and immediately notify Departmental Representative.
- .7 Protect surface drainage, mechanical and electrical from damage and blockage.
- .8 Provide on-site facilities and containers for collection and storage of reusable and recyclable materials.
- .9 Separate and store materials produced during project in designated areas.
- .10 Prevent contamination of materials to be salvaged and recycled and handle materials in accordance with requirements for acceptance by designated processing facilities.
 - .1 On-site source separation is recommended.
 - .2 Remove co-mingled materials to off site processing facility for separation.
 - .3 Obtain waybills, receipts and/or scale tickets for separated materials removed from site.
 - .4 Materials reused on-site are considered to be diverted from landfill and as such are to be included in all reporting.

1.13 DISPOSAL OF WASTES

- .1 Do not bury rubbish or waste materials.
- .2 Do not dispose of waste, volatile materials, mineral spirits, oil or paint thinner into waterways, storm, or sanitary sewers.
- .3 Keep records of construction waste including:
 - .1 Number and size of bins.
 - .2 Waste type of each bin.
 - .3 Total tonnage generated.
 - .4 Tonnage reused or recycled.
 - .5 Reused or recycled waste destination.
- .4 Remove materials on-site as Work progresses.
- .5 Prepare project summary to verify destination and quantities on a material-by-material basis as identified in the waste audit.

1.14 SCHEDULING

- .1 Co-ordinate Work with other activities at site to ensure timely and orderly progress of Work.

2 PRODUCTS

2.1 NOT USED

- .1 Not Used.

3 EXECUTION

3.1 APPLICATION

- .1 Do Work in compliance with WRW and WSSP.
- .2 Handle waste materials not reused, salvaged, or recycled in accordance with appropriate regulations and codes.

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 for reuse and recycling in accordance with Section 01 74 19 - Construction/Demolition Waste Management and Disposal.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.
 - .2 Source separate materials to be reused/recycled into specified sort areas.

3.3 DIVERSION OF MATERIALS

- .1 Separate materials from general waste stream and stockpile in separate piles or containers, as reviewed by Departmental Representative, and consistent with applicable fire regulations.
 - .1 Mark containers or stockpile areas.
 - .2 Provide instruction on disposal practices.
- .2 On-site sale of salvaged materials is not permitted.

3.4 WASTE DIVERSION REPORT

- .1 At completion of Project, prepare written Waste Diversion Report indicating quantities of materials reused, recycled or disposed of as well as the following:
 - .1 Identify final diversion results and measure success against goals from Waste Reduction Workplan.
 - .2 Compare final quantities/percentages diverted with initial projections in Waste Audit and Waste Reduction Workplan and explain variances.
 - .1 Supporting documentation.
 - .2 Waybills and tracking forms.
 - .3 Description of issues, resolutions and lessons learned.

WASTE MANAGEMENT AND DISPOSAL

3.5 WASTE AUDIT (WA)

.1	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Schedule A - Waste Audit (WA)	Material	Estimated	Total	Generatio	%	% Reused
	Material Category	Quantity	Waste %	Quantity	n Point	Recycled	
		Unit		of Waste	(unit)		
	Wood and Plastics						
	Off-cuts						
	Warped Pallet						
	Forms						
	Plastic Packaging						
	Cardboard						
	Packaging						
	Other						

3.6 WASTE REDUCTION WORKPLAN (WRW)

.1	(1)	(2)	(3)	(4)	(5)	(6)
	Schedule B	Person(s)	Total	Actual	Actual	Material
	Material Category	Responsible	Quantity of	Reused	Recycled	Destination
			Waste	Amount	Amount	
				(units)	(units)	
				Projected	Projected	
	Wood and Plastics					
	Off-cuts					
	Warped Pallet					
	Forms					
	Plastic Packaging					
	Cardboard					
	Packaging					
	Other					

3.7 COST/REVENUE ANALYSIS WORKPLAN (CRAW)

.1	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Schedule E - Cost/Revenue Analysis Workplan (CRAW)	Total	Volume	Weight	Disposal	Category	Cost (-) /
	Material	Quantity	(cum)	(cum)	Cost/Credit	Sub-Total	Revenue (+)
	Description	(unit)			\$(+/-)	\$(+/-)	\$
	Wood						
	Wood Stud						
	Plywood						
	Other						

3.8 CANADIAN GOVERNMENTAL DEPARTMENTS CHIEF RESPONSIBILITY FOR THE ENVIRONMENT

.1 Schedule G - Government Chief Responsibility for the Environment:

WASTE MANAGEMENT AND DISPOSAL

<u>Province</u>	<u>Address</u>	<u>General Inquires</u>	<u>Fax</u>
Ontario Ministry of Environment and Energy	135 St. Clair Avenue West Toronto ON M4V 1P5	416-323-4321 800-565-4923	416-323-4682
Environment Canada	Toronto ON	416-734-4494	

END OF SECTION

1 GENERAL

1.1 REFERENCE STANDARDS

- .1 Canadian Environmental Protection Act (CEPA)
 - .1 SOR/2008-197, Storage Tank Systems for Petroleum Products and Allied Petroleum Products Regulations.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Two weeks prior to Substantial Performance of the Work, submit to the Departmental Representative, two draft copies of operating and maintenance manuals in English.
- .3 Make revisions to operating and maintenance manuals as per comments provided by Departmental Representative. Submit 4 final copies of operating and maintenance manuals in English and French, and one electronic copy each in English and in French.
- .4 Provide spare parts, maintenance materials and special tools of same quality and manufacture as products provided in Work.
- .5 Provide evidence, if requested, for type, source and quality of products supplied.

1.3 FORMAT

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

1.4 CONTENTS - PROJECT RECORD DOCUMENTS

- .1 Table of Contents for Each Volume: provide title of project;
 - .1 Date of submission; names.

CLOSEOUT SUBMITTALS

- .2 Addresses, and telephone numbers of Consultant and Contractor with name of responsible parties.
- .3 Schedule of products and systems, indexed to content of volume.
- .2 For each product or system:
 - .1 List names, addresses and telephone numbers of subcontractors and suppliers, including local source of supplies and replacement parts.
- .3 Product Data: mark each sheet to identify specific products and component parts, and data applicable to installation; delete inapplicable information.
- .4 Drawings: supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams.
- .5 Typewritten Text: as required to supplement product data.
 - .1 Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions specified in Section 01 45 00 - Quality Control.
- .6 Training: refer to appropriate Specification Sections.

1.5 AS -BUILT DOCUMENTS AND SAMPLES

- .1 Maintain, in addition to requirements in General Conditions, at site for Departmental Representative one record copy of:
 - .1 Contract Drawings.
 - .2 Specifications.
 - .3 Addenda.
 - .4 Change Orders and other modifications to Contract.
 - .5 Reviewed shop drawings, product data, and samples.
 - .6 Field test records.
 - .7 Inspection certificates.
 - .8 Manufacturer's certificates.
- .2 Store record documents and samples in field office apart from documents used for construction.
 - .1 Provide files, racks, and secure storage.
- .3 Label record documents and file in accordance with Section number listings in List of Contents of this Project Manual.
 - .1 Label each document "PROJECT RECORD" in neat, large, printed letters.
- .4 Maintain record documents in clean, dry and legible condition.
 - .1 Do not use record documents for construction purposes.
- .5 Keep record documents and samples available for inspection by Departmental Representative.

1.6 RECORDING INFORMATION ON PROJECT RECORD DOCUMENTS

- .1 Use felt tip marking pens, maintaining separate colours for each major system, for recording information.
- .2 Record information concurrently with construction progress.
 - .1 Do not conceal Work until required information is recorded.

CLOSEOUT SUBMITTALS

- .3 Contract Drawings and shop drawings: mark each item to record actual construction, including:
 - .1 Measured depths of elements of foundation in relation to finish first floor datum.
 - .2 Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
 - .3 Measured locations of internal utilities and appurtenances, referenced to visible and accessible features of construction.
 - .4 Field changes of dimension and detail.
 - .5 Changes made by change orders.
 - .6 Details not on original Contract Drawings.
 - .7 Referenced Standards to related shop drawings and modifications.
- .4 Specifications: mark each item to record actual construction, including:
 - .1 Manufacturer, trade name, and catalogue number of each product actually installed, particularly optional items and substitute items.
 - .2 Changes made by Addenda and change orders.
- .5 Other Documents: maintain manufacturer's certifications, inspection certifications, field test records, and other documentation required by individual specifications sections.
- .6 Provide digital photos, if requested, for site records.

1.7 FINAL SURVEY

- .1 Submit final site survey certificate in accordance with Section 01 71 00 - Examination and Preparation, certifying that elevations and locations of completed Work are in conformance, or non-conformance with Contract Documents.

1.8 EQUIPMENT AND SYSTEMS

- .1 For each item of equipment and each system include description of unit or system, and component parts.
 - .1 Give function, normal operation characteristics and limiting conditions.
 - .2 Include performance curves, with engineering data and tests, and complete nomenclature and commercial number of replaceable parts.
- .2 Panel board circuit directories: provide electrical service characteristics, controls, and communications.
- .3 Include installed colour coded wiring diagrams.
- .4 Operating Procedures: include start-up, break-in, and routine normal operating instructions and sequences.
 - .1 Include regulation, control, stopping, shut-down, and emergency instructions.
 - .2 Include summer, winter, and any special operating instructions.
- .5 Maintenance Requirements: include routine procedures and guide for trouble-shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.
- .6 Provide servicing and lubrication schedule, and list of lubricants required.
- .7 Include manufacturer's printed operation and maintenance instructions.

- .8 Include sequence of operation by controls manufacturer.
- .9 Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.
- .10 Provide installed control diagrams by controls manufacturer.
- .11 Provide Contractor's co-ordination drawings, with installed colour coded piping diagrams.
- .12 Provide charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.
- .13 Provide list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.
- .14 Include test and balancing reports as specified in Section 01 45 00 - Quality Control and 01 91 13 - General Commissioning (Cx) Requirements.
- .15 Above ground storage tank inspection documentation, registration, forms, decommissioning and removal in accordance with CEPA SOR/2008-197.
- .16 Additional requirements: as specified in individual specification sections.

1.9 MATERIALS AND FINISHES

- .1 Building products, applied materials, and finishes: include product data, with catalogue number, size, composition, and colour and texture designations.
 - .1 Provide information for re-ordering custom manufactured products.
- .2 Instructions for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.
- .3 Moisture-protection and weather-exposed products: include manufacturer's recommendations for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.
- .4 Additional requirements: as specified in individual specifications sections.

1.10 MAINTENANCE MATERIALS

- .1 Spare Parts:
 - .1 Provide spare parts, in quantities specified in individual specification sections.
 - .2 Provide items of same manufacture and quality as items in Work.
 - .3 Deliver to site; place and store.
 - .4 Receive and catalogue items.
 - .1 Submit inventory listing to Departmental Representative.
 - .2 Include approved listings in Maintenance Manual.
 - .5 Obtain receipt for delivered products and submit prior to final completion.
- .2 Extra Stock Materials:
 - .1 Provide maintenance and extra materials, in quantities specified in individual specification sections.

CLOSEOUT SUBMITTALS

- .2 Provide items of same manufacture and quality as items in Work.
- .3 Deliver to site; place and store.
- .4 Receive and catalogue items.
 - .1 Submit inventory listing to Departmental Representative.
 - .2 Include approved listings in Maintenance Manual.
- .5 Obtain receipt for delivered products and submit prior to final completion.

- .3 Special Tools:
 - .1 Provide special tools, in quantities specified in individual specification section.
 - .2 Provide items with tags identifying their associated function and equipment.
 - .3 Deliver to site; place and store.
 - .4 Receive and catalogue items.
 - .1 Submit inventory listing to Departmental Representative.
 - .2 Include approved listings in Maintenance Manual.

1.11 DELIVERY, STORAGE AND HANDLING

- .1 Store spare parts, maintenance materials, and special tools in manner to prevent damage or deterioration.
- .2 Store in original and undamaged condition with manufacturer's seal and labels intact.
- .3 Store components subject to damage from weather in weatherproof enclosures.
- .4 Store paints and freezable materials in a heated and ventilated room.
- .5 Remove and replace damaged products at own expense and for review by Departmental Representative.

1.12 WARRANTIES

- .1 Develop warranty management plan to contain information relevant to Warranties.
- .2 Submit warranty management plan, 30 days before planned pre-warranty conference, to Departmental Representative approval.
- .3 Warranty management plan to include required actions and documents to assure that Departmental Representative receives warranties to which it is entitled.
- .4 Provide plan in narrative form and contain sufficient detail to make it suitable for use by future maintenance and repair personnel.
- .5 Assemble approved information in binder, submit upon acceptance of work and organize binder as follows:
 - .1 Separate each warranty or bond with index tab sheets keyed to Table of Contents listing.
 - .2 List subcontractor, supplier, and manufacturer, with name, address, and telephone number of responsible principal.
 - .3 Obtain warranties and bonds, executed in duplicate by subcontractors, suppliers, and manufacturers, within ten days after completion of applicable item of work.
 - .4 Verify that documents are in proper form, contain full information, and are notarized.
 - .5 Co-execute submittals when required.
 - .6 Retain warranties and bonds until time specified for submittal.

CLOSEOUT SUBMITTALS

- .6 Include information contained in warranty management plan as follows:
 - .1 Roles and responsibilities of personnel associated with warranty process, including points of contact and telephone numbers within the organizations of Contractors, subcontractors, manufacturers or suppliers involved.
 - .2 Listing and status of delivery of Certificates of Warranty for extended warranty items, to include roofs, HVAC balancing, pumps, motors, transformers, and commissioned systems such as fire protection, alarm systems, sprinkler systems, and lightning protection systems.
 - .3 Provide list for each warranted equipment, item, feature of construction or system indicating:
 - .1 Name of item.
 - .2 Model and serial numbers.
 - .3 Location where installed.
 - .4 Name and phone numbers of manufacturers or suppliers.
 - .5 Names, addresses and telephone numbers of sources of spare parts.
 - .6 Warranties and terms of warranty: include overall warranty of construction. Indicate items that have extended warranties and show separate warranty expiration dates.
 - .7 Cross-reference to warranty certificates as applicable.
 - .8 Starting point and duration of warranty period.
 - .9 Summary of maintenance procedures required to continue warranty in force.
 - .10 Cross-Reference to specific pertinent Operation and Maintenance manuals.
 - .11 Organization, names and phone numbers of persons to call for warranty service.
 - .12 Typical response time and repair time expected for various warranted equipment.
 - .4 Contractor's plans for attendance at 4 and 9 month post-construction warranty inspections.
 - .5 Procedure and status of tagging of equipment covered by extended warranties.
 - .6 Post copies of instructions near selected pieces of equipment where operation is critical for warranty and/or safety reasons.
- .7 Respond in timely manner to oral or written notification of required construction warranty repair work.

1.13 WARRANTY TAGS

- .1 Tag, at time of installation, each warranted item. Provide durable, oil and water resistant tag approved by Departmental Representative.
- .2 Attach tags with copper wire and spray with waterproof silicone coating.
- .3 Leave date of acceptance until project is accepted for occupancy.
- .4 Indicate following information on tag:
 - .1 Type of product/material.
 - .2 Model number.
 - .3 Serial number.
 - .4 Contract number.
 - .5 Warranty period.
 - .6 Inspector's signature.
 - .7 Construction Contractor.

2 PRODUCTS

2.1 NOT USED

.1 Not Used.

3 EXECUTION

3.1 NOT USED

.1 Not Used.

END OF SECTION

1 GENERAL

1.1 REFERENCES

- .1 Canadian Standards Association (CSA International).
- .1 CSA S350-M1980(R2003). Code of Practice for Safety in Demolition of Structures.

1.2 SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Prior to beginning of Work on site, submit detailed Waste Reduction Workplan in accordance with Section 01 74 19 – Waste Management and Disposal.
- .3 Submit pre-demolition audit and deconstruction / disassembly plan prior to starting work.
- .4 Before proceeding with demolition of load bearing walls or other walls and where required by authority having jurisdiction, submit for review by Departmental Representative shoring and underpinning drawings prepared by Qualified Professional Engineer registered or licensed in the Province of Ontario, showing proposed method.

1.3 QUALITY ASSURANCE

- .1 Ensure Work is performed in compliance with CSA S350 and applicable provincial regulations.
- .2 Prior to start of Work arrange for site visit with Departmental Representative to examine existing site conditions adjacent to demolition work.
- .3 Meetings:
 - .1 Hold project meetings every week.
 - .2 Ensure key personnel including site supervisor, project manager, subcontractor representatives and WMC attend.
 - .3 WMC must provide written report on status of waste diversion activity at each meeting.
- .4 Departmental Representative will provide written notification of change to meeting schedule established upon contract award 24 hours prior to scheduled meeting.

1.4 WASTE MANAGEMENT AND DISPOSAL

- .1 Prior to beginning any On-Site work, submit detailed Waste Reduction Workplan in accordance with Section 01 74 19 – Waste Management and Disposal. Indicate:
 - .1 Descriptions of and anticipated quantities in percentages of materials to be salvaged reused, recycled and landfilled.
 - .2 Schedule of selective demolition.

DEMOLITION FOR MINOR WORKS

- .3 Number and location of dumpsters.
- .4 Anticipated frequency of tipping.
- .5 Name and address of haulers, waste facilities and waste receiving organizations.
- .2 The Waste Management Co-ordinator is responsible for fulfilment of reporting requirements.
- .3 Submit pre-demolition audit and deconstruction / disassembly plan prior to starting work.
- .4 Separate waste materials for reuse and recycling in accordance with Section 01 74 19 – Waste Management and Disposal.
- .5 Divert excess materials from landfill to site approved by Departmental Representative.

1.5 EXISTING CONDITIONS

- .1 Review "Designated Substance Report" and take precautions to protect environment.
- .2 Should materials resembling spray or trowel applied asbestos, PCB's, Mould or other designated substance listed as hazardous be encountered in course of deconstruction, stop work, take preventative measures, and notify Departmental Representative immediately. Do not proceed until written instructions have been received. Refer to Section 01 35 29.06 - Health and Safety Requirements.
- .3 Structures to be demolished to be based on their condition at time of examination prior to tendering.
- .4 Remove, protect and store salvaged items as directed by Departmental Representative. Salvage items as identified by Departmental Representative. Deliver to Departmental Representative as directed.

2 PRODUCTS**2.1 EQUIPMENT**

- .1 Demonstrate that tools are being used in manner which allows for salvage of materials in best condition possible.

3 EXECUTION**3.1 PREPARATION**

- .1 Do Work in accordance with Section 01 35 29.06 - Health and Safety Requirements.
- .2 Inspect building with Departmental Representative and verify extent and location of items designated for removal, disposal, alternative disposal, recycling, salvage and items to remain.

DEMOLITION FOR MINOR WORKS

- .3 Investigate site and structure to determine dismantling, processing and storage logistics required prior to beginning of Work.
- .4 Develop strategy for deconstruction to facilitate optimum salvage of reusable and recyclable materials.
- .5 Obtain necessary permits and approvals. Provide copies to Departmental Representative prior to start of Work on site and within 24 hours of written request.
- .6 Post signs in visible locations and appropriate languages which indicates to workers, subcontractors, haulers, the location of processing and stockpiling of each material, bin location and use e.g. ("CLEAN WOOD ONLY").
- .7 Locate and protect utilities inside and outside the building. Do not disrupt active or energized utilities traversing premises or designated to remain undisturbed. Notify and obtain approval of utility companies before starting demolition.
- .8 Locate and protect existing building services to remain that serve other parts of the building.
- .9 Disconnect and re-route all electrical, telephone and communication service lines passing through area to be deconstructed. Post warning signs on electrical lines and equipment which must remain energized to serve other products during period of demolition.
- .10 Disconnect, cap, plug or divert, as required, existing utilities within the building where they interfere with the execution of the work, in conformity with the requirements of the authorities having jurisdiction.
- .11 Immediately notify Departmental Representative in case of damage to any utility or service, designated to remain in place.
- .12 Immediately notify the Departmental Representative should uncharted utility or service be encountered and await instruction in writing regarding remedial action.

3.2 ACOUSTIC CONTROL REQUIREMENTS

- .1 All work is to be conducted to ensure low noise generation and to prevent sound propagation through the building structure to adjacent spaces.
 - .1 Low-noise generation is defined as deconstruction activities that are inherently quiet or unobtrusive and deconstruction activities that have been mitigated to prevent the noise impact such that no impulsive noises are discernable and average noise levels over any half hour do not exceed the background.
- .2 Appoint the Site Supervisor to act as the Acoustic Control Officer for the project. The appointed person's sole duty shall be to coordinate the work and take responsibility for the prevention of sound transmission to adjacent spaces. The Acoustic Control Officer shall:
 - .1 Develop and implement a demolition methodology that prevents transmission of sounds into the building structure and prevents transmission of noise to

DEMOLITION FOR MINOR WORKS

- spaces beside and below the work areas. Submit Noise Control Workplan (NCW) to Departmental Representative for approval prior to commencing demolition activities on site.
- .2 Update the NCW throughout demolition identifying activities that will necessitate additional acoustic control measures at bi-weekly construction meetings.
 - .3 Remain vigilant on the site at all times and respond to issues as they arise.
 - .4 Facilitate deconstruction by acquiring and making available insulated tarpaulins, rubber matting, composite tire matting and other impact absorbing materials as the work progresses.
-
- .3 Ensure that demolition activities involve deconstruction and disassembly of component parts and assemblies as opposed to in-situ destruction.
 - .4 Ensure that material and assemblies are transferred from heights to floor level using appropriately sized lifts.
 - .5 Ensure that material that can be disassembled of site is removed to prevent on site noise production.
 - .6 Ensure that all pneumatic tools are fitted with effective exhaust port silencers.

3.3 PROTECTION

- .1 Prevent movement, settlement or damage of adjacent structures, services, walks, paving, landscaping and adjacent grades and parts of building to remain. Provide bracing shoring and underpinning as required. Repair damage caused by deconstruction as directed by Departmental Representative.
- .2 Support affected structures and, if safety of structure being deconstructed or adjacent structures or services appears to be endangered, take preventative measures. Cease operations and immediately notify Departmental Representative.
- .3 Keep noise, dust, and inconvenience to occupant of adjacent tenant spaces to minimum. See acoustic control/mitigation requirements in the Preparation section of this spec section.
- .4 Protect building systems, services and equipment.
- .5 Provide temporary construction dust screens, covers, railings, supports and other protection as required.
- .6 Prior to commencing deconstruction, cover all HVAC return airs and supply airs within the deconstruction zone with high quality micro filters and turn of air flows.
- .7 Prevent debris from blocking streets and restricting normal access and egress from the building.

3.4 AIRTIGHT DUST PARTITIONS

- .1 Prior to undertaking any demolition work, provide airtight partitions to define the area of work to approval of Departmental Representative. Relocate dust enclosure to suit progress of the work and phasing. Do not damage or fasten to adjacent existing surfaces to remain.
- .2 Construct temporary airtight construction partitions as noted in Section 01 00 10 - General Instructions.
- .3 At completion of work on floor, vacuum clean and carefully remove temporary dust partitions. Reinststate all surfaces to approval of Departmental Representative.

3.5 SALVAGE

- .1 Salvage materials identified for re-use or handover to Departmental Representative. Remove and store materials to be salvaged, in manner to prevent damage.
 - .1 Store and protect in accordance with requirements for maximum preservation of material.
 - .2 Handle salvaged materials as new materials.
- .2 Remove, protect and store salvaged items as directed by Departmental Representative. Salvage items as identified by Departmental Representative. Deliver to Departmental Representative as directed.
- .3 Label and package component parts of mechanical and electrical material specified for salvage in accordance with Departmental Representative's instructions or as specified to prevent damage or loss.
- .4 Remove items to be reused, store as directed by Departmental Representative and re-install under appropriate section of specifications.

3.6 REMOVAL OF HAZARDOUS WASTES

- .1 Refer to Section 01 14 25 - Designated Substance for materials identified as Hazardous.

3.7 DISASSEMBLY

- .1 Materials removed from designated structures are property of Contractor.
- .2 Throughout course of deconstruction pay close attention to connections and material assemblies. Employ workmanship procedures which minimize damage to materials and equipment.
- .3 Ensure workers and subcontractors are trained to carry out work in accordance with appropriate deconstruction techniques.
- .4 Project supervisor with previous deconstruction experience must be present on site throughout project.
- .5 Deconstruct in accordance with CSA S350 and other applicable safety standards.

DEMOLITION FOR MINOR WORKS

- .6 Workers must utilize adequate fall protection including certified harness and belay systems as required by applicable Health & Safety regulations.

3.8 DEMOLITION

- .1 Refer to Section 01 00 10 - General Instruction, Scheduling, for day and time of day restrictions on noise producing work. Demolition noise is not permitted to impact occupants in adjacent tenant spaces within the building.
- .2 Remove existing equipment, services, and obstacles where required for refinishing or making good of existing surfaces, and replace as work progresses.
- .3 At end of each work shift, leave Work in safe and stable condition. Protect interiors of parts not to be demolished from exterior elements at all times.
- .4 Demolish to minimize dusting. Keep materials wetted as directed by Departmental Representative.
- .5 Remove structural framing. Maintain structural integrity of structure. Provide temporary bracing as required.
- .6 Contain fibrous materials (e.g. Insulation) to minimize release of airborne fibres while being transported within facility.
- .7 Coordinate removal of existing carpet with supplier of new carpet for disposal through carpet reclamation program.
- .8 Use natural lighting to do Work where possible. Shut off lighting except those required for security purposes at end of each day.
- .9 Systematically remove finishes, furnishings, and mechanical and electrical equipment as indicated and as instructed by Departmental Representative.
- .10 Carefully remove interior windows and doors from structure.
- .11 Disassemble non-loadbearing interior partitions and remove materials from structure.
- .12 Disassemble in sequence: roof, parapet, brick veneer, interior nonloadbearing partitions, exterior concrete masonry unit back-up walls.
- .13 Separate from waste stream, material designated for alternate disposal or in condition suitable for reuse and/or recycling.
- .14 Source separate for recycling materials that cannot be salvaged for reuse including wood, metal, concrete and asphalt.

3.9 CUTTING AND CORING OF EXISTING CONCRETE FLOORS

- .1 Perform core drilling of existing concrete slabs as required for the installation of new mechanical and electrical services. Cutting and coring to be performed by contractors specializing in this type of work in occupied facilities. Submit names of proposed

DEMOLITION FOR MINOR WORKS

contractors to Departmental Representative for approval a minimum of 72 hours prior to the start of any on site operations.

- .2 Prior to scheduling coring activities scan slabs for reinforcing and employ the services of a Structural Engineer licensed to practice in the province of Ontario to review results and approve of core locations. Report discrepancies in locations relative to plans to the Departmental Representative a minimum of 72 hours in advance of planned coring activities.
- .3 Perform operations at times as scheduled during “off hours” and to approval of Departmental Representative. Schedule at times to create least disturbance to occupants. Take precautions to approval of Departmental Representative to protect adjacent areas as well as areas below.
- .4 Perform scan testing of the existing slab prior to undertaking any demolition. Provide 48 hour advance notice of Testing to Departmental Representative and arrange to perform scanning in presence of Departmental Representative. Based on the results of the scan, the Departmental Representative will decide on the final locations of the openings in order to minimize structural effect on the existing slabs.

3.10 PROCESSING

- .1 Refer also to Section 01 74 19 – Waste Management and Disposal for other processing requirements.
- .2 Designate location for processing of materials which eliminates double handling and provides adequate space to maintain efficient material flow.
- .3 Separate, materials to ensure best possible condition of salvaged materials.
- .4 Keep processing area clean and free of excess debris.
- .5 Supply separate, marked disposal bins for categories of waste material. Do not remove bins from site until inspected and approved by Departmental Representative. Notify Departmental Representative prior to removal of bins from site.
- .6 Separate processed materials into organized piles for stockpiling. Provide collection area for materials processed or designated for alternate disposal. Pile materials on pallets to facilitate transport off-site or to storage areas.

3.11 STOCKPILING

- .1 Refer to Section 01 74 19 – Waste Management and Disposal for other processing requirements.
- .2 Label stockpiles, indicating material type and quantity.
- .3 Designate appropriate security resources/measures to prevent vandalism, damage and theft.
- .4 Locate stockpiled materials convenient for use in new construction. Eliminate double handling wherever possible.

DEMOLITION FOR MINOR WORKS

- .5 Stockpile materials designated for alternate disposal in location which facilitates removal from site and examination by potential end markets, and which does not impede disassembly, processing, or hauling procedures.
- .6 Separate from general waste stream each of following materials. Stockpile materials in neat and orderly fashion in location and as directed by Departmental Representative for alternate disposal. Stockpile materials in accordance with applicable fire and safety regulations.
 - .1 Glass fibre ceiling tiles.
 - .2 Wood fibre ceiling tiles.
 - .3 Power source poles deemed unfit for reuse by Departmental Representative.
 - .4 Wiring and conduit.
 - .5 Outlets/switches.
 - .6 Floor receptacles.
 - .7 Metal duct work, baffles, HVAC equipment.
 - .8 Demountable partitions.

3.12 REMOVAL FROM SITE

- .1 At end of each work shift, remove all processed materials. No storage of salvaged materials on site is permitted. Remove stockpiled material from site as directed by Departmental Representative when it interferes with operations of project construction. Remove stockpiles of like materials by alternate disposal option once collection of materials is complete.
- .2 Transport material designated for alternate disposal to approved facilities, or receiving organizations listed in waste reduction workplan and in accordance with applicable regulations. Do not deviate from facilities or receiving organizations listed in waste reduction workplan without prior written authorization from Departmental Representative.
- .3 Dispose of materials not designated for alternate disposal in accordance with applicable regulations. Disposal facilities must be approved of and listed in waste reduction workplan. Do not deviate from disposal facilities listed in waste reduction workplan without prior written authorization from Departmental Representative.
- .4 Provide written submittals throughout construction documenting waste management removals and overall summaries at the end of construction as required in Section 01 74 19 – Waste Management and Disposal.

3.13 CLEANING AND RESTORATION

- .1 Keep site clean and organized throughout deconstruction.
- .2 Upon completion of project, remove debris, trim surfaces and leave work site clean.
- .3 Upon completion of project, reinstate areas, landscaping, parking surfaces, walkways, light standards, affected by Work to condition which existed prior to beginning of Work and to same condition of adjacent, undisturbed areas.

END OF SECTION

Part 1 General**1.1 RELATED SECTIONS**

- .1 Section 01 14 25 – Designated Substances Report

1.2 REFERENCES

- .1 Comply with current Federal, Provincial, and local requirements pertaining to silica, provided that in case of conflict among these requirements or with these specifications the more stringent requirement applies. Comply with regulations in effect at time work is performed.
- .2 Federal Legislation
 - .1 Canada Labour Code and associated regulations.
- .3 Provincial legislation
 - .1 Ontario Occupational Health and Safety Act, R.S.O. 1990, Regulation 490/09 “Designated Substances”.

1.3 DEFINITIONS

- .1 **Dangerous Goods:** product, substance, or organism that is specifically listed or meets hazard criteria established in Transportation of Dangerous Goods Regulations.
- .2 **Hazardous Material:** product, substance, or organism that is used for its original purpose; and that is either dangerous goods or a material that may cause adverse impact to environment or adversely affect health of persons, animals, or plant life when released into the environment.
- .3 **Hazardous Material Workplan:** A brief report identifying the location and quantities of hazardous materials and the methods that will be used to remove, store, transport and dispose of them.
- .4 **Workplace Hazardous Materials Information System (WHMIS):** Canada-wide system designed to give employers and workers information about hazardous materials used in workplace. Under WHMIS, information on hazardous materials is provided on container labels, material safety data sheets (MSDS), and worker education programs. WHMIS is put into effect by combination of federal and provincial laws.

1.4 SUBMITTALS

- .1 Silica abatement section within Hazardous Material Work Plan.

1.5 PRECAUTIONARY MEASURES AND PROCEDURES

- .1 Execute work by methods to minimize raising silica dust from demolition operations. Where practical, wet methods or a dust collection system should be used to reduce dust.
- .2 Adequate ventilation, including local exhaust ventilation, should be maintained to prevent the accumulation and recirculation of harmful concentrations of free crystalline silica in the work area.

SILICA PRECAUTIONARY MEASURES

- .3 As practical, processes that generate silica dust should be completed in enclosed areas wherever possible to prevent the spread of silica dust outside of the work area.
- .4 Implement and maintain silica dust control measures during work to ensure that silica levels do not exceed allowable limits.
- .5 Departmental Representative may stop work at any time when release of silica dust to adjacent area is suspected. Contractor must discuss procedures that Contractor proposes to resolve problem. Make all necessary changes to operations prior to resuming any demolition activities that may cause release of silica dust at no extra cost to the Departmental Representative.
- .6 Silica dust should be cleaned from machinery and work surfaces by wet sweeping, the use of sweeping compounds or vacuum cleaners fitted with a HEPA filter to prevent the recirculation of dusty air. Cleaning methods such as blowing with compressed air or dry sweeping should be avoided. Where exposure to free crystalline silica occurs, protective work clothing should be vacuumed before removal.
- .7 Store material containing silica dust in closed containers or use other appropriate means to prevent dust from becoming airborne.

1.6 PERSONAL PROTECTIVE EQUIPMENT

- .1 Anticipated minimum levels of personal protection based on work activity involving silica dust are listed below and are in addition to the personal protective equipment required for the completion of the demolition activities. Personal Protection are dependent on the work practices and associated silica exposure risks.
 - .1 Air purifying half-mask respirator equipped with HEPA filter cartridges or supplied-air type, personally issued to the worker and marked as to efficiency and purpose, and acceptable to the Provincial Authority having jurisdiction as suitable for silica and the level of silica exposure in the Work Area. If disposable type filters are used, provide sufficient filters so that workers can install new filters following disposal of used filters and before re-entering contaminated areas.
 - .2 Eye Protection: Goggles, Safety glasses with side shields, or Face shield.
 - .3 If requested by a worker,
 - .1 Hand Protection: Gloves
 - .2 Clothing: Full body protective clothing

1.7 AIR MONITORING

- .1 If air monitoring shows that work areas contain crystalline silica above the specified action levels, these areas shall be cleaned by previously outlined methods at no additional cost to the Departmental Representative.

1.8 PERMITS

- .1 Contractor is responsible to obtain all necessary permits, licenses and approvals to conduct the abatement (e.g. Ontario Ministry of the Environment (MOE) waste generating number, etc.).

Part 2 Products

2.1 **NOT USED**

 .1 Not Used.

Part 3 **Execution**

3.1 **NOT USED**

 .1 Not Used.

END OF SECTION

1 GENERAL

1.1 RELATED REQUIREMENTS

- .1 Section 09 22 16 - Non-Structural Metal Framing

1.2 REFERENCE STANDARDS

- .1 CSA Group
 - .1 CSA B149-15 PACKAGE, Special Package: B149.1-15, Natural Gas and Propane Installation Code and B149.2-15, Propane Storage and Handling Code.
- .2 Underwriters Laboratories of Canada (ULC)
 - .1 CAN/ULC-S604:2016, Standard for Factory-Built Type A Chimneys.
 - .2 CAN/ULC-S702.1-14/S702.2-15, Standard for Mineral Fibre Insulation for Buildings Part 1: Material Specification / Part 2: Installation.

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 blanket insulation and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Certificates:
 - .1 Submit product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.
- .4 Test Reports:
 - .1 Submit certified test reports showing compliance with specified performance characteristics and physical properties.

1.4 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 in dry location 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 in accordance with Section 01 74 19 - Waste Management and Disposal.

BLANKET INSULATION

2 PRODUCTS

2.1 INSULATION

- .1 Acoustic batt and blanket mineral fibre: to CAN/ULC-S702.
 - .1 Type: 1.
 - .2 Thickness: to suit cavity wall stud depth and as indicated.

2.2 ACCESSORIES

- .1 Wire stays: as recommended by manufacturer.

3 EXECUTION

3.1 EXAMINATION

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for blanket insulation application 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.

3.2 INSULATION INSTALLATION

- .1 Keep insulation minimum 75 mm from heat emitting devices such as recessed light fixtures, and minimum 50 mm from sidewalls of CAN/ULC-S604 Type A chimneys and CSA B149.1 and CSA B149.2 Type B and L vents.
- .2 Do not enclose insulation until it has been inspected and approved by Departmental Representative.

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

1 GENERAL

1.1 RELATED REQUIREMENTS

- .1 Division 23 – Heating, Ventilation and Air-Conditioning (HVAC).
- .2 Division 25 – Integrated Automation.
- .3 Division 26 – Electrical.
- .4 Division 28 – Electronic Safety and Security.

1.2 REFERENCE STANDARDS

- .1 National Research Council Canada (NRC)
 - .1 National Building Code of Canada (NBC), 2015.
- .2 Underwriter's Laboratories of Canada (ULC)
 - .1 ULC-S115-11 (R2016), Fire Tests of Firestop Systems.

1.3 DEFINITIONS

- .1 Fire Stop Material: device intended to close off opening or penetration 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 material that has Listed Systems Design and is 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 on site fire stop system.
- .4 Tightly Fitted; (ref: NBC Part 3.1.9.1(1) and 9.10.9.6(1)): penetrating items that are cast in place in buildings of noncombustible construction or have "0" annular space in buildings of combustible construction.
 - .1 Words "tightly fitted" should ensure that integrity of fire separation is such that it prevents passage of smoke and hot gases to unexposed side of fire separation.

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 datasheet and include product characteristics, performance criteria, physical size, finish and limitations.
 - .2 Submit two copies of WHMIS MSDS - Material Safety Data Sheets in accordance with Section 01 35 29.06 – Health and Safety Requirements.

FIRE STOPPING

- .3 Shop Drawings:
 - .1 Submit shop drawings to show proposed material, reinforcement, anchorage, fastenings and method of installation.
 - .2 Construction details should accurately reflect actual job conditions.
- .4 Samples:
 - .1 Submit duplicate 300 x 300 mm samples showing actual fire stop material proposed for project.
- .5 Quality assurance submittals: submit following in accordance with Section 01 45 00 - Quality Control.
 - .1 Test reports: in accordance with CAN-ULC-S101 for fire endurance for surface burning characteristics.
 - .1 Submit certified test reports from approved independent testing laboratories, indicating compliance of applied fire stopping with specifications for specified performance characteristics and physical properties.
 - .2 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
 - .3 Manufacturer's Instructions: submit manufacturer's installation instructions and special handling criteria, installation sequence, and cleaning procedures.

1.5 QUALITY ASSURANCE

- .1 Pre-Installation Meetings: convene pre-installation meeting one week prior to beginning work of this Section, with contractor's representative in accordance with Section 01 00 10 - General Instructions to:
 - .1 Verify project requirements.
 - .2 Review installation and substrate conditions.
 - .3 Co-ordination with other building subtrades.
 - .4 Review manufacturer's installation instructions and warranty requirements.

1.6 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, and ULC markings.
- .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.
- .3 Waste Management and Disposal:

FIRE STOPPING

- .1 Separate waste materials in accordance with Section 01 74 19 - Waste Management and Disposal.

2 PRODUCTS**2.1 MATERIALS**

- .1 Fire stopping and smoke seal systems: in accordance with CAN-ULC-S115.
 - .1 Asbestos-free materials and systems capable of maintaining effective barrier against flame, smoke and gases in compliance with requirements of CAN-ULC-S115 and not to exceed opening sizes for which they are intended and conforming to specified special requirements described in PART 3.
 - .2 Fire stop system rating: to match fire resistance rating of wall and floor assembly as indicated in the drawings.
- .2 Service penetration assemblies: systems tested to CAN-ULC-S115.
- .3 Service penetration fire stop components: certified by test laboratory to CAN-ULC-S115.
- .4 Fire-resistance rating of installed fire stopping assembly in accordance with NBC.
- .5 Proprietary modular fire stopping and smoke seal pathways at openings intended for ease of re-entry such as cables:
 - .1 Automatically adjustable mechanical seal: intumescent seal.
 - .2 Shell: 1.5 mm galvanised steel shell.
 - .3 Fire resistance rating: 1 hour
 - .4 Allowable cable filling: 100% visual.
 - .5 Volume expansion 800%
- .6 Fire stopping and smoke seals at openings around penetrations for pipes, ductwork and other mechanical items requiring sound and vibration control: elastomeric seal.
- .7 Primers: to manufacturer's recommendation for specific material, substrate, and end use.
- .8 Water (if applicable): potable, clean and free from injurious amounts of deleterious substances.
- .9 Damming and backup materials, supports and anchoring devices: to manufacturer's recommendations, and in accordance with tested assembly being installed as acceptable to authorities having jurisdiction.
- .10 Sealants for vertical joints: non-sagging.

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 PREPARATION

- .1 Examine sizes and conditions of voids to be filled to establish correct thicknesses and installation of materials.
 - .1 Ensure that substrates and surfaces are clean, dry and frost free.
- .2 Prepare surfaces in contact with fire stopping materials and smoke seals to manufacturer's instructions.
- .3 Maintain insulation around pipes and ducts penetrating fire separation.
- .4 Mask where necessary to avoid spillage and over coating onto adjoining surfaces; remove stains on adjacent surfaces.

3.3 INSTALLATION

- .1 Install fire stopping and smoke seal material and components in accordance with manufacturer's certified tested system listing.
- .2 Seal holes or voids made by through penetrations, poke-through termination devices, and unpenetrated openings or joints to ensure continuity and integrity of fire separation are maintained.
- .3 Provide temporary forming as required and remove forming only after materials have gained sufficient strength and after initial curing.
- .4 Tool or trowel exposed surfaces to neat finish.
- .5 Install proprietary modular fire stopping and smoke seal pathways where cabling infrastructure intersects fire rated wall construction and where indicated on drawings. Follow manufacturer's written instruction for installation.
- .6 Remove excess compound promptly as work progresses and upon completion.
- .7 Install firestop insulation as required and where indicated to form complete firestop and smoke seal. Install as backup material where required to areas receiving firestop sealant.
- .8 Install firestop sealant to areas indicated, ensure full depth of joint filled with material, remove excess immediately.
- .9 Seal around electrical boxes and outlets with sealing putty in accordance with manufacturer's instructions.

3.4 SEQUENCES OF OPERATION

- .1 Proceed with installation only when submittals have been reviewed by Departmental Representative.
- .2 Install floor fire stopping before interior partition erections.
- .3 Metal deck bonding: fire stopping to precede spray applied fireproofing to ensure required bonding.

FIRE STOPPING

- .4 Mechanical pipe insulation: certified fire stop system component.
 - .1 Ensure pipe insulation installation precedes fire stopping.

3.5 FIELD QUALITY CONTROL

- .1 Inspections: notify Departmental Representative when ready for inspection and prior to concealing or enclosing fire stopping materials and service penetration assemblies.

3.6 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.
- .3 Remove temporary dams after initial set of fire stopping and smoke seal materials.

3.7 SCHEDULE

- .1 Fire stop and smoke seal at:
 - .1 Penetrations through fire-resistance rated masonry, concrete, and gypsum board partitions and walls.
 - .2 Top of fire-resistance rated masonry and gypsum board partitions.
 - .3 Intersection of fire-resistance rated masonry and gypsum board partitions.
 - .4 Control and sway joints in fire-resistance rated masonry and gypsum board partitions and walls.
 - .5 Penetrations through fire-resistance rated floor slabs, ceilings and roofs.
 - .6 Openings and sleeves installed for future use through fire separations.
 - .7 Around mechanical and electrical assemblies penetrating fire separations.
 - .8 Rigid ducts: greater than 129 cm²: fire stopping to consist of bead of fire stopping material between retaining angle and fire separation and between retaining angle and duct, on each side of fire separation.

END OF SECTION

1 GENERAL

1.1 RELATED REQUIREMENTS

- .1 Section 08 11 00 – Metal Doors and Frames.

1.2 REFERENCE STANDARDS

- .1 ASTM International
 - .1 ASTM C 919-12 (2017), Standard Practice for Use of Sealants in Acoustical 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 joint sealants and include product characteristics, performance criteria, physical size, finish and limitations.
 - .2 Manufacturer's product to describe:
 - .1 Caulking compound.
 - .2 Primers.
 - .3 Sealing compound, each type, including compatibility when different sealants are in contact with each other.
 - .3 Submit 2 copies of WHMIS MSDS in accordance with Section 01 35 29.06 - Health and Safety Requirements.
- .3 Samples:
 - .1 Submit 2 samples of each type of material and colour.
 - .2 Cured samples of exposed sealants for each colour where required to match adjacent material.
- .4 Manufacturer's Instructions:
 - .1 Submit instructions to include installation instructions for each product used.

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 incorporation into manual.

1.5 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.

JOINT SEALANTS

- .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 Replace defective or damaged materials with new.
- .4 Packaging Waste Management: remove for reuse and return by manufacturer in accordance with Section 01 74 19 - Waste Management and Disposal.

1.6 SITE CONDITIONS

- .1 Ambient Conditions:
 - .1 Proceed with installation of joint sealants only when:
 - .1 Ambient and substrate temperature conditions are within limits permitted by joint sealant manufacturer or are above 4.4 degrees C.
 - .2 Joint substrates are dry.
 - .3 Conform to manufacturer's recommended temperatures, relative humidity, and substrate moisture content for application and curing of sealants including special conditions governing use.
- .2 Joint-Width Conditions:
 - .1 Proceed with installation of joint sealants only where joint widths are more than those allowed by joint sealant manufacturer for applications indicated.
- .3 Joint-Substrate Conditions:
 - .1 Proceed with installation of joint sealants only after contaminants capable of interfering with adhesion are removed from joint substrates.

1.7 ENVIRONMENTAL REQUIREMENTS

- .1 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of hazardous materials; and regarding labelling and provision of Material Safety Data Sheets (MSDS) acceptable to Health Canada.
- .2 Operate ventilation system on maximum outdoor air and exhaust during installation of caulking and sealants.

2 PRODUCTS

2.1 SEALANT MATERIALS

- .1 Do not use caulking that emits strong odours, contains toxic chemicals or is not certified as mould resistant in air handling units.
- .2 When low toxicity caulks are not possible, confine usage to areas which off gas to exterior, are contained behind air barriers, or are applied several months before occupancy to maximize off gas time.

- .3 Where sealants are qualified with primers use only these primers.
- .4 Colours: multiple colours of each type of sealant will be selected by Departmental Representative. Colours will be selected from full and extended range of available and custom colours to match adjacent surfaces as closely as possible

2.2 SEALANT MATERIAL DESIGNATIONS

- .1 Sealant TYPE A: one-component, medium-modulus, neutral cure silicone. To ASTM C920, Type S, Grade NS, Class 50. Use NT, M, G, A and O..
- .2 Sealant TYPE C: multi-component or single component, self-levelling or slope grade polyurethane. To ASTM C920, Type M, Grade P, Class 100/50. Use T, M, A and O.
- .3 Sealant TYPE D: multi-component, chemical curing, polyurethane. To ASTM C920, Type M, Grade P, Class 25. Use T, M, A and O.
- .4 Sealant TYPE E: one-component, solvent release, acrylic latex. To CAN/CGSB-19.17.
- .5 Sealant TYPE F: one-component, acetoxy silicone containing non-toxic fungicidal agents. To ASTM C920, Type S, Grade NS, Class 25. Use NT, G, A and O.
- .6 Sealant TYPE H: to ASTM C919. One-component, non-skinning, non-hardening, butyl rubber acoustic.
- .7 Preformed compressible and non-compressible back-up materials:
 - .1 Polyethylene, urethane, neoprene or vinyl foam:
 - .1 Extruded closed cell foam backer rod.
 - .2 Size: oversize 30 to 50 %.
 - .2 Neoprene or butyl rubber:
 - .1 Round solid rod, Shore A hardness 70.
 - .3 High density foam:
 - .1 Extruded closed cell polyvinyl chloride (PVC), extruded polyethylene, closed cell, Shore A hardness 20, tensile strength 140 to 200 kPa, extruded polyolefin foam, 32 kg/m³ density, or neoprene foam backer, size as recommended by manufacturer.
 - .4 Bond breaker tape:
 - .1 Polyethylene bond breaker tape which will not bond to sealant.
- .8 Water Cut-Off Mastic: One-component, low-viscosity, self-wetting, butyl-blend mastic designed to be used in conjunction with roofing and waterproofing systems.

2.3 SEALANT SELECTION

- .1 Perimeters of exterior openings where frames meet exterior facade of building (i.e. brick, block, precast masonry): Sealant TYPE A.
- .2 Coping joints and coping-to facade joints: Sealant TYPE C.

- .3 Exterior joints in horizontal wearing surfaces (as itemized): Sealant TYPE C or D.
- .4 Seal interior perimeters of exterior openings as detailed on drawings: Sealant TYPE A.
- .5 Interior control and expansion joints in floor surfaces: Sealant TYPE C.
- .6 Perimeters of interior frames, as detailed and itemized: Sealant TYPE D.
- .7 Interior masonry vertical control joints (block-to-block, block-to-concrete, and intersecting masonry walls): Sealant TYPE D.
- .8 Perimeter of bath fixtures (e.g. sinks, tubs, urinals, stools, water closets, basins, vanities): Sealant TYPE F.
- .9 Exposed interior control joints in drywall: Sealant TYPE E
- .10 Perimeter of interior gypsum board partitions: Sealant TYPE H: to achieve STC rating noted in drawings.

2.4 JOINT CLEANER

- .1 Non-corrosive and non-staining type, compatible with joint forming materials and sealant in accordance with sealant manufacturer's written recommendations.
- .2 Primer: in accordance with sealant manufacturer's written recommendations.

3 EXECUTION

3.1 EXAMINATION

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for joint sealants 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.

3.2 SURFACE PREPARATION

- .1 Examine joint sizes and conditions to establish correct depth to width relationship for installation of backup materials and sealants.
- .2 Clean bonding joint surfaces of harmful matter substances including dust, rust, oil grease, and other matter which may impair Work.
- .3 Do not apply sealants to joint surfaces treated with sealer, curing compound, water repellent, or other coatings unless tests have been performed to ensure compatibility of materials. Remove coatings as required.

- .4 Ensure joint surfaces are dry and frost free.
- .5 Prepare surfaces in accordance with manufacturer's directions.

3.3 PRIMING

- .1 Where necessary to prevent staining, mask adjacent surfaces prior to priming and caulking.
- .2 Prime sides of joints in accordance with sealant manufacturer's instructions immediately prior to caulking.

3.4 BACKUP MATERIAL

- .1 Apply bond breaker tape where required to manufacturer's instructions.
- .2 Install joint filler to achieve correct joint depth and shape, with approximately 30% compression.

3.5 MIXING

- .1 Mix materials in strict accordance with sealant manufacturer's instructions.

3.6 APPLICATION

- .1 Sealant:
 - .1 Apply sealant in accordance with manufacturer's written instructions.
 - .2 Mask edges of joint where irregular surface or sensitive joint border exists to provide neat joint.
 - .3 Apply sealant in continuous beads.
 - .4 Apply sealant using gun with proper size nozzle.
 - .5 Use sufficient pressure to fill voids and joints solid.
 - .6 Form surface of sealant with full bead, smooth, free from ridges, wrinkles, sags, air pockets, embedded impurities.
 - .7 Tool exposed surfaces before skinning begins to give slightly concave shape.
 - .8 Remove excess compound promptly as work progresses and upon completion.
- .2 Curing:
 - .1 Cure sealants in accordance with sealant manufacturer's instructions.
 - .2 Do not cover up sealants until proper curing has taken place.

3.7 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 00 - Cleaning.
 - .1 Leave Work area clean at end of each day.
 - .2 Clean adjacent surfaces immediately.
 - .3 Remove excess and droppings, using recommended cleaners as work progresses.
 - .4 Remove masking tape after initial set of sealant.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in

JOINT SEALANTS

accordance with Section 01 74 00 - Cleaning.

- .3 Waste Management: separate waste materials in accordance with Section 01 74 19 - Waste Management and Disposal.

3.8 PROTECTION

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by joint sealants installation.

END OF SECTION

1 GENERAL

1.1 RELATED REQUIREMENTS

- .1 Section 08 71 00 – Door Hardware.
- .2 Section 09 21 16 – Gypsum Board Assemblies.
- .3 Section 09 91 23 – Interior Painting.

1.2 REFERENCE STANDARDS

- .1 American Society for Testing and Materials International (ASTM)
 - .1 ASTM A 653/A 653M-17, Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 - .2 ASTM B 29-14, Standard Specification for Refined Lead.
 - .3 ASTM B 749-14, Standard Specification for Lead and Lead Alloy Strip, Sheet and Plate Products.
 - .4 ASTM E90 – 09(2016), Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.
- .2 Canadian Standards Association (CSA International)
 - .1 CSA-G40.20-13/G40.21-13, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
 - .2 CSA W59-13, Welded Steel Construction (Metal Arc Welding).
- .3 Canadian Steel Door Manufacturers' Association (CSDMA)
 - .1 CSDMA, Recommended Specifications for Commercial Steel Door and Frame Products, 2006.
 - .2 CSDMA, Recommended Selection and Usage Guide, 2009.
- .4 National Fire Protection Association (NFPA)
 - .1 NFPA (Fire) 80, Standard for Fire Doors and Other Opening Protectives, 2016 Edition.
 - .2 NFPA 252, Standard for Fire Doors and Other Opening Protectives, 2017 Edition.
- .5 Underwriters' Laboratories of Canada (ULC)
 - .1 CAN/ULC-S701.1: 2017, Standard for Thermal Insulation, Polystyrene, Boards and Pipe Covering.
 - .2 CAN/ULC-S702.1-14/ULC-S702.2-15, Standard for Thermal Insulation, Mineral Fibre, for Buildings. Part 1: material Specification / Part 2: Installation
 - .3 CAN/ULC-S704.1: 2017, Standard for Thermal Insulation, Polyurethane and Polyisocyanurate Boards, Faced.
 - .4 CAN/ULC-S104-15, Standard Method for Fire Tests of Door Assemblies.
 - .5 CAN/ULC-S105: 2016, Standard Specification for Fire Door Frames Meeting the Performance Required by CAN/ULC-S104.

1.3 SYSTEM DESCRIPTION

- .1 Design Requirements:

METAL DOORS AND FRAMES

- .1 Steel fire rated doors and frames: labelled and listed by an organization accredited by Standards Council of Canada in conformance with CAN4-S104 for ratings specified or indicated.
- .2 Install conduits and channels as required for installation of electronic hardware as indicated on electrical drawings.
- .3 Provide fire labelled frames for openings requiring fire protection ratings. Test products in conformance with CAN4-S104 and listed by nationally recognized agency having factory inspection services.
- .4 Acoustic Performance: minimum Sound Transmission Class (STC) 45, tested to ASTM E90.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Provide product data: in accordance with Section 01 33 00 - Submittal Procedures.
- .3 Provide shop drawings: in accordance with Section 01 33 00 - Submittal Procedures.
 - .1 Indicate each type of door, material, steel core thicknesses, mortises, reinforcements, location of exposed fasteners, openings, glazing, arrangement of hardware fire rating, and finishes.
 - .2 Indicate each type frame material, core thickness, reinforcements, glazing stops, location of anchors and exposed fastenings, reinforcing, fire rating, and finishes.
 - .3 Include schedule identifying each unit, with door marks and numbers relating to numbering on drawings and door schedule.
- .4 Provide samples in accordance with Section 01 33 00 - Submittal Procedures.
- .5 Submit one 300 x 300 mm corner sample of each type of frame.

1.5 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 in accordance with Section 01 74 19 - Waste Management and Disposal.

2 PRODUCTS

2.1 MATERIALS

- .1 Hot dipped galvanized steel sheet: to ASTM A 653M, ZF75, minimum base steel thickness in accordance with CSDMA Table 1 - Thickness for Component Parts.
- .2 Reinforcement: to CSA G40.20/G40.21, Type 44W, coating designation to ASTM A 653M, ZF75.

2.2 DOOR CORE MATERIALS

- .3 Acoustic Doors: Manufacturers proprietary noncombustible acoustically rated core material to meet Sound Transmission Classification (STC) 45.
- .4 Prepare door for installation of electronic hardware as indicated on electrical drawings.

2.3 ADHESIVES

- .1 Steel components: heat resistant, spray grade, resin reinforced neoprene/rubber (polychloroprene) based, low viscosity, contact cement.
- .2 Polystyrene and polyurethane cores: heat resistant, epoxy resin based, low viscosity, contact cement.

2.4 PRIMER

- .1 Touch-up prime CAN/CGSB-1.181.

2.5 PAINT

- .1 Field paint steel doors and frames in accordance with Sections 09 91 23 - Interior Painting. Protect weatherstrips from paint. Provide final finish free of scratches or other blemishes.

2.6 ACCESSORIES

- .1 Door silencers: single stud rubber/neoprene type.
- .2 Exterior and interior top and bottom caps: steel, spot welded in place.
- .3 Metallic paste filler: to manufacturer's standard.
- .4 Acoustic Seals: provide perimeter and bottom seals, tested as part of the ASTM E90 assembly to meet the specified STC rating, and as described in Section 08 71 00 – Door Hardware.
- .5 Fire labels: metal riveted.
- .6 Sealant: one-part silicone to CAN/CGSB-19.13.

2.7 FRAMES FABRICATION GENERAL

- .1 Fabricate frames in accordance with CSDMA specifications.
- .2 Fabricate frames to profiles and maximum face sizes as indicated.
- .3 Interior frames: 1.6 mm welded type construction with door frame reinforcement plate welded inside the frame.
- .4 Blank, reinforce, drill, and tap frames for mortised, templated hardware, and electronic hardware using templates provided by finish hardware supplier. Reinforce frames for surface mounted hardware.
- .5 Frame reinforcement: weld a 6.4 mm x 25 mm x 610mm steel plate to the inside of the frame and align centre with the lock bolt. Refer to Hardware Schedule for applicable doors.

METAL DOORS AND FRAMES

- .6 Protect mortised cutouts with steel guard boxes.
- .7 Prepare door frames as follows:
 - .1 ANSI strike.
 - .2 Reinforcing at head for door closer.
 - .3 Hole: 19 mm diameter for contact.
 - .4 Heavy or standard weight template hinges, 1.5 or 2 pair.
 - .5 Auxiliary deadbolt.
 - .6 Guard boxes at strike and hinge locations.
 - .7 Power box at head.
- .8 Prepare frame for door silencers, 3 for single door.
- .9 Prepare frame for installation of electronic hardware as indicated on electrical drawings.
- .10 Manufacturer's nameplates on frames and screens are not permitted.
- .11 Conceal fastenings except where exposed fastenings are indicated.
- .12 Provide factory-applied touch up primer at areas where zinc coating has been removed during fabrication.
- .13 Insulate interior and exterior frame components with polyurethane insulation.

2.8 FRAME ANCHORAGE

- .1 Provide appropriate anchorage to floor and wall construction.
- .2 Locate each wall anchor immediately above or below each hinge reinforcement on hinge jamb and directly opposite on strike jamb.
- .3 Provide 2 anchors for rebate opening heights up to 1520 mm and 1 additional anchor for each additional 760 mm of height or fraction thereof.
- .4 Locate anchors for frames in existing openings not more than 150 mm from top and bottom of each jambs and intermediate at 660 mm on centre maximum.

2.9 FRAMES: WELDED TYPE

- .1 Welding in accordance with CSA W59.
- .2 Accurately mitre or mechanically joint frame product and securely weld on inside of profile.
- .3 Cope accurately and securely weld butt joints of mullions, transom bars, centre rails and sills.
- .4 Grind welded joints and corners to a flat plane, fill with metallic paste and sand to uniform smooth finish.
- .5 Securely attach floor anchors to inside of each jamb profile.
- .6 Weld a 6.4 mm x 25 mm x 610mm steel plate to the inside of the frame and align centre with the lock bolt. Refer to Hardware Schedule for applicable doors.

METAL DOORS AND FRAMES

- .7 Weld in 2 temporary jamb spreaders per frame to maintain proper alignment during shipment.
- .8 Securely attach lead to inside of frame profile from return to jamb soffit (inclusive) on door side of frame only.

2.10 DOOR FABRICATION GENERAL

- .1 Doors: swing type, flush, with provision for glass and/or louvre openings as indicated.
- .2 Fabricate doors with longitudinal edges welded. Seams: grind welded joints to a flat plane, fill with metallic paste filler and sand to a uniform smooth finish.
- .3 Doors: manufacturers' construction, tested and/or engineered as part of a fully operable assembly, including door, frame, gasketing and hardware in accordance with ASTM E90 to provide STC 45 minimum.
- .4 Blank, reinforce, drill doors and tap for mortised, templated hardware and electronic hardware.
- .5 Factory prepare holes 12.7 mm diameter and larger except mounting and through-bolt holes, on site, at time of hardware installation.
- .6 Reinforce doors where required, for surface mounted hardware. Provide flush steel top caps to exterior doors. Provide inverted, recessed, spot welded channels to top and bottom of interior doors.
- .7 Provide factory-applied touch-up primer at areas where zinc coating has been removed during fabrication.
- .8 Provide fire labelled doors for those openings requiring fire protection ratings, as scheduled. Test such products in conformance with CAN4-S104 and list by nationally recognized agency having factory inspection service and construct as detailed in Follow-Up Service Procedures/Factory Inspection Manuals issued by listing agency to individual manufacturers.
- .9 Manufacturer's nameplates on doors are not permitted.

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 GENERAL

- .1 Install labelled steel fire rated doors and frames to NFPA 80 except where specified otherwise.
- .2 Install doors and frames to CSDMA Installation Guide.

3.3 FRAME INSTALLATION

- .1 Set frames plumb, square, level and at correct elevation.

- .2 Secure anchorages and connections to adjacent construction.
- .3 Install frames by building-in as indicated on drawings. Wall constructions are to be seated to the backside of the rabbet or anchor plate in steel stud assemblies. Frames are to be set into steel stud wall framing with anchors every 400 mm vertically.
- .4 Brace frames rigidly in position while building-in. Install temporary horizontal wood spreader at third points of door opening to maintain frame width. Provide vertical support at centre of head for openings over 1200 mm wide. Remove temporary spreaders after frames are built-in.
- .5 Caulk perimeter of frames between frame and adjacent material.

3.4 DOOR INSTALLATION

- .1 Install doors and hardware in accordance with hardware templates and manufacturer's instructions and Section 08 71 00 - Door Hardware.
- .2 Provide even margins between doors and jambs and doors and finished floor and thresholds as follows.
 - .1 Hinge side: 1.0 mm.
 - .2 Latchside and head: 1.5 mm.
 - .3 Finished floor, top of carpet, sill and thresholds: 13 mm.
- .3 Adjust operable parts for correct function.

3.5 FINISH REPAIRS

- .1 Touch up with primer finishes damaged during installation.
- .2 Fill exposed frame anchors and surfaces with imperfections with metallic paste filler and sand to a uniform smooth finish.

END OF SECTION

DOOR HARDWARE**Part 1 General****1.1 RELATED SECTIONS**

- .1 Section 08 11 00 - Metal Doors and Frames.
- .2 Section 28 14 00 – Access Control Systems.
- .3 Section 28 31 00 – Intrusion Detection.

1.2 REFERENCES

- .1 Canadian Steel Door and Frame Manufacturers' Association (CSDFMA).
 - .1 CSDFMA Canadian Metric Guide for Steel Doors and Frames (Modular Construction): standard hardware location dimensions.
- .2 American National Standard Institute (ANSI), Builders Hardware Manufacturers Association (BHMA)
 - .1 ANSI/BHMA A156.1-2000. Butts and Hinges.
 - .2 ANSI/BHMA A156.2-2003. Bored and Preassembled Locks and Latches.
 - .3 ANSI/BHMA A156.3-2001. Exit Devices.
 - .4 ANSI/BHMA A156.4-2000. Door Controls- Closers.
 - .5 ANSI/BHMA A156.5-2001. Auxiliary Locks and Associated Products.
 - .6 ANSI/BHMA A156.7-2003. Template Hinge Dimensions.
 - .7 ANSI/BHMA A156.13-2002. Mortise Locks & Latches.
 - .8 ANSI/BHMA A156.15-2001. Release Devices
 - .9 ANSI/BHMA A156.16-2002. Auxiliary Hardware.
 - .10 ANSI/BHMA A156.17-2004. Self Closing Hinges & Pivots
 - .11 ANSI/BHMA A156.18-2000. Materials/ Finishes.
 - .12 ANSI/BHMA A156.19-2002. Power Assist & Low Energy Power Operated Doors
 - .13 ANSI/BHMA A156.20-2001. Strap & Tee Hinges and Hasps
 - .14 ANSI/BHMA A156.24-2003. Delayed Egress Locking Systems
 - .15 ANSI/BHMA A156.28-2000. Recommended Practices for Keying Systems
 - .16 ANSI/BHMA A156.30-2003. High Security Cylinders
 - .17 ANSI/BHMA A156.31-2001. Electric Strikes & Frame Mounted Actuators

1.3 SUBMITTALS

- .1 Submit manufacturer's printed product literature, specifications and data sheet in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit samples in accordance with Section 01 33 00 - Submittal Procedures.
 - .1 Identify each sample by label indicating applicable specification paragraph number, brand name and number, finish and hardware package number.

DOOR HARDWARE

- .2 After approval samples will be returned for incorporation in the Work.
- .3 Submit 5 copies of contract hardware list to Departmental Representative in accordance with Section 01 33 00 - Submittal Procedures. Indicate specified hardware, including make, model, material, function, size, finish and other pertinent information. Include complete cross-reference to information included in Door Schedule.
- .4 Submit manufacturer's installation instructions.
- .5 Provide operation and maintenance data for door closers, locksets, door holders, electrified hardware and fire exit hardware for incorporation into manual specified in Section 017800 - Closeout Submittals.

1.4 QUALITY ASSURANCE

- .1 Regulatory Requirements. All hardware for doors in fire separations and exit doors to be certified by a Canadian Certification Organization accredited by Standards Council of Canada.
- .2 Submit certified test reports showing compliance with specified performance characteristics and physical properties.
- .3 Provide product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

1.5 DELIVERY, STORAGE, AND HANDLING

- .1 Deliver, store, handle and protect materials in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Package each item of hardware including fastenings, separately or in like groups of hardware, label each package as to item definition and location.
- .3 Store finishing hardware in locked, clean and dry area.

1.6 WASTE DISPOSAL AND MANAGEMENT

- .1 Separate and recycle waste materials in accordance with Section 01 74 19 – Waste Management and Disposal.
- .2 Remove from site and dispose of packaging materials at appropriate recycling facilities.
- .3 Dispose of corrugated cardboard, polystyrene and plastic packaging material in appropriate on-site bin for recycling in accordance with site waste management program.

1.7 MAINTENANCE

- .1 Provide maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.

DOOR HARDWARE

- .2 Supply two sets of wrenches for door closers, locksets and fire exit hardware.
- .3 Brief maintenance staff regarding proper care, cleaning, and general maintenance.

Part 2 Products**2.1 HARDWARE ITEMS**

- .1 Use one manufacturer's products only for similar items.

2.2 DOOR HARDWARE

- .1 Use one manufacturer's products only for all similar items.
- .2 Butts and hinges: to ANSI/BHMA A156.1.
 - .1 Designated by letter A and numeral identifiers, followed by size and finish as listed in Hardware Schedule.
 - .2 Use non-removable pins (NRP) and safety Studs (SS) for all exterior locations and NRP only where indicated for interior doors.
 - .3 Use non-ferrous material for all exterior locations and where indicated. Finish as indicated in Hardware Schedule.
- .3 Mortised locks and latches: to ANSI/BHMA A156.13-2003.
 - .1 Series 1000 cylindrical lock grade 1, designed for function.
 - .2 Locksets are to be supplied less cylinder (L/C) unless specified otherwise.
 - .3 Lever handles: round tubular design complete with return to door.
 - .4 Roses: round plain design.
 - .5 Normal strikes: box type, lip projection not beyond jamb.
 - .6 Finish: as noted in the Hardware Schedule.
- .4 Exit devices: to ANSI/BHMA A156.3.
 - .1 Grade 1, modern flat touch bar design. No exposed touch bar fasteners. No exposed cavities when operated. Furnish strikes to suit door & frame material and application.
 - .2 Latch bolts for rim style devices are to be a full 19mm projection, 25mm strike engagement. High-grade, heat-treated, corrosion-resistant nickel steel alloy. Slide action deadbolt with positive deadlocking by auxiliary bolt. Two-piece deadbolt mechanism.
 - .3 Locking trim functions are to be supplied less cylinder (L/C) unless specified otherwise.
 - .4 Type and function as specified in Hardware Schedule.
 - .5 Vertical rod devices are to be 'Less Bottom Rod' (LBR) where specified.
 - .6 Lever design on the trim is to match exactly the lever design on mortised locksets.
 - .7 Provide fire rated devices for all fire rated doors requiring exit devices.

DOOR HARDWARE

- .8 Finish 630.
- .5 Door closers and Accessories: to AHSI/BHMA A156.4.
 - .1 Closers: to ANSI/BHMA A156.4. Designated by letter C and numeral identifiers listed in Hardware Schedule. Grade 1 complete with cast iron bodies, full rectangular cover plates, separate adjusting valves for sweep, latching and backcheck. Fully adjustable spring power. Closers are to have delayed action and built-in stop features where specified. Finish 689.
 - .2 Adjust closers to require no greater than 22 Newtons of force to open interior doors and no more than 34 Newtons of force to open exterior doors.
 - .3 Overhead holders: to ANSI/BHMA A156.8. Designated by letter C and numeral identifiers listed in Hardware Schedule. Finish 630.
- .6 Electric Strikes: ANSI/BHMA A156.31-2001
 - .1 Electric strikes are to be heavy-duty stainless steel construction and fire rated for fire rated openings.
 - .2 All electric strikes are to be Fail Secure "FSE" requiring power to unlock unless noted otherwise. Confirm voltage before ordering.
- .7 Auxiliary locks and associated products: to ANSI/BHMA A156.5. Designated by letter E and numeral identifiers listed in Hardware Schedule. Finished as indicated in Hardware Schedule.
- .8 Cylinders are to be mechanical high security "Level C" to ANSI/BHMA A156.30 finished to 626, for installation in all locksets, deadlocks and exit devices unless specified otherwise in the attached schedule.
- .9 Auxiliary Hardware: to ANSI/BHMA A156.16.
 - .1 Flush bolts: heavy-duty flush mounted bolts. Size as indicated. Mounted to inactive leaf. Finished as indicated in Hardware Schedule.
 - .2 Floor stops shall be dome type, heavy-duty, cast bronze, low or high-rise as noted in schedule.
 - .3 Wall stops shall be heavy-duty, cast bronze c/w concave pad with no visible fasteners as noted in schedule.

2.3 FASTENINGS

- .1 Use only fasteners provided by manufacturer. Failure to comply may void manufacturer's warranties and applicable licensed labels. The use of "quick" type fasteners, unless specifically supplied by manufacturer, is unacceptable.
- .2 Supply screws, bolts, expansion shields and other fastening devices required for satisfactory installation and operation of hardware.
- .3 Exposed fastening devices are to match finish of hardware.
- .4 Where pull is scheduled on one side of door and push plate on other side, supply fastening devices, and install so pull can be secured through door from reverse side. Install push plate to cover fasteners.

DOOR HARDWARE

- .5 Use fasteners compatible with material through which they pass.
- .6 Doors and frames will not be painted in final installation therefore it is critical to protect the factory applied galvanised finish during preparation, fastening and on final installations.

2.4 KEYING

- .1 New cylinders are to be keyed differently, keyed alike and master keyed to an existing building master as directed by the Departmental Representative.
- .2 Provide keys in duplicate for every new-keyed cylinder in this Contract.
- .3 Provide three master keys for each MK group.
- .4 Stamp keying code numbers on keys and cylinders.
- .5 Supply temporary cylinders random keyed different for use during construction by the contractor.

Part 3 Execution**3.1 MANUFACTURER'S INSTRUCTIONS**

- .1 Comply with manufacturer's written data, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.
- .2 Furnish metal door and frame manufacturers with complete instructions and templates for preparation of their work to receive hardware.
- .3 Furnish manufacturers' instructions for proper installation of each hardware component.

3.2 INSTALLATION

- .1 Unless noted otherwise install hardware to standard hardware location dimensions in accordance with Canadian Metric Guide for Steel Doors and Frames (Modular Construction) prepared by Canadian Steel Door and Frame Manufacturers' Association.
- .2 Note specific mounting height for locks and exit devices shown in architectural door elevations. Centreline of locksets and exit devices to be 850mm from finished floor.
- .3 Where doorstop contacts door pulls, mount stop to strike bottom of pull.
- .4 Do not modify finishing hardware without manufacturers written consent.
- .5 Door Closers:
 - .1 Confirm degree of swing for door closers.

DOOR HARDWARE

- .2 Ensure that all adjustments have been made to sweep, latching and backcheck cycles for each closer.
- .3 Mount on room side of doors wherever possible.
- .6 Use only manufacturer's supplied fasteners. Failure to comply may void manufacturer's warranties and applicable licensed labels. Use of "quick" type fasteners, unless specifically supplied by manufacturer, is unacceptable.
- .7 Remove construction cores or locks when directed by Departmental Representative. Install permanent cores and check operation of locks.
- .8 Door contacts are to be supplied and installed by Departmental Representative but rough-in for these contacts is to be part of this contract.
- .9 Contractor is to patch and make good all holes in existing frames resulting from relocation of existing hardware and electronic components.

3.3 ADJUSTING

- .1 Adjust door hardware, operators, closures and controls for optimum, smooth operating condition, safety and for weather tight closure.
- .2 Adjust door closers to require no more than 22 Newtons of force to open interior doors and no more than 34 Newtons of force to open exterior doors.
- .3 Lubricate hardware, operating equipment and other moving parts.
- .4 Adjust door hardware to provide tight fit at contact points with frames.
- .5 Adjust hardware for proper installation and function.
- .6 Consult with Departmental Representative before changing the hand of any lockset.

3.4 CO-ORDINATION WITH ELECTRICAL

- .1 Ensure co-ordination with the Electrical Contractor.
- .2 Provide all necessary information including templates to the Electrical Contractor.
- .3 Line voltage, wiring including low voltage, electrical back boxes, conduits as required and fire alarm interface where required is to be supplied and installed by the Electrical Contractor.
- .4 The Electrical Contractor is to supply switched line voltage to each power supply and each automatic operator in this contract
- .5 Low voltage wiring from hardware device to transformers is to be supplied and installed by the Electrical Contractor.

3.5 CO-ORDINATION WITH ELECTRONIC SAFETY & SECURITY

- .1 Ensure co-ordination with the Security contractor.

DOOR HARDWARE

- .2 Ensure co-ordination with the Departmental Representative.
- .3 Provide all necessary information including templates to the Departmental Representative.

3.6 CLEANING

- .1 Perform cleaning after installation to remove construction and accumulated environmental dirt.
- .2 Clean hardware with damp rag and approved non-abrasive cleaner, and polish hardware in accordance with manufacture's instructions.
- .3 Remove protective material from hardware items where present.
- .4 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

3.7 DEMONSTRATION

- .1 Brief maintenance staff regarding:
 - .1 Proper care, cleaning, and general maintenance of projects complete hardware.
 - .2 Description, use, handling, and storage of keys.
 - .3 Use, application and storage of wrenches for door closers, locksets and fire exit hardware.
- .2 Demonstrate operation, operating components, adjustment features, and lubrication requirements.

3.8 LEGEND

- .1 HM Dr: Indicates hollow metal door. Paint
- .2 IHM Dr: Indicates insulated hollow metal door. Paint.
- .3 PS Fr: Indicates pressed steel frame. Paint.
- .4 IPS Fr: Indicates insulated pressed steel frame. Paint.
- .5 LTS Indicates Length to suit opening size.
- .6 Exist. Indicates existing door and frame to remain. Paint.

DOOR HARDWARE

3.9 HARDWARE SCHEDULE

HG01

1	Sgl dr	D200a			LHR
1	Sgl dr	D200d			RHR
3	Ea	Hinge	A8112 114 x 101	NRP, SS	652
1	Ea	Exit Device	Type 1, F01, Fig. 2		630
1	Ea	Intrusion Door Contact	Interlogix – 1078 Series	Recessed	Grey
1	Ea	Door Closer	C02021 x PT4G		689
1	Ea	Strobe / Sounder			
1	Ea	Kickplates	J102 250mm x LTS	TAPE	630
1	Ea	Floor Stop	L02141		626

Note: 1) Line voltage, low voltage wiring, electrical back boxes, conduit as required and fire alarm interface by electrical.

2) Connections and commissioning by security.

3) Card readers are to unlock the doors and activate the auto operators.

HG02

1	Sgl dr	D200b			LHR
3	Ea	Hinge	A8111 114 x 101		652
1	Ea	Lockset	F08 x Lever	MK	626
1	Ea	Credential Reader	HID Multiclass RP40		
1	Ea	Access Control	AMAG Symmetry		
1	Ea	Electric Strike	HES 9600		630
2	Ea	Intrusion Door Contact	Interlogix – 1078 Series	Recessed	Grey
1	Ea	Arm Status Indicator	Status indicator CX-LED1-R light, single gang, LED 12/28VDC		
1	Ea	Request to Exit	Kantech T-REX LT		White
1	Ea	Door Closer	C02021		689
1	Ea	Kickplate	J102 250mm x LTS	TAPE	630
1	Ea	Floor Stop	L02141		626

Note: 1) Card reader, request to exit and door contacts by security.

2) Line voltage, low voltage wiring, electrical back boxes, conduit as required and fire alarm interface by electrical.

3) Connections and commissioning by security.

DOOR HARDWARE

HG03

1	Sgl dr	D200c			RHR
3	Ea	Hinge	A8111 114 x 101		652
1	Ea	Lockset	F08 x Lever	MK	626
1	Ea	Credential Reader	HID Multiclass RP40		
1	Ea	Access Control	AMAG Symmetry		
1	Ea	Electric Strike	HES 9600		630
1	Ea	Intrusion Door Contact	Interlogix – 1078 Series	Recessed	Grey
1	Ea	Intrusion Keypad	DSC Maxsys LCD 4501		
1	Ea	Request to Exit	Kantech T-REX LT		White
1	Ea	Door Closer	C02021		689
1	Ea	Kickplate	J102 250mm x LTS	TAPE	630
1	Ea	Floor Stop	L02141		626

Note: 1) Card reader, request to exit and door contacts by security.

2) Line voltage, low voltage wiring, electrical back boxes, conduit as required and fire alarm interface by electrical.

3) Connections and commissioning by security.

END OF SECTION

1 GENERAL

1.1 RELATED REQUIREMENTS

- .1 Section 09 22 16 – Non-Structural Metal Framing.
- .2 Section 09 91 23 – Interior Painting.

1.2 REFERENCE STANDARDS

- .1 Aluminum Association (AA)
 - .1 AA DAF 45-03(R2009), Designation System for Aluminum Finishes.
- .2 ASTM International
 - .1 ASTM C 475/C475M-17, Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board.
 - .2 ASTM C 840-17a, Standard Specification for Application and Finishing of Gypsum Board.
 - .3 ASTM C 954-18, Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs From 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness.
 - .4 ASTM C 1002-18, Standard Specification for Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs.
 - .5 ASTM C 1047-14a, Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base.
 - .6 ASTM C 1280-13a, Standard Specification for Application of Exterior Gypsum Panel Products for Use as Sheathing.
 - .7 ASTM C 1177/C 1177M-17, Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing.
 - .8 ASTM C 1178/C 1178M-13, Standard Specification for Glass Mat Water-Resistant Gypsum Backing Panel.
 - .9 ASTM C1288-17. Standard Specification for Fiber-Cement Interior Substrate Sheets.
 - .10 ASTM C1396/C1396M-17, Standard Specification for Gypsum Board.
- .3 Underwriter's Laboratory of Canada
 - .1 CAN/ULC-S102-10, Standard Method of Test of Surface Burning Characteristics of Building Materials and 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 gypsum board assemblies and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Samples:

- .1 Submit for review and acceptance of each unit. Submit 300 mm long samples of corner bead, casing bead, vinyl mouldings, shadow mould, cornice cap, and insulating strip.

1.4 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 gypsum board assemblies materials in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect gypsum board assemblies from nicks, scratches, and blemishes.
 - .3 Protect from weather, elements and damage from construction operations.
 - .4 Handle gypsum boards to prevent damage to edges, ends or surfaces.
 - .5 Protect prefinished aluminum surfaces with wrapping strippable coating. Do not use adhesive papers or sprayed coatings which bond when exposed to sunlight or weather.
 - .6 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.

1.5 AMBIENT CONDITIONS

- .1 Maintain temperature 10 degrees C minimum, 21 degrees C maximum for 48 hours prior to and during application of gypsum boards and joint treatment, and for 48 hours minimum after completion of joint treatment.
- .2 Apply board and joint treatment to dry, frost free surfaces.
- .3 Ventilation: ventilate building spaces as required to remove excess moisture that would prevent drying of joint treatment material immediately after its application.

2 PRODUCTS

2.1 MATERIALS

- .1 Standard board: to ASTM C1396/C1396M. Type X, minimum 15.9 mm thick, 1200 mm wide x maximum practical length. Ends square cut, edges bevelled.
- .2 Metal furring runners, hangers, tie wires, inserts, anchors: manufacturer's standard profiles to suit specific requirements.
- .3 Drywall furring channels: 0.5 mm core thickness, galvanized steel channels for screw attachment of gypsum board.
- .4 Steel drill screws: for application of gypsum board with steel drill screws into heavier gauge steel studs: to ASTM C954.

- .5 Casing beads, corner beads, control joints and edge trim: to ASTM C1047, zinc coated by electrolytic process. 0.5 mm base thickness, perforated flanges, one piece length per location.
- .6 Sealants: in accordance with Section 07 92 00 - Joint Sealants.
- .7 Acoustic sealant: as specified in Section 07 92 00 - Joint Sealants.
- .8 Insulating strip: rubberized, moisture resistant, 6 mm thick closed cell neoprene strip, 19 mm wide, with self-sticking permanent adhesive on one face, continuous length.
- .9 Joint compound: to ASTM C 475, asbestos free. Manufacturer's premixed commercial grade compound.

3 EXECUTION

3.1 EXAMINATION

- .1 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts are acceptable for gypsum board assemblies 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 ERECTION

- .1 Do application and finishing of gypsum board to ASTM C 840 except where specified otherwise.
- .2 Support light fixtures by providing additional ceiling suspension hangers within 150 mm of each corner and at maximum 600 mm around perimeter of fixture.
- .3 Install work level to tolerance of 1:1200.
- .4 Frame with furring channels, perimeter of openings for access panels, light fixtures, diffusers, grilles, and audio-video mounting hardware.
- .5 Furr for gypsum board faced vertical bulkheads within and at termination of ceilings.
- .6 Install wall furring for gypsum board wall finishes to ASTM C 840, except where specified otherwise.
- .7 Furr duct shafts, beams, columns, pipes and exposed services where indicated.

3.3 APPLICATION

- .1 Apply gypsum board after bucks, anchors, blocking, sound attenuation, electrical and mechanical work have been approved.

- .2 Apply gypsum board to metal furring or framing using screw fasteners for first layer. Maximum spacing of screws 300 mm on centre.
 - .1 Single-Layer Application:
 - .1 Apply gypsum board on ceilings prior to application of walls to ASTM C 840.
 - .2 Apply gypsum board vertically or horizontally, providing sheet lengths that will minimize end joints.
- .3 Apply 12 mm diameter bead of acoustic sealant continuously around periphery of each face of partitioning to seal gypsum board/structure junction where partitions abut fixed building components. Seal full perimeter of cut-outs around electrical boxes, ducts, and service penetrations, in partitions where perimeter sealed with acoustic sealant.
- .4 Install gypsum board on walls vertically to avoid end-butt joints.
- .5 Install gypsum board with face side out.
- .6 Do not install damaged or damp boards.

3.4 INSTALLATION

- .1 Erect accessories straight, plumb or level, rigid and at proper plane. Use full length pieces where practical. Make joints tight, accurately aligned and rigidly secured. Mitre and fit corners accurately, free from rough edges. Secure at 150 mm on centre.
- .2 Install casing beads where gypsum board butts against surfaces having no trim concealing junction and where indicated. Seal joints with sealant.
- .3 Install insulating strips continuously at edges of gypsum board and casing beads abutting metal window and exterior door frames, to provide thermal break.
- .4 Construct control joints of preformed units set in gypsum board facing and supported independently on both sides of joint.
- .5 Provide continuous polyethylene dust barrier behind and across control joints.
- .6 Locate control joints at changes in substrate construction and at approximate 10 m spacing on long continuous walls.
- .7 Install control joints straight and true.
- .8 Construct expansion joints, at building expansion and construction joints. Provide continuous dust barrier.
- .9 Install expansion joint straight and true.
- .10 Install access doors to electrical and mechanical fixtures specified in respective sections.
 - .1 Rigidly secure frames to furring or framing systems.
- .11 Finish face panel joints and internal angles with joint system consisting of joint compound, joint tape and taping compound installed according to manufacturer's directions and feathered out onto panel faces.

GYPSUM BOARD ASSEMBLIES

- .12 Gypsum Board Finish: finish gypsum board walls and ceilings to following levels in accordance with AWCI Levels of Gypsum Board Finish:
 - .1 Levels of finish:
 - .1 Level 5: embed tape for joints and interior angles in joint compound and apply three separate coats of joint compound over joints, angles, fastener heads and accessories; apply a thin skim coat of joint compound to entire surface; surfaces smooth and free of tool marks and ridges.
- .13 Finish corner beads, control joints and trim as required with two coats of joint compound and one coat of taping compound, feathered out onto panel faces.
- .14 Fill screw head depressions with joint and taping compounds to bring flush with adjacent surface of gypsum board so as to be invisible after surface finish is completed.
- .15 Sand lightly to remove burred edges and other imperfections. Avoid sanding adjacent surface of board.
- .16 Completed installation to be smooth, level or plumb, free from waves and other defects and ready for surface finish.
- .17 Apply one coat of white primer sealer over surface to be textured. When dry apply textured finish in accordance with manufacturer's instructions.
- .18 Mix joint compound slightly thinner than for joint taping.
- .19 Apply thin coat to entire surface using trowel or drywall broad knife to fill surface texture differences, variations or tool marks.
- .20 Allow skim coat to dry completely.
- .21 Remove ridges by light sanding or wiping with damp cloth.

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.
- .2 Waste Management: separate waste materials for reuse and 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.

3.6 PROTECTION

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by gypsum board assemblies installation.

END OF SECTION

1 GENERAL

1.1 RELATED REQUIREMENTS

- .1 Section 09 21 16 – Gypsum Board Assemblies

1.2 REFERENCE STANDARDS

- .1 ASTM International
 - .1 ASTM C 645-14e1, Standard Specification for Nonstructural Steel Framing Members.
 - .2 ASTM C 754-18, Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products.
 - .3 ASTM F1267-18, Standard Specification for Metal Expanded Steel.
 - .4 ASTM A627-03 (2011), Standard Test Methods for Tool-Resisting Steel Bars, Flats, and Shapes for Detention and Correctional facilities the Design of Cold-Formed Steel Structural Members
- .2 National Association of Architectural Metal Manufacturers (NAAMM)
 - .1 EMMA 557-99, Expanded Metal Manufacturers Association Standards for Expanded Metal.
- .3 The Master Painters Institute (MPI)
 - .1 Architectural Painting Specification Manual - current edition.
 - .1 MPI #26, Primer, Galvanized Metal, Cementitious.
- .4 Canadian Standards Association (CSA International)
 - .1 CAN/CSA-S136-16, North American Specification for the Design of Cold-Formed Steel Structural Members

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures. Submit drawings stamped and signed by professional engineer registered or licensed in Ontario, Canada for wall support above finished ceiling.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for metal framing and include product characteristics, performance criteria, physical size, finish and limitations.

1.4 QUALITY ASSURANCE

- .1 Test Reports: submit certified test reports showing compliance with specified performance characteristics and physical properties.
- .2 Certificates: submit product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

1.5 DELIVERY, STORAGE AND HANDLING

NON-STRUCTURAL METAL FRAMING

- .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 off ground, 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.
- .4 Develop Construction Waste Reduction Workplan related to Work of this Section and in accordance with Section 01 74 19 - Waste Management and Disposal.
- .5 Packaging Waste Management: remove for reuse packaging materials as specified in Waste Reduction Workplan in accordance with Section 01 74 19 - Waste Management and Disposal.

2 PRODUCTS**2.1 MATERIALS**

- .1 Non-load bearing channel stud framing: to ASTM C 645, stud size as indicated, roll formed from 0.91 mm thickness hot dipped galvanized steel sheet, for screw attachment of gypsum board.
 - .1 Knock-out service holes at 460 mm centres.
 - .2 Conform to engineering tables designed to meet CSA-S136-01, North American Specification for the Design of Cold-Formed Steel Structural Members for the wall heights indicated on plans.
- .2 Floor and ceiling tracks: to ASTM C 645, in widths to suit stud sizes, 32 mm flange height.
- .3 Metal channel stiffener: manufacturer's standard size, 1.4 mm thick cold rolled steel, coated with rust inhibitive coating.
- .4 Acoustical sealant: in accordance with Section 07 92 00 - Joint Sealants.

3 EXECUTION**3.1 EXAMINATION**

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for non-structural metal framing application 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 ERECTION

NON-STRUCTURAL METAL FRAMING

- .1 Install steel stud systems in accordance with ASTM C754 and manufacturers written instructions.
- .2 Align partition tracks at floor and ceiling and secure at 600 mm on centre maximum.
- .3 Place studs vertically at 400 mm on centre and not more than 50 mm from abutting walls, and at each side of openings and corners.
 - .1 Position studs in tracks at floor and ceiling. Cross brace steel studs as required to provide rigid installation to manufacturer's instructions.
- .4 Erect metal studding to tolerance of 1:1000.
- .5 Attach studs to ceiling track using screws.
- .6 Co-ordinate simultaneous erection of studs with installation of service lines. When erecting studs ensure web openings are aligned.
- .7 Co-ordinate erection of studs with installation of door/window frames and special supports or anchorage for work specified in other Sections.
- .8 Provide two studs extending from floor to ceiling at each side of openings wider than stud centres specified.
 - .1 Secure studs together, 50 mm apart using column clips or other approved means of fastening placed alongside frame anchor clips.
- .9 Install additional heavy gauge single jamb studs at openings.
- .10 Erect track at head of door/window openings and sills of sidelight/window openings to accommodate intermediate studs.
 - .1 Secure track to studs at each end, in accordance with manufacturer's instructions.
 - .2 Install intermediate studs above and below openings in same manner and spacing as wall studs.
- .11 Frame openings and around built-in equipment, cabinets, access panels, on four sides. Extend framing into reveals. Check clearances with equipment suppliers.
- .12 Provide 40 mm stud or furring channel secured between studs for attachment of fixtures behind lavatory basins, toilet and bathroom accessories, and other fixtures including grab bars and towel rails, attached to steel stud partitions.
- .13 Install steel studs or furring channel between studs for attaching electrical and other boxes.
- .14 Extend all partitions to steel deck except where noted otherwise on drawings.
- .15 Maintain clearance under beams and structural slabs to avoid transmission of structural loads to studs.
 - .1 Use 50 mm leg slotted ceiling track to provide slip joint.
- .16 Install two continuous beads of acoustical sealant and insulating strip under studs and tracks around perimeter of sound control partitions.

3.3 CLEANING

NON-STRUCTURAL METAL FRAMING

- .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 reuse and 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 non-structural metal framing application.

END OF SECTION

1 GENERAL

1.1 REFERENCE STANDARDS

- .1 American Society for Testing and Materials International (ASTM)
 - .1 ASTM C 423-17, Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method.
 - .2 ASTM E 1264-14, Standard Classification for Acoustical Ceiling Products.
 - .3 ASTM E 1477-98a(2017), Standard Test Method for Luminous Reflectance Factor of Acoustical Materials by Use of Integrating-Sphere Reflectometers.
- .2 Standards Council of Canada
 - .1 CAN/ULC-S102-10, Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit samples in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data: submit WHMIS MSDS in accordance with Section 01 35 29.06 – Health and Safety Requirements.
- .3 Submit duplicate samples of each type of acoustical units.

1.3 QUALITY ASSURANCE

- .1 Mock-up:
 - .1 Construct mock-ups in accordance with Section 01 45 00 - Quality Control.
 - .2 Construct mock-up 10 m² minimum of each type acoustical tile ceiling including one inside corner and one outside corner.
 - .3 Construct mock-up where directed.
 - .4 Allow 24 hours for inspection of mock-up by Departmental Representative before proceeding with ceiling work.
 - .5 When accepted, mock-up will demonstrate minimum standard for this work. Mock-up may remain as part of the finished work.
- .2 Health and Safety:
 - .1 Do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Protect on site stored or installed absorptive material from moisture damage.
- .2 Store extra materials required for maintenance, where directed by Departmental Representative.
- .3 Waste Management and Disposal:
 - .1 Separate waste materials in accordance with Section 01 74 19 - Waste Management and Disposal.

ACOUSTICAL PANEL CEILINGS

- .2 Remove from site and dispose of packaging materials for recycling in accordance with Waste Management Plan (WMP).

1.5 ENVIRONMENTAL REQUIREMENTS

- .1 Permit wet work to dry before beginning to install.
- .2 Maintain uniform minimum temperature of 15 degrees C and humidity of 20-40% before and during installation.
- .3 Store materials in work area 48 hours prior to installation.

1.6 EXTRA MATERIALS

- .1 Provide extra materials of acoustic units in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Provide acoustical units amounting to 5% of gross ceiling area for each pattern and type required for project.
- .3 Ensure extra materials are from same production run as installed materials.
- .4 Clearly identify each type of acoustic unit, including colour and texture.
- .5 Deliver to Departmental Representative, upon completion of the work of this section.

2 PRODUCTS**2.1 MATERIALS**

- .1 Type ACT: Acoustic units for suspended ceiling system: to ASTM E 1264.
 - .1 Type III, Form 2.
 - .2 Class A.
 - .3 Cellulose fibre with minimum 66% recycled content.
 - .4 Pattern CE.
 - .5 Flame spread rating of 25 or less in accordance with CAN/ULC-S102.
 - .6 Smoke developed 50 or less in accordance with CAN/ULC-S102.
 - .7 Noise Reduction Coefficient (NRC) designation of 0.90.
 - .8 Ceiling Attenuation Class (CAC) rating 30, in accordance with ASTM E 1264
 - .9 Light Reflectance (LR) range of 0.90 to ASTM E 1477.
 - .10 Edge type square.
 - .11 Colour white.
 - .12 Size 610 x 1220 x 25 mm thick.

3 EXECUTION**3.1 EXAMINATION**

- .1 Do not install acoustical panels and tiles until work above ceiling has been inspected by Departmental Representative.

3.2 INSTALLATION

- .1 Comply with manufacturer's written data, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and datasheet.
- .2 Install acoustical panels and tiles in ceiling suspension system.
- .3 Scribe acoustic units to fit adjacent work. Butt joints tight, terminate edges with moulding.
- .4 Install prefinished metal shadow trim at perimeter of new wall construction as indicated in drawings.

3.3 INTERFACE WITH OTHER WORK

- .1 Co-ordinate ceiling work to accommodate components of other sections, such as light fixtures, diffusers, speakers, sprinkler heads, to be built into acoustical ceiling components.

END OF SECTION

1 GENERAL

1.1 REFERENCE STANDARDS

- .1 Department of Justice Canada (Jus)
 - .1 Canadian Environmental Protection Act (CEPA), 1999, c. 33
- .2 Environment Canada (EC)
 - .1 Analytical Methods for Determining Volatile Organic Compound Concentration and Other Parameters for the VOC Regulations.
- .3 Master Painters Institute (MPI)
 - .1 MPI Architectural Painting Specifications Manual, 2014.
- .4 National Research Council Canada (NRC)
 - .1 National Fire Code of Canada (NFC) 2015.
- .5 Society for Protective Coatings (SSPC)
 - .1 SSPC Painting Manual, Volume Two, 8th Edition, Systems and Specifications Manual (PB-00802).

1.2 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.

1.3 SCHEDULING

- .1 Submit work schedule for various stages of painting to Departmental Representative for review. Submit schedule minimum of 48 hours in advance of proposed operations.
- .2 Obtain written authorization from Departmental Representative for changes in work schedule.
- .3 Schedule painting operations to prevent disruption of occupants.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit product data and instructions for each paint and coating product to be used.
 - .2 Submit product data for the use and application of paint thinner.
 - .3 Submit copy of Workplace Hazardous Materials Information System (WHMIS) Material Safety Data Sheets (MSDS) in accordance with Section 01 33 00 - Submittal Procedures. Indicate VOCs during application and curing.

- .3 Samples:
 - .1 Submit full range colour sample chips to indicate where colour availability is restricted.
 - .2 Submit duplicate 200 x 300 mm sample panels of each paint with specified paint or coating in colours, gloss/sheen and textures required to MPI Architectural Painting Specification Manual standards submitted on following substrate materials:
 - .1 3 mm plate steel for finishes over metal surfaces.
 - .2 13 mm gypsum board for finishes over gypsum board and other smooth surfaces.
 - .3 Retain reviewed samples on-site to demonstrate acceptable standard of quality for appropriate on-site surface.
 - .4 Test reports: submit certified test reports for paint from approved independent testing laboratories, indicating compliance with specifications for specified performance characteristics and physical properties.
 - .1 Lead, cadmium and chromium: presence of and amounts.
 - .2 Mercury: presence of and amounts.
 - .3 Organochlorines and PCBs: presence of and amounts.
 - .5 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
 - .6 Manufacturer's Instructions:
 - .1 Submit manufacturer's installation and application instructions.
 - .7 Closeout Submittals: submit maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals include following:
 - .1 Product name, type and use.
 - .2 Manufacturer's product number.
 - .3 Colour numbers.
 - .4 MPI Environmentally Friendly classification system rating.

1.5 MAINTENANCE

- .1 Extra Materials:
 - .1 Deliver to extra materials from same production run as products installed. Package products with protective covering and identify with descriptive labels. Comply with Section 01 78 00 - Closeout Submittals.
 - .2 Quantity: provide one - four litre can of each type and colour of finish coating. Identify colour and paint type in relation to established colour schedule and finish system.
 - .3 Delivery, storage and protection: comply with Departmental Representative requirements for delivery and storage of extra materials.

1.6 DELIVERY, STORAGE AND HANDLING

- .1 Packing, Shipping, Handling and Unloading:
 - .1 Pack, ship, handle and unload materials in accordance with Section 01 61 00 - Common Product Requirements and manufacturer's written instructions.
- .2 Acceptance at Site:
 - .1 Identify products and materials with labels indicating:
 - .1 Manufacturer's name and address.
 - .2 Type of paint or coating.
 - .3 Compliance with applicable standard.
 - .4 Colour number in accordance with established colour schedule.

INTERIOR PAINTING

- .3 Remove damaged, opened and rejected materials from site.
- .4 Storage and Protection:
 - .1 Provide and maintain dry, temperature controlled, secure storage.
 - .2 Store materials and supplies away from heat generating devices.
 - .3 Store materials and equipment in well ventilated area with temperature range 7 degrees C to 30 degrees C.
- .5 Store temperature sensitive products above minimum temperature as recommended by manufacturer.
- .6 Keep areas used for storage, cleaning and preparation clean and orderly. After completion of operations, return areas to clean condition.
- .7 Remove paint materials from storage only in quantities required for same day use.
- .8 Fire Safety Requirements:
 - .1 Provide one 9 kg Type ABC dry chemical fire extinguisher adjacent to storage area.
 - .2 Store oily rags, waste products, empty containers and materials subject to spontaneous combustion in ULC approved, sealed containers and remove from site on a daily basis.
 - .3 Handle, store, use and dispose of flammable and combustible materials in accordance with National Fire Code of Canada requirements.
- .9 Waste Management and Disposal:
 - .1 Separate waste materials in accordance with Section 01 74 19 - Waste Management and Disposal.
 - .2 Place materials defined as hazardous or toxic in designated containers.
 - .3 Ensure emptied containers are sealed and stored safely.
 - .4 Unused paint materials must be disposed of at official hazardous material collections site as approved by Departmental Representative.
 - .5 Paint, stain and wood preservative finishes and related materials (thinners, and solvents) are regarded as hazardous products and are subject to regulations for disposal. Information on these controls can be obtained from Provincial Ministries of Environment and Regional levels of Government.
 - .6 Material which cannot be reused must be treated as hazardous waste and disposed of in an appropriate manner.
 - .7 Place materials defined as hazardous or toxic waste, including used sealant and adhesive tubes and containers, in containers or areas designated for hazardous waste.
 - .8 To reduce the amount of contaminants entering waterways, sanitary/storm drain systems or into ground follow these procedures:
 - .1 Retain cleaning water for water-based materials to allow sediments to be filtered out.
 - .2 Retain cleaners, thinners, solvents and excess paint and place in designated containers and ensure proper disposal.
 - .3 Return solvent and oil soaked rags used during painting operations for contaminant recovery, proper disposal, or appropriate cleaning and laundering.
 - .4 Dispose of contaminants in approved legal manner in accordance with hazardous waste regulations.

INTERIOR PAINTING

- .5 Empty paint cans are to be dry prior to disposal or recycling (where available).
- .9 Where paint recycling is available, collect waste paint by type and provide for delivery to recycling or collection facility.
- .10 Set aside and protect surplus and uncontaminated finish materials. Deliver to or arrange collection by organizations for verifiable re-use or re-manufacturing.

1.7 SITE CONDITIONS

- .1 Heating, Ventilation and Lighting:
 - .1 Ventilate enclosed spaces in accordance with Section 01 35 29.06 - Health and Safety Requirements.
 - .2 Provide heating facilities to maintain ambient air and substrate temperatures above 10 degrees C for 24 hours before, during and after paint application until paint has cured sufficiently.
 - .3 Provide continuous ventilation for seven days after completion of application of paint.
 - .4 Coordinate use of existing ventilation system with Departmental Representative and ensure its operation during and after application of paint as required.
 - .5 Provide temporary ventilating and heating equipment where permanent facilities are not available or supplemental ventilating and heating equipment if ventilation and heating from existing system is inadequate to meet minimum requirements.
 - .6 Provide minimum lighting level of 323 Lux on surfaces to be painted.
- .2 Temperature, Humidity and Substrate Moisture Content Levels:
 - .1 Unless pre-approved written approval by Paint Inspection Agency and product manufacturer, perform no painting when:
 - .1 Ambient air and substrate temperatures are below 10 degrees C.
 - .2 Substrate temperature is above 32 degrees C unless paint is specifically formulated for application at high temperatures.
 - .3 Substrate and ambient air temperatures are not expected to fall within MPI or paint manufacturer's prescribed limits.
 - .4 The relative humidity is over 85% or when the dew point is more than 3 degrees C variance between the air/surface temperature. Paint should not be applied if the dew point is less than 3 degrees C below the ambient or surface temperature. Use sling psychrometer to establish the relative humidity before beginning paint work.
 - .5 Ensure that conditions are within specified limits during drying or curing process, until newly applied coating can itself withstand 'normal' adverse environmental factors.
 - .2 Perform painting work when maximum moisture content of the substrate is below:
 - .1 Allow new concrete and masonry to cure minimum of 28 days.
 - .2 15% for wood.
 - .3 12% for plaster and gypsum board.
 - .3 Test for moisture using calibrated electronic Moisture Meter. Test concrete floors for moisture using "cover patch test".
 - .4 Test concrete, masonry and plaster surfaces for alkalinity as required.

- .3 Surface and Environmental Conditions:
 - .1 Apply paint finish in areas where dust is no longer being generated by related construction operations or when wind or ventilation conditions are such that airborne particles will not affect quality of finished surface.
 - .2 Apply paint to adequately prepared surfaces and to surfaces within moisture limits.
 - .3 Apply paint when previous coat of paint is dry or adequately cured.
- .4 Additional interior application requirements:
 - .1 Apply paint finishes when temperature at location of installation can be satisfactorily maintained within manufacturer's recommendations.

2 PRODUCTS

2.1 MATERIALS

- .1 Paint materials listed in the MPI Approved Products List (APL) are acceptable for use on this project.
- .2 Provide paint materials for paint systems from single manufacturer.
- .3 Only qualified products with E3 "Environmentally Friendly" rating are acceptable for use on this project.
- .4 Conform to latest MPI requirements for interior painting work including preparation and priming.
- .5 Materials (primers, paints, coatings, varnishes, stains, lacquers, fillers, thinners, solvents, etc.) in accordance with MPI Architectural Painting Specification Manual "Approved Product" listing.
- .6 Linseed oil, shellac, and turpentine: highest quality product from approved manufacturer listed in MPI Architectural Painting Specification Manual, compatible with other coating materials as required.
- .7 Water-borne paints and stains, recycled water-borne surface coatings and water borne varnishes to meet minimum "Environmentally Friendly" E3 rating.

2.2 COLOURS

- .1 Departmental Representative will provide Colour Schedule after Contract award.
- .2 Colour schedule will be based upon selection of ten base colours and five accent colours. No more than fifteen colours will be selected for entire project and no more than five colours will be selected in each area.
- .3 Selection of colours from manufacturer's full range of colours.
- .4 Where specific products are available in restricted range of colours, selection based on limited range.
- .5 Second coat in three coat system to be tinted slightly lighter colour than top coat to show visible difference between coats.

2.3 MIXING AND TINTING

- .1 Perform colour tinting operations prior to delivery of paint to site. Obtain written approval from Departmental Representative for tinting of painting materials.
- .2 Mix paste, powder or catalyzed paint mixes in accordance with manufacturer's written instructions.
- .3 Use and add thinner in accordance with paint manufacturer's recommendations. Do not use kerosene or similar organic solvents to thin water-based paints.
- .4 Thin paint for spraying in accordance with paint manufacturer's instructions.
- .5 Re-mix paint in containers prior to and during application to ensure break-up of lumps, complete dispersion of settled pigment, and colour and gloss uniformity.

2.4 GLOSS/SHEEN RATINGS

- .1 Paint gloss is defined as sheen rating of applied paint, in accordance with following values:

	<u>Gloss @ 60 degrees</u>	<u>Sheen @ 85 degrees</u>
Gloss Level 1- Matte Finish (flat)	Max. 5	Max. 10
Gloss Level 2 - Velvet-Like Finish	Max.10	10 to 35
Gloss Level 3- Eggshell Finish	10 to 25	10 to 35
Gloss Level 4 - Satin-Like Finish	20 to 35	min. 35
Gloss Level 5- Traditional Semi-Gloss Finish	35 to 70	
Gloss Level 6 - Traditional Gloss	70 to 85	
Gloss Level 7 - High Gloss Finish	More than 85	

- .2 Gloss level ratings of painted surfaces as indicated and as noted on Room Schedule.

2.5 INTERIOR PAINTING SYSTEMS

- .1 Steel piping and conduits: sprinkler and gas piping, etc.:
 - .1 INT 5.1S - Institutional low odour/low VOC. Gloss Level 5 – Traditional semi-gloss finish.
- .2 Galvanized metal: doors, frames.
 - .1 INT 5.3N - Institutional low odour/low VOC. Gloss Level 5 – Traditional semi-gloss finish.
- .3 Plaster and gypsum board: gypsum wallboard, drywall, "sheet rock type material", and textured finishes:
 - .1 Walls: INT 9.2M - Institutional low odour/low VOC. Gloss Level 3 – Eggshell finish.
 - .2 Ceilings: INT 9.2M - Institutional low odour/low VOC. Gloss Level 1 – Matte finish.

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 sheet.

3.2 GENERAL

- .1 Perform preparation and operations for interior painting in accordance with MPI Architectural Painting Specifications Manual except where specified otherwise.
- .2 Apply paint materials in accordance with paint manufacturer's written application instructions.

3.3 EXAMINATION

- .1 Investigate existing substrates for problems related to proper and complete preparation of surfaces to be painted. Report to Departmental Representative damages, defects, unsatisfactory or unfavourable conditions before proceeding with work.
- .2 Conduct moisture testing of surfaces to be painted using properly calibrated electronic moisture meter, except test concrete floors for moisture using simple "cover patch test". Do not proceed with work until conditions fall within acceptable range as recommended by manufacturer.
- .3 Maximum moisture content as follows:
 - .1 Stucco, plaster and gypsum board: 12%.

3.4 PREPARATION

- .1 Protection:
 - .1 Protect building surfaces and adjacent structures from paint spatters, markings and other damage by suitable non-staining covers or masking. If damaged, clean and restore surfaces as directed by Departmental Representative.
 - .2 Protect items that are permanently attached such as Fire Labels on doors and frames.
 - .3 Protect factory finished products and equipment.
- .2 Surface Preparation:
 - .1 Remove electrical cover plates, light fixtures, surface hardware on doors, bath accessories and other surface mounted equipment, fittings and fastenings prior to undertaking painting operations. Identify and store items in secure location and re-installed after painting is completed.
 - .2 Move and cover furniture and portable equipment as necessary to carry out painting operations. Replace as painting operations progress.
 - .3 Place "WET PAINT" signs in occupied areas as painting operations progress. Signs to approval of Departmental Representative.
- .3 Clean and prepare surfaces in accordance with MPI Architectural Painting Specification Manual requirements. Refer to MPI Manual in regard to specific requirements and as follows:
 - .1 Remove dust, dirt, and other surface debris by vacuuming, wiping with dry, clean cloths or compressed air.

INTERIOR PAINTING

- .2 Wash surfaces with a biodegradable detergent and bleach where applicable and clean warm water using a stiff bristle brush to remove dirt, oil and other surface contaminants.
 - .3 Rinse scrubbed surfaces with clean water until foreign matter is flushed from surface.
 - .4 Allow surfaces to drain completely and allow to dry thoroughly.
 - .5 Prepare surfaces for water-based painting, water-based cleaners should be used in place of organic solvents.
 - .6 Use trigger operated spray nozzles for water hoses.
 - .7 Many water-based paints cannot be removed with water once dried. Minimize use of mineral spirits or organic solvents to clean up water-based paints.
- .4 Prevent contamination of cleaned surfaces by salts, acids, alkalis, other corrosive chemicals, grease, oil and solvents before prime coat is applied and between applications of remaining coats. Apply primer, paint, or pretreatment as soon as possible after cleaning and before deterioration occurs.
 - .5 Sand and dust between coats as required to provide adequate adhesion for next coat and to remove defects visible from a distance up to 1000 mm.
 - .6 Clean metal surfaces to be painted by removing rust, loose mill scale, welding slag, dirt, oil, grease and other foreign substances in accordance with MPI requirements. Remove traces of blast products from surfaces, pockets and corners to be painted by brushing with clean brushes, blowing with clean dry compressed air, or vacuum cleaning.
 - .7 Touch up of shop primers with primer as specified.
 - .8 Do not apply paint until prepared surfaces have been accepted by Departmental Representative

3.5 APPLICATION

- .1 Method of application to be as approved by Departmental Representative. Apply paint by brush, roller, air sprayer or airless sprayer. Conform to manufacturer's application instructions unless specified otherwise.
- .2 Brush and Roller Application:
 - .1 Apply paint in uniform layer using brush and/or roller type suitable for application.
 - .2 Work paint into cracks, crevices and corners.
 - .3 Paint surfaces and corners not accessible to brush using spray, daubers and/or sheepskins. Paint surfaces and corners not accessible to roller using brush, daubers or sheepskins.
 - .4 Brush and/or roll out runs and sags, and over-lap marks. Rolled surfaces free of roller tracking and heavy stipple.
 - .5 Remove runs, sags and brush marks from finished work and repaint.
- .3 Spray application:
 - .1 Provide and maintain equipment that is suitable for intended purpose, capable of atomizing paint to be applied, and equipped with suitable pressure regulators and gauges.
 - .2 Keep paint ingredients properly mixed in containers during paint application either by continuous mechanical agitation or by intermittent agitation as frequently as necessary.
 - .3 Apply paint in uniform layer, with overlapping at edges of spray pattern. Back roll first coat application.

- .4 Brush out immediately all runs and sags.
- .5 Use brushes and rollers to work paint into cracks, crevices and places which are not adequately painted by spray.
- .4 Use dipping, sheepskins or daubers only when no other method is practical in places of difficult access.
- .5 Apply coats of paint continuous film of uniform thickness. Repaint thin spots or bare areas before next coat of paint is applied.
- .6 Allow surfaces to dry and properly cure after cleaning and between subsequent coats for minimum time period as recommended by manufacturer.
- .7 Sand and dust between coats to remove visible defects.
- .8 Finish surfaces both above and below sight lines as specified for surrounding surfaces, including such surfaces as tops of interior cupboards and cabinets and projecting ledges.
- .9 Finish closets and alcoves as specified for adjoining rooms.
- .10 Finish top, bottom, edges and cutouts of doors after fitting as specified for door surfaces.

3.6 MECHANICAL/ ELECTRICAL EQUIPMENT

- .1 Paint finished area exposed conduits, piping, hangers, ductwork and other mechanical and electrical equipment with colour and finish to match adjacent surfaces, except as indicated.
- .2 Boiler room, mechanical and electrical rooms: paint exposed conduits, piping, hangers, ductwork and other mechanical and electrical equipment.
- .3 Other unfinished areas: leave exposed conduits, piping, hangers, ductwork and other mechanical and electrical equipment in original finish and touch up scratches and marks.
- .4 Touch up scratches and marks on factory painted finishes and equipment with paint as supplied by manufacturer of equipment.
- .5 Do not paint over nameplates.
- .6 Keep sprinkler heads free of paint.
- .7 Paint inside of ductwork where visible behind grilles, registers and diffusers with primer and one coat of matte black paint.
- .8 Paint fire protection piping red.
- .9 Paint disconnect switches for fire alarm system and exit light systems in red enamel.
- .10 Paint both sides and edges of backboards for telephone and electrical equipment before installation. Leave equipment in original finish except for touch-up as required, and paint conduits, mounting accessories and other unfinished items.
- .11 Do not paint interior transformers and substation equipment.

3.7 SITE TOLERANCES

- .1 Walls: no defects visible from a distance of 1000 mm at 90 degrees to surface.
- .2 Ceilings: no defects visible from floor at 45 degrees to surface when viewed using final lighting source.
- .3 Final coat to exhibit uniformity of colour and uniformity of sheen across full surface area.

3.8 FIELD QUALITY CONTROL

- .1 Field inspection of painting operations to be carried out by independent inspection firm as designated by Departmental Representative.
- .2 Advise Departmental Representative when surfaces and applied coating is ready for inspection. Do not proceed with subsequent coats until previous coat has been approved.
- .3 Cooperate with inspection firm and provide access to areas of work.

3.9 RESTORATION

- .1 Clean and re-install hardware items removed before undertaken painting operations.
- .2 Remove protective coverings and warning signs as soon as practical after operations cease.
- .3 Remove paint splashings on exposed surfaces that were not painted. Remove smears and spatter immediately as operations progress, using compatible solvent.
- .4 Protect freshly completed surfaces from paint droppings and dust to approval of Departmental Representative. Avoid scuffing newly applied paint.
- .5 Restore areas used for storage, cleaning, mixing and handling of paint to clean condition as approved by Departmental Representative.

END OF SECTION

1 GENERAL

1.1 RELATED REQUIREMENTS

- .1 Section 09 21 16 – Gypsum Board Assemblies.

1.2 REFERENCE STANDARDS

- .1 Aluminum Association (AA)
 - .1 AA DAF 45-03(R2009), Designation System for Aluminum Finishes.
- .2 South Coast Air Quality Management District (SCAQMD), California State, Regulation XI. Source Specific Standards
 - .1 SCAQMD Rule 1168 (A2017), 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 wall and corner guards and include product characteristics, performance criteria, physical size, finish and limitations.
 - .2 Submit WHMIS MSDS in accordance with Section 01 35 29.06 - Health and Safety Requirements. Indicate VOC's for material as follows:
 - .1 Caulking materials during application and curing.
 - .2 Adhesives.
- .3 Installation Drawings:
 - .1 Indicate on drawings large scale details, materials, finishes, dimensions, anchorage and assembly.
- .4 Samples:
 - .1 Submit duplicate 300 mm long samples of profiles and colours for corner and wall guards.

1.4 QUALITY ASSURANCE

- .1 Test Reports:
 - .1 Submit certified test reports showing compliance with specified performance characteristics and physical properties.
- .2 Certificates:
 - .1 Submit product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

1.5 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 off ground indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect wall and corner guards 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.

2 PRODUCTS

2.1 MATERIALS

- .1 Metal corner guard Typ CG1: 1.6 mm thick, 75 x 75 mm size, 1220 mm long, with 3 mm corner radius type 304 satin finished stainless steel, with removable protective paper cover, to profiles indicated, surface, mechanically mounted.

2.2 ACCESSORIES

- .1 Fasteners: self-tapping stainless steel, flush (countersunk) mounting.

3 EXECUTION

3.1 EXAMINATION

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for wall and corner guards 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.

3.2 MANUFACTURER'S INSTRUCTIONS

- .1 Compliance: comply with manufacturer's written data, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.

3.3 INSTALLATION

- .1 Install units on solid backing and erect with materials and components straight, tight and in alignment.
- .2 Mechanically fasten corner guards to substrate at 200 mm on centre and as indicated..

3.4 CLEANING

WALL AND DOOR PROTECTION

- .1 Progress Cleaning: clean in accordance with Section 01 74 00 - Cleaning.
 - .1 Leave Work area clean at end of each day.
- .2 Perform cleaning after installation to remove construction and accumulated environmental dirt.
- .3 Clean surfaces after installation using manufacturer's written recommended cleaning procedures.
- .4 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.
- .5 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00 - Cleaning.
- .6 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.

3.5 PROTECTION

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by wall and corner guards installation.

END OF SECTION

Part 1 GENERAL**1.1 RELATED SECTIONS**

- .1 Section 01 00 10 – General Instructions.

1.2 REFERENCE STANDARDS

- .1 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).
- .2 National Fire Protection Association (NFPA)
 - .1 NFPA 10-2013, Standard for Portable Fire Extinguishers.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 00 10 – General Instructions.
- .2 Product Data:
 - .1 Submit manufacturer's printed product literature and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.
 - .2 Submit copies WHMIS MSDS - Material Safety Data Sheets in accordance with Section 01 00 10 – General Instructions.
- .3 Provide shop drawings.
- .4 Closeout Submittals:
 - .1 Provide operation and maintenance data for incorporation into manual specified in Section 01 00 10 – General Instructions.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Packing, shipping, handling and unloading:
 - .1 Deliver, store and handle materials in accordance with Section 01 00 10 – General Instructions.
- .2 Waste Management and Disposal:
 - .1 Separate waste materials for recycling and reuse in accordance with Section 01 00 10 – General Instructions.

Part 2 PRODUCTS**2.1 MULTI-PURPOSE DRY CHEMICAL EXTINGUISHERS**

- .1 Stored pressure rechargeable type with hose and shut-off nozzle, ULC labelled for A, B and C class protection.
 - .1 Sizes 2.25 and 4.5 kg.

2.2 EXTINGUISHER BRACKETS

- .1 Type recommended by extinguisher manufacturer.

2.3 CABINETS

- .1 Flush type as indicated, constructed of 1.6 mm thick steel, 180 degrees opening door of 2.5 mm thick steel with latching device.
- .2 Cabinet to maintain fire resistive rating of construction in which they occur.
- .3 Cabinet door: with 5 mm full glass panel.
- .4 Finish:
 - .1 Tub: prime coated.
 - .2 Door and frame: No.4 satin finish stainless steel.

2.4 IDENTIFICATION

- .1 Identify extinguishers in accordance with recommendations of CAN/ULC-S508 and ANSI/NFPA 10.
- .2 Attach bilingual tag or label to extinguishers, indicating month and year of installation. Provide space for service dates.

Part 3 EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION

- .1 Install or mount extinguishers in cabinets or on brackets in accordance with NFPA 10.

END OF SECTION

Part 1 GENERAL**1.1 RELATED SECTIONS**

- .1 01 00 10 – General Instructions
- .2 28 31 01 – Fire Alarm Systems

1.2 REFERENCES

- .1 American National Standards Institute/National Fire Prevention Association (ANSI/NFPA)
 - .1 NFPA 13 – Standard for the Installation of Sprinkler Systems, Latest Edition
- .2 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).

1.3 SAMPLES

- .1 Submit samples of following:
 - .1 Each type of sprinkler head.
 - .2 Signs.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Product Data: Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 00 10 – General Instructions.
- .2 Shop Drawings:
 - .1 Submit shop drawings in accordance with Section 01 00 10 – General Instructions.
 - .1 Shop drawings: submit drawings stamped and signed by professional engineer registered or licensed in the Province of Ontario, Canada.
- .3 Quality assurance submittals: submit following in accordance with Section 01 00 10 – General Instructions.
 - .1 Test reports:
 - .1 Submit certified test reports for wet pipe fire protection sprinkler systems from approved independent testing laboratories, indicating compliance with specifications for specified performance characteristics and physical properties.
 - .2 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
 - .3 Instructions: submit manufacturer's installation instructions.
 - .2 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 00 10 – General Instructions, in accordance with ANSI/NFPA 13.
 - .2 Drawings:

WET PIPE SPRINKLER SYSTEMS

- .1 Sprinkler heads and piping system layout.
 - .1 Prepare detail working drawings of system layout in accordance with NFPA 13, "Working Drawings (Plans)".
 - .2 Show data essential for proper installation of each system.
 - .3 Show details, plan view, elevations, and sections of systems supply and piping.
- .3 Design Data:
 - .1 Calculations of sprinkler system design.
 - .2 Indicate type and design of each system.
- .4 Field Test Reports:
 - .1 Preliminary tests on piping system.
- .5 Records:
 - .1 As-built drawings of each system.
 - .1 After completion, but before final acceptance, submit complete set of as-built drawings of each system for record purposes.
 - .2 Submit drawings on reproducible media with title block.
- .6 Operation and Maintenance Manuals:
 - .1 Provide maintenance data for incorporation into manual specified in Section 01 00 10 – General Instructions.

1.5 QUALITY ASSURANCE

- .1 Qualifications:
 - .1 Installer: company or person specializing in wet sprinkler systems with documented experience.

1.6 MAINTENANCE

- .1 Extra Materials:
 - .1 Provide maintenance materials in accordance with Section 01 00 10 – General Instructions.
 - .2 Provide spare sprinkler heads and tools as required by ANSI/NFPA 13.

Part 2 PRODUCTS**2.1 DESIGN REQUIREMENTS**

- .1 Sprinkler system is existing; modify to suit new layout and ceiling elevations. Control components of system to remain as is.
- .2 Design automatic wet pipe fire suppression sprinkler systems in accordance with required and advisory provisions of NFPA 13, for light hazard occupancy by hydraulic calculations for uniform distribution of water over design area.
- .3 Include with each system materials, accessories, and equipment inside and outside building to provide each system complete and ready for use.

WET PIPE SPRINKLER SYSTEMS

- .4 Design and provide each system to give full consideration to blind spaces, piping, electrical equipment, ducts, and other construction and equipment in accordance with detailed shop drawings.
- .5 Locate sprinklers in consistent pattern with ceiling grid, lights, and air supply diffusers.
- .6 Devices and equipment for fire protection service: ULC approved for use in wet pipe sprinkler systems.
- .7 Design systems for earthquake protection. Power-actuated fasteners and drop-in anchors shall not be used for tension loads.
- .8 Location of sprinklers:
 - .1 Locate sprinklers in relation to ceiling and spacing of sprinklers not to exceed that permitted by NFPA 13 for light hazard occupancy, 20.1 m² per sprinkler.
 - .2 Uniformly space sprinklers on branch.
- .9 Water Distribution:
 - .1 Make distribution uniform throughout the area in which sprinklers will open.
 - .2 Discharge from individual sprinklers in hydraulically most remote area to be 100% of specified density.
- .10 Density of Application of Water:
 - .1 Size pipe to provide specified density when system is discharging specified total maximum required flow.
 - .2 Application to horizontal surfaces below sprinklers shall be 4.1 lpm per m².
- .11 Sprinkler Discharge Area:
 - .1 Area: hydraulically most remote 139 m² area as defined in NFPA 13.
- .12 Outside Hose Allowances:
 - .1 Include allowance in hydraulic calculations of 379 lpm for inside hose streams.
- .13 Friction Losses:
 - .1 Calculate losses in piping in accordance with Hazen-Williams formula with 'C' value of 120 for steel piping, and 140 for cement-lined ductile-iron piping.

2.2 ABOVE GROUND PIPING SYSTEMS

- .1 Provide fittings for changes in direction of piping and for connections.
 - .1 Make changes in piping sizes through tapered reducing pipe fittings.
- .2 Perform welding in shop; field welding will only be permitted on a case-by-case basis.
- .3 Conceal piping in areas with suspended ceiling.

2.3 PIPE, FITTINGS AND VALVES

- .1 Pipe:
 - .1 Ferrous: to ANSI/NFPA 13.
 - .2 Copper tube: to ANSI/NFPA 13.

WET PIPE SPRINKLER SYSTEMS

- .2 Fittings and joints to ANSI/NFPA 13:
 - .1 Ferrous: screwed, welded, flanged or roll grooved.
 - .2 Copper tube: screwed, soldered, brazed.
 - .3 Provide threaded fittings into which sprinkler heads, sprinkler head riser nipples, or drop nipples are threaded.
 - .4 Plain-end fittings with mechanical couplings and fittings which use steel gripping devices to bite into pipe when pressure is applied will not be permitted.
 - .5 Rubber gasketed grooved-end pipe and fittings with mechanical couplings are permitted in pipe sizes 32 mm and larger.
 - .6 Fittings: ULC approved for use in wet pipe sprinkler systems.
 - .7 Ensure fittings, mechanical couplings, and rubber gaskets are supplied by same manufacturer.
 - .8 Side outlet tees using rubber gasketed fittings are not permitted.
 - .9 Sprinkler pipe and fittings: metal.
- .3 Pipe hangers:
 - .1 ULC listed for fire protection services in accordance with NFPA.

2.4 SPRINKLER HEADS

- .1 General: to ANSI/NFPA 13 and ULC listed for fire services.
- .2 Sprinkler Head Type:
 - .1 Type A: Standard, upright or pendant for unfinished areas.
 - .1 Bronze finish.
 - .2 Type B: Standard, exposed, pendant for suspended ceilings:
 - .1 Bright chrome finish (satin option)
 - .2 3" (75 mm) dia. escutcheon plate, bright chrome finish (satin/white options).
 - .3 Type C: Semi/fully recessed pendant for drywall or suspended ceilings.
 - .1 Bright chrome finish (satin option).
 - .2 Sprinkler cup assembly.
 - .4 Type D: Concealed pendant for drywall or suspended ceiling:
 - .1 Bronze finish.
 - .2 Sprinkler cup assembly.
 - .3 Coverplate to suit Architectural finishes. Submit sample to Departmental Representative for approval prior to installation.
- .3 Provide nominal 12 mm orifice sprinkler heads.
 - .1 Release element of each head to be of intermediate temperature rating or higher as suitable for specific application, and as indicated.
 - .2 All sprinklers shall be standard response.
 - .3 Provide corrosion-resistant sprinkler heads and sprinkler head guards in accordance with NFPA 13.
 - .4 Deflector to be not more than 75 mm below suspended ceilings.

.5 Ceiling plates to be not more than 25 mm deep.

2.5 SIGNS

- .1 Attach properly lettered Bilingual and approved metal signs to each valve and alarm device to ANSI/NFPA 13.
- .2 Permanently fix hydraulic design data nameplates to riser of each system.

2.6 SPARE PARTS CABINET

- .1 Provide metal cabinet with extra sprinkler heads and sprinkler head wrench. Number and types of extra sprinkler heads as specified in NFPA 13.

Part 3 EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION

- .1 Install, inspect and test to acceptance in accordance with ANSI/NFPA 13.

3.3 PIPE INSTALLATION

- .1 Install piping straight and true to bear evenly on hangers and supports. Do not hang piping from plaster ceilings.
- .2 Keep interior and ends of new piping and existing piping thoroughly clean and dry.
- .3 Protect piping systems during installation by means of plugs or other approved methods. When work is not in progress, securely close open ends of piping to prevent entry of water and foreign matter.
- .4 Inspect piping before installing.

3.4 FIELD PAINTING

- .1 Apply coatings to clean, dry surfaces, using clean brushes.
- .2 Clean surfaces to remove dust, dirt, rust, and loose mill scale.
- .3 Shield sprinkler heads with protective covering while painting is in progress.
- .4 Upon completion of painting, remove protective covering from sprinkler heads.
- .5 Remove any sprinkler heads which have been painted and replace with new sprinkler heads.

3.5 FIELD QUALITY CONTROL

- .1 Site Test, Inspection:
 - .1 Perform test to determine compliance with specified requirements in presence of Departmental Representative.

WET PIPE SPRINKLER SYSTEMS

- .2 Test, inspect, and approve piping before covering or concealing.
- .3 Preliminary Tests:
 - .1 Hydrostatically test each system for a 2-hour period with no leakage or reduction in pressure.
 - .2 Flush piping with potable water in accordance with NFPA 13.
 - .3 Piping above suspended ceilings: tested, inspected, and approved before installation of ceilings.
 - .4 Test alarms and other devices.
 - .5 Test water flow alarms by flowing water through inspector's test connection. When tests have been completed and corrections made, submit signed and dated certificate in accordance with NFPA 13.
- .4 Formal Tests and Inspections:
 - .1 Do not submit request for formal test and inspection until preliminary test and corrections are completed and approved.
 - .2 Submit written request for formal inspection at least 5 days prior to inspection date.
 - .3 Repeat required tests as directed.
 - .4 Correct defects and make additional tests until systems comply with contract requirements.
 - .5 Furnish appliances, equipment, instruments, connecting devices, and personnel for tests.

3.6 CLEANING

- .1 Clean in accordance with Section 01 00 10 – General Instructions.
 - .1 Remove surplus materials, excess materials, rubbish, tools and equipment.
- .2 Clean Management: separate waste materials for reuse and recycling in accordance with Section 01 00 10 – General Instructions.

END OF SECTION

Part 1 GENERAL**1.1 RELATED REQUIREMENTS**

- .1 Refer to the following sections for specifications necessary to complete the work specified in this Division.
 - .1 Section 09 91 23 - Painting.
 - .2 Section 23 05 93 - Testing, Adjusting and Balancing for HVAC.

1.2 REFERENCES

- .1 National Research Council of Canada (NRCC)/Institute for Research in Construction.
 - .1 NRCC 53301, National Building Code of Canada 2015 (NBCC).

1.3 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 Province of Ontario, Canada where specified.
- .3 Shop drawings to show, where applicable:
 - .1 Mounting arrangements.
 - .2 Operating and maintenance clearances.
- .4 Shop drawings and product data accompanied by:
 - .1 Detailed drawings of bases, supports, and anchor bolts.
 - .2 Acoustical sound power data, where applicable.
 - .3 Points of operation on performance curves.
 - .4 Manufacturer to certify current model production.
 - .5 Certification of compliance to applicable codes.
- .5 In addition to transmittal letter referred to in Section 01 33 00 - Submittal Procedures: use MCAC "Shop Drawing Submittal Title Sheet". Identify section and paragraph number.
- .6 Closeout Submittals:
 - .1 Provide operation and maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.
 - .2 Operation and maintenance manual approved by, and final copies deposited with, Departmental Representative before final inspection.
 - .3 Operation data to include:
 - .1 Description of systems and their controls.
 - .2 Operation instruction for systems and component.
 - .3 Description of actions to be taken in event of equipment failure.
 - .4 Maintenance data to include:
 - .1 Servicing, maintenance, operation and trouble-shooting instructions for each item of equipment.
 - .2 Data to include schedules of tasks, frequency, tools required and task time.

COMMON WORK RESULTS FOR HVAC

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

1.4 QUALITY ASSURANCE

- .1 Quality Assurance: in accordance with Section 01 45 00 - Quality Control.

1.5 MAINTENANCE

- .1 Furnish spare parts in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Provide one set of special tools required to service equipment as recommended by manufacturers and in accordance with Section 01 78 00 - Closeout Submittals.

1.6 DELIVERY, STORAGE, AND HANDLING**.1 Waste Management and Disposal:**

- .1 Construction/Demolition Waste Management and Disposal: in accordance with Section 01 74 21 - Construction/Demolition Waste Management.

Part 2 PRODUCTS**2.1 MATERIALS**

- .1 Materials and products to be new unless otherwise noted.

Part 3 EXECUTION**3.1 GENERAL**

- .1 Perform Work in accordance with National Building Code including all amendments up to tender closing date, more stringent requirements of other codes of provincial or local application, and requirements of Authorities Having Jurisdiction provided that, in case of conflict or discrepancy, the more stringent requirements apply.

3.2 PAINTING REPAIRS AND RESTORATION

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

3.3 CLEANING

- .1 Clean interior and exterior of all systems including strainers. Remove all visible dirt and debris from inside of air handling units and ductwork.

3.4 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.
 - .1 Duct leakage tests.
- .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 - 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 Schedule site visits, to review Work, as directed in PART 1 - QUALITY ASSURANCE.

3.5 DEMONSTRATION

- .1 Departmental Representative will use equipment and systems for test purposes prior to acceptance. Supply labour, material, and instruments required for testing.

- .1 Supply tools, equipment and personnel to demonstrate and instruct operating and maintenance personnel in operating, controlling, adjusting, trouble-shooting and servicing of all systems and equipment during regular work hours, prior to acceptance.
- .2 Use operation and maintenance manual, as-built drawings, and audio visual aids as part of instruction materials.
- .3 Instruction duration time requirements as specified in appropriate sections.
- .4 Contractor shall record these demonstrations on video tape for future reference.
- .5 Provide DVD copy of demonstration to Departmental Representative prior to requesting Final Certificate of Completion.

3.6 **NEW OPENINGS IN EXISTING STRUCTURE**

- .1 Review location of new openings with Departmental Representative prior to coring.
- .2 Do not core through existing beams, including ribs in concrete structure.
- .3 Perform X-ray examination of structure when other means of examination cannot provide confirmation that structure members will not be damaged.

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 RELATED REQUIREMENTS

- .1 Section 23 05 00 - Common Work Results for HVAC.

1.2 USE OF SYSTEMS

- .1 Use of existing permanent heating and ventilating systems for supplying temporary heat or ventilation is permitted only under following conditions:
 - .1 Entire system is complete, pressure tested, cleaned, flushed out.
 - .2 There is no possibility of damage.
 - .3 Supply ventilation systems are protected by 60% filters, inspected daily, changed every 2 weeks or more frequently as required.
 - .4 Return systems have approved filters over openings, inlets, outlets.
 - .5 Systems will be:
 - .1 Operated as per manufacturer's recommendations and instructions.
 - .2 Operated by Contractor.
 - .3 Monitored continuously by Contractor.
 - .6 Warranties are not relaxed.
 - .7 Regular preventive and other manufacturers recommended maintenance routines are performed by Contractor at own expense and under supervision of Departmental Representative.
 - .8 Refurbish entire system before static completion; clean internally and externally, restore to "as- new" condition, replace filters in air systems.
- .2 Filters specified in this Section are over and above those specified in other Sections of this project.
- .3 Exhaust systems are not included in approvals for temporary heating ventilation.

Part 2 PRODUCTS

2.1 NOT USED

- .1 Not Used.

Part 3 EXECUTION

3.1 NOT USED

- .1 Not Used.

END OF SECTION

Part 1 GENERAL**1.1 RELATED REQUIREMENTS**

- .1 Section 23 05 00 - Common Work Results for HVAC.

1.2 REFERENCES

- .1 American Society of Mechanical Engineers (ASME)
 - .1 ASME B31.1-2014, Power Piping.
- .2 ASTM International
 - .1 ASTM A125-96(2013)e1, Standard Specification for Steel Springs, Helical, Heat-Treated.
 - .2 ASTM A307-14, Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60,000 PSI Tensile Strength.
 - .3 ASTM A563-15, 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 SP-58-2009, Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application and Installation.
- .5 Underwriter's Laboratories of Canada (ULC)

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 00 10 – General Instruction.
- .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 drawings stamped and signed by professional engineer registered or licensed in Province of Ontario, Canada.
 - .2 Submit shop drawings for:
 - .1 Bases, hangers and supports.
 - .2 Connections to equipment and structure.
 - .3 Structural assemblies.
- .4 Certificates:
 - .1 Submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
- .5 Manufacturers' Instructions:
 - .1 Provide manufacturer's installation instructions.
 - .1 Departmental Representative will make available 1 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 Section 01 61 00 - Common Product Requirements and 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.
- .3 Packaging Waste Management: in accordance with Section 01 74 21 - Construction/Demolition Waste Management.

Part 2 PRODUCTS**2.1 SYSTEM DESCRIPTION**

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

2.2 GENERAL

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

2.3 PIPE HANGERS

- .1 Finishes:
 - .1 Pipe hangers and supports: galvanized after manufacture.
 - .2 Use electro-plating galvanizing process.
 - .3 Ensure steel hangers in contact with copper piping are copper plated or epoxy coated.
- .2 Upper attachment structural: suspension from lower flange of I-Beam:
 - .1 Cold piping NPS 2 maximum: malleable iron C-clamp with hardened steel cup point setscrew, locknut and carbon steel retaining clip.
 - .1 Rod: 9 mm UL listed, 13 mm FM approved.

- .2 Cold piping NPS 2 1/2 or greater, hot piping: malleable iron beam clamp, eye rod, jaws and extension with carbon steel retaining clip, tie rod, nuts and washers, UL listed, FM approved to MSS SP-58.
- .3 Upper attachment structural: suspension from upper flange of I-Beam:
 - .1 Cold piping NPS 2 maximum: ductile iron top-of-beam C-clamp with hardened steel cup point setscrew, locknut and carbon steel retaining clip, UL listed, FM approved to MSS SP-58.
 - .2 Cold piping NPS 2 1/2 or greater, hot piping: malleable iron top-of-beam jaw-clamp with hooked rod, spring washer, plain washer and nut UL listed, FM approved.
- .4 Upper attachment to concrete:
 - .1 Ceiling: carbon steel welded eye rod, clevis plate, clevis pin and cotters with weldless forged steel eye nut. Ensure eye 6 mm minimum greater than rod diameter.
 - .2 Concrete inserts: wedge shaped body with knockout protector plate UL listed, FM approved to MSS SP-58.
- .5 Shop and field-fabricated assemblies:
 - .1 Trapeze hanger assemblies: steel angle or sections.
 - .2 Steel brackets: steel angle or sections.
- .6 Hanger rods: threaded rod material to MSS SP-58:
 - .1 Ensure that hanger rods are subject to tensile loading only.
 - .2 Provide linkages where lateral or axial movement of pipework is anticipated.
 - .3 Do not use 22 mm or 28 mm rod.
- .7 Pipe attachments: material to MSS SP-58:
 - .1 Attachments for steel piping: carbon steel galvanized.
 - .2 Attachments for copper piping: copper plated black steel.
 - .3 Use insulation shields for hot pipework.
 - .4 Oversize pipe hangers and supports.
- .8 Adjustable clevis: material to MSS SP-58 UL listed, FM approved, clevis bolt with nipple spacer and vertical adjustment nuts above and below clevis.
 - .1 Ensure "U" has hole in bottom for rivetting to insulation shields.
- .9 Yoke style pipe roll: carbon steel yoke, rod and nuts with cast iron roll, to MSS SP-58.
- .10 U-bolts: carbon steel to MSS SP-58 with 2 nuts at each end to ASTM A563.
 - .1 Finishes for steel pipework: galvanized.
 - .2 Finishes for copper, glass, brass or aluminum pipework: galvanized, with formed portion plastic coated or epoxy coated.
- .11 Pipe rollers: cast iron roll and roll stand with carbon steel rod to MSS SP-58.

2.4 INSULATION PROTECTION SHIELDS

- .1 Insulated cold piping:
 - .1 64 kg/m³ density insulation plus insulation protection shield to: MSS SP-58, galvanized sheet carbon steel. Length designed for maximum 3 m span.
- .2 Insulated hot piping:

- .1 Curved plate 300 mm long, with edges turned up, welded-in centre plate for pipe sizes NPS 12 and over, carbon steel to comply with MSS SP-58.

2.5 CONSTANT SUPPORT SPRING HANGERS

- .1 Springs: alloy steel to ASTM A125, shot peened, magnetic particle inspected, with +/-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. Adjustments 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 minimum.
- .6 Individually calibrated scales on each side of support calibrated prior to shipment, complete with calibration record.

2.6 VARIABLE SUPPORT SPRING HANGERS

- .1 Vertical movement: 13 mm minimum, 50 mm 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 2 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 +/-5 % spring rate tolerance, tested for free height, spring rate, loaded height and provided with CMTR.

2.7 EQUIPMENT SUPPORTS

- .1 Fabricate equipment supports not provided by equipment manufacturer from structural grade steel. Submit calculations with shop drawings.

2.8 EQUIPMENT ANCHOR BOLTS AND TEMPLATES

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

Part 3 EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION

- .1 .1 Install in accordance with:
 - .1 Manufacturer's instructions and recommendations.
- .2 Vibration Control Devices:

- .1 Install on piping systems at pumps, boilers, chillers, cooling towers, and as indicated.
- .3 Clamps on riser piping:
 - .1 Support independent of connected horizontal pipework using riser clamps and riser clamp lugs welded to riser.
 - .2 Bolt-tightening torques to industry standards.
 - .3 Steel pipes: install below coupling or shear lugs welded to pipe.
 - .4 Cast iron pipes: install below joint.
- .4 Clevis plates:
 - .1 Attach to concrete with 4 minimum concrete inserts, one at each corner.
 - .2 Provide supplementary structural steelwork where structural bearings do not exist or where concrete inserts are not in correct locations.
 - .3 Use approved constant support type hangers where:
 - .1 Vertical movement of pipework is 13 mm or more,
 - .2 Transfer of load to adjacent hangers or connected equipment is not permitted.
- .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 HANGER SPACING

- .1 Plumbing piping: to National Plumbing Code.
- .2 Fire protection: to applicable fire code.
- .3 Copper piping: up to NPS 1/2: every 1.5 m.
- .4 Flexible joint roll groove pipe: in accordance with table below for steel, but not less than one hanger at joints. Table listings for straight runs without concentrated loads and where full linear movement is not required.
- .5 Within 300 mm of each elbow.

Maximum Pipe Size: NPS	Maximum Spacing Steel	Maximum Spacing Copper
up to 1-1/4	2.4 m	1.8 m
1-1/2	3.0 m	2.4 m
2	3.0 m	2.4 m
2-1/2	3.7 m	3.0 m
3	3.7 m	3.0 m
3-1/2	3.7 m	3.3 m
4	3.7 m	3.6 m
5	4.3 m	
6	4.3 m	
8	4.3 m	
10	4.9 m	
12	4.9 m	

- .6 Pipework greater than NPS 12: to MSS SP-58.

3.4 HANGER INSTALLATION

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

3.5 HORIZONTAL MOVEMENT

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

3.6 FINAL ADJUSTMENT

- .1 Adjust hangers and supports:
 - .1 Ensure that rod is vertical under operating conditions.
 - .2 Equalize loads.
- .2 Adjustable clevis:
 - .1 Tighten hanger load nut securely to ensure proper hanger performance.
 - .2 Tighten upper nut after adjustment.
- .3 C-clamps:
 - .1 Follow manufacturer's recommended written instructions and torque values when tightening C-clamps to bottom flange of beam.
- .4 Beam clamps:
 - .1 Hammer jaw firmly against underside of beam.

3.7 FIELD QUALITY CONTROL

- .1 Site Tests: conduct following tests in accordance with Section 01 00 10 – General Instruction and submit report as described in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS.
- .2 Manufacturer's Field Services:
 - .1 Obtain written report 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.

3.8 CLEANING

- .1 Clean in accordance with Section 01 00 10 – General Instruction.
 - .1 Remove surplus materials, excess materials, rubbish, tools and equipment.
- .2 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 00 10 – General Instruction.

END OF SECTION

Part 1 GENERAL**1.1 RELATED REQUIREMENTS**

- .1 Section 23 05 00 - Common Work Results for HVAC.
- .2 Section 23 05 49.01 - Seismic Restraint Systems (SRS) - Type P2 Buildings.
- .3 Section 23 05 93 - Testing, Adjusting and Balancing for HVAC.

1.2 REFERENCES

- .1 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).
- .2 National Fire Protection Association (NFPA)
 - .1 NFPA 13-2016, Standard for the Installation of Sprinkler Systems.
- .3 National Building Code of Canada (NBC), 2015.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submittals: in accordance with Section 01 00 10 – General Instruction.

Part 2 PRODUCTS**2.1 GENERAL**

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

2.2 ELASTOMERIC PADS

- .1 Type EP1 – neoprene waffle or ribbed; 9 mm minimum thick; 50 durometer; maximum loading 350 kPa.
- .1 Type EP2 – rubber waffle or ribbed; 9 mm minimum thick; 30 durometer natural rubber; maximum loading 415 kPa.
- .2 Type EP3 – neoprene-steel-neoprene; 9 mm minimum thick neoprene bonded to 1.71 mm steel plate; 50 durometer neoprene, waffle or ribbed; holes sleeved with isolation washers; maximum loading 350 kPa.
- .3 Type EP4 – rubber-steel-rubber; 9 mm minimum thick rubber bonded to 1.71 mm steel plate; 30 durometer natural rubber, waffle or ribbed; holes sleeved with isolation washers; maximum loading 415 kPa.

2.3 ELASTOMERIC MOUNTS

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

2.4 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.

- .1 Ratio of height when loaded to diameter of spring between 0.8 to 1.0.
- .2 Cadmium plate for outdoor 100% relative humidity installations.
- .3 Colour code springs.

2.5 SPRING MOUNT

- .1 Zinc or cadmium plated hardware; housings coated with rust resistant paint.
- .1 Type M2 – stable open spring: support on bonded 6 mm minimum thick ribbed neoprene or rubber friction and acoustic pad.
- .2 Type M3 – stable open spring: 6 mm minimum thick ribbed neoprene or rubber friction and acoustic pad, bonded under isolator and on isolator top plate; levelling bolt for rigidly mounting to equipment.
- .3 Type M4 – restrained stable open spring: supported on bonded 6 mm minimum thick ribbed neoprene or rubber friction and acoustic pad; built-in resilient limit stops, removable spacer plates.
- .4 Type M5 – enclosed spring mounts with snubbers for isolation up to 950 kg maximum.

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 degrees arc without metal to metal contact.
- .1 Type H1 – neoprene – in-shear, moulded with rod isolation bushing which passes through hanger box.
- .2 Type H2 – stable spring, elastomeric washer, cup with moulded isolation bushing which passes through hanger box.
- .3 Type H3 – stable spring, elastomeric element, cup with moulded isolation bushing which passes through hanger box.
- .4 Type H4 – stable spring, elastomeric element with precompression washer and nut with deflection indicator.

2.7 ACOUSTIC BARRIERS FOR ANCHORS AND GUIDES

- .1 Acoustic barriers: between pipe and support, consisting of 25 mm minimum thick heavy duty duck and neoprene isolation material.

2.8 SEISMIC CONTROL MEASURES

- .1 Refer to Section 23 05 49.01 - Seismic Restraint Systems (SRS) - Type P2 Buildings.

Part 3 EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION

- .1 Seismic control measures to meet requirements of NBC.
- .1 Install vibration isolation equipment in accordance with manufacturer's instructions and adjust mountings to level equipment.
- .2 Ensure piping, ducting and electrical connections to isolated equipment do not reduce system flexibility and that piping, conduit and ducting passage through walls and floors do not transmit vibrations.
- .3 Unless indicated otherwise, support piping connected to isolated equipment with spring mounts or spring hangers with 25 mm minimum static deflection as follows:
 - .1 Up to 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.
- .4 Where isolation is bolted to floor use vibration isolation rubber washers.
- .5 Block and shim level bases so that ductwork and piping connections can be made to rigid system at operating level, before isolator adjustment is made. Ensure that there is no physical contact between isolated equipment and building structure.

3.3 FIELD QUALITY CONTROL

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

3.4 CLEANING

- .1 Proceed in accordance with Section 01 00 10 – General Instruction.
- .2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 GENERAL**1.1 RELATED REQUIREMENTS**

- .1 Section 21 13 13 - Wet Pipe Sprinkler Systems.

1.2 REFERENCES

- .1 Canadian Standards Association (CSA International)
 - .1 CSA G40.20-13/G40.21-13, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel, Includes Updated No. 1 (2014).
- .2 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).
- .3 National Building Code of Canada (NBC), 2015.

1.3 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.

1.4 DESCRIPTION

- .1 SRS fully integrated into, and compatible with:
 - .1 Noise and vibration controls specified elsewhere.
 - .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 Ontario.

1.5 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 Province of Ontario.
- .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 work sheets, tables Simplified, Detailed work sheets, tables. Simplified, conservative assumptions are acceptable.
 - .11 Detailed design of SRS including complete working drawings prepared to same standard of quality and size as technical 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.
 - .5 Quality assurance submittals: submit following in accordance with Section 01 33 00 - Submittal Procedures.
 - .6 Closeout Submittals:
 - .1 Provide maintenance data including monitoring requirements for incorporation into manuals specified in Section 01 78 00 - Closeout Submittals.

Part 2 PRODUCTS

2.1 SRS MANUFACTURER

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

2.2 GENERAL

- .1 SRS to provide gentle and steady cushioning action and avoid high impact loads.
- .2 SRS to restrain seismic forces in every direction.
- .3 Fasteners and attachment points to resist same load as seismic restraints.
- .4 SRS of Piping systems compatible with:
 - .1 Expansion, anchoring and guiding requirements.
 - .2 Equipment vibration isolation and equipment SRS.
- .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 firestopping.
- .8 Wet pipe sprinkler systems: Refer to Section 21 13 13 - Wet Pipe Sprinkler Systems.

2.3 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 and buckling in axial direction.
 - .3 Hanger rods to withstand compressive loading and buckling.

2.4 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.

2.5 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 and buckling in axial direction.
- .3 Hanger rods to withstand compressive loading and buckling.

2.6 SERVICE UTILITIES ENTRANCE INTO BUILDING

- .1 Provide flexibility to prevent breakage in the event of earthquake activity.

Part 3 EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION

- .1 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 degrees to each other (in plan), tie back to structure at maximum of 45 degrees 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 Manufacturer's Field Services:
 - .1 Arrange with manufacturer's representative to review work of this Section and submit written reports to verify compliance with technical documents.
 - .2 Manufacturer's Field Services: consisting of product use recommendations and periodic site visits to review installation, scheduled as follows:
 - .1 After delivery and storage of Products.
 - .2 After preparatory work is complete but before installation commences.
 - .3 Twice during the installation, at 25% and 60% completion stages.
 - .4 Upon completion of installation.

- .2 Submit manufacturer's reports to Departmental Representative within 3 days of manufacturer representative's review.
- .3 Inspection and Certification:
 - .1 SRS: inspected and certified by Manufacturer upon completion of installation.
 - .2 Provide written report to Departmental Representative with certificate of compliance.
- .4 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

Part 1 GENERAL**1.1 RELATED REQUIREMENTS**

- .1 Section 23 05 00 - Common Work Results for HVAC.

1.2 REFERENCES

- .1 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-24.3-92, Identification of Piping Systems.
- .2 National Fire Protection Association (NFPA)
 - .1 NFPA 13-2016, Standard for the Installation of Sprinkler Systems
 - .2 NFPA 14-2016, Standard for the Installation of Standpipe and Hose Systems

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Product Data:
 - .1 Submittals: in accordance with Section 01 00 10 – General Instruction.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle in accordance with Section 01 00 10 – General Instruction.
- .2 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.
- .3 Packaging Waste Management: in accordance with 01 00 10 – General Instruction.
- .4 Store at temperatures and conditions recommended by manufacturer.

Part 2 PRODUCTS**2.1 MANUFACTURER'S EQUIPMENT NAMEPLATES**

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

2.2 SYSTEM NAMEPLATES

- .1 Colours:
 - .1 Hazardous: red letters, white background.
 - .2 Elsewhere: black letters, white background (except where required otherwise by applicable codes).
- .2 Construction:

MECHANICAL IDENTIFICATION

- .1 3 mm thick laminated plastic or white anodized aluminum, matte finish, with square corners, letters accurately aligned and machine engraved into core.
- .3 Sizes:
- .1 Conform to following table:

Size #mm	Sizes(mm)	No. of Lines	Height of Letters
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 Provide identification nameplates for all systems in each mechanical room, and on all terminal cabinets and control panels.
- .2 Nameplates to be made from laminated phenolic plastic sheet, minimum size 100 mm wide x 40 mm high, engraved with min. 20 mm high letters, red letters on white background for fire protection and hazardous systems, black letters on white background elsewhere.

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 PIPING SYSTEMS GOVERNED BY CODES

- .1 Identification:
- .1 Sprinklers: to NFPA 13.
- .2 Standpipe and hose systems: to NFPA 14.

2.5 SYSTEM NAMEPLATES

- .1 Provide identification nameplates for all systems in each mechanical room, and on all terminal cabinets and control panels.

- .2 Nameplates to be made from laminated phenolic plastic sheet, minimum size 100 mm wide x 40 mm high, engraved with min. 20 mm high letters, red letters on white background for fire protection and hazardous systems, black letters on white background elsewhere.
- .3 Where existing identification system is in use, apply the existing system to the new work.

2.6 IDENTIFICATION OF PIPING SYSTEMS

- .1 Identify all piping systems according to the following:
- .1 Colour band, according to the legend following, to the full circumference of piping, including insulation where applied. Length of colour band to accommodate legend and flow directional arrows.
- .2 System legend to be applied in block capital letters, colour and sizes according to CAN/CGSB-24.3.
- .3 Arrows indicating flow direction to be 100 mm long x 50 mm high for piping up to 75 mm in diameter, and 150 mm long x 50 mm high for piping 100 mm diameter and larger.
- .4 Where required, pictograms to be applied in conformance with WHMIS regulations.
- .2 Materials for background colour markings, legend and arrows to be waterproof and heat-resistant pressure sensitive plastic marker tags for piping 20 mm diameter and smaller.
- .3 For piping 25 mm diameter and above, use pressure sensitive plastic-coated cloth or vinyl material with protective coating, waterproof contact adhesive undercoating, suitable for 100% RH ambient conditions and operating temperature of 150°C.

- .4 Colours for lettering and arrows:

BACKGROUND	LETTERING AND ARROWS
Yellow	Black
Green	White
Red	White

- .5 Background colour marking and legend for piping systems:

SERVICE	BACKGROUND COLOUR MARKING	LEGEND
Domestic hot water supply	Green	DOM. HW SUPPLY
Domestic hot water recirculation	Green	DOM. HW CIRC
Domestic cold water supply	Green	DOM. CWS
Sanitary	Yellow	SAN
Plumbing vent	Green	SAN. VENT
Sprinklers	Red	SPRINKLERS

- .6 Where existing identification system is in use, apply the existing system to the new work.

2.7 IDENTIFICATION DUCTWORK SYSTEMS

- .1 50 mm high stenciled letters and directional arrows 150 mm long x 50 mm high.

- .2 Colours: black, or coordinated with base colour to ensure strong contrast.

2.8 VALVES, CONTROLLERS

- .1 Brass tags with 12 mm stamped identification data filled with black paint.
- .2 Include flow diagrams for each system, of approved size, showing charts and schedules with identification of each tagged item, valve type, service, function, normal position, location of tagged item.

2.9 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.

2.10 LANGUAGE

- .1 Identification in English and French.

Part 3 EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 IDENTIFICATION FOR PIPING AND DUCTWORK SYSTEMS

- .1 Apply identification after painting has been completed.
- .2 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.
- .3 Adjacent to each change in direction.
- .4 At least once in each room through which piping or ductwork passes.
- .5 On both sides of visual obstruction, or where service is difficult to follow.
- .6 On both sides of separations such as walls, floors, partitions.
- .7 Where system is installed in pipe chases, ceiling spaces, galleries, other confined spaces: at entry and exit points, and at each access opening.
- .8 At beginning and end points of each run, and at each piece of equipment in run.
- .9 At point immediately upstream of major manually operated or automatically controlled valves, dampers, etc. Where this is not possible, place identification as close as possible, preferably on upstream side.
- .10 Identification to be easily and accurately readable from usual operating areas and from access points. Position of identification to be 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.
- .11 Provide standoffs for nameplates on insulated surfaces.

- .12 Secure valve tags with non-ferrous chains or closed S-hooks.
- .13 Provide and hang one copy of flow diagrams and valve schedules, mounted in frames behind non-glare glass where directed by Departmental Representative. Additional copies of flow diagrams and schedules to be included in maintenance manuals.
- .14 Valves in each system to be numbered consecutively.

END OF SECTION

Part 1 GENERAL**1.1 RELATED REQUIREMENTS**

- .1 Section 23 05 00 - Common Work Results For HVAC.

1.2 QUALIFICATIONS OF TAB PERSONNEL

- .1 Submit names of personnel to perform TAB to Departmental Representative within 90 days of award of contract.
- .2 Provide documentation confirming qualifications, successful experience.
- .3 TAB: performed in accordance with the requirements of standard under which TAB Firm's qualifications are approved:
 - .1 Associated Air Balance Council, (AABC) National Standards for Total System Balance, MN-1-2002.
 - .2 National Environmental Balancing Bureau (NEBB) TABES, Procedural Standards for Testing, Adjusting, Balancing of Environmental Systems-2013.
 - .3 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA), HVAC TAB HVAC Systems - Testing, Adjusting and Balancing-2002.
- .4 Recommendations and suggested practices contained in the TAB Standard: mandatory.
- .5 Use TAB Standard provisions, including checklists, and report forms to satisfy Contract requirements.
- .6 Use TAB Standard for TAB, including qualifications for TAB Firm and Specialist and calibration of TAB instruments.
- .7 Where instrument manufacturer calibration recommendations are more stringent than those listed in TAB Standard, use manufacturer's recommendations.
- .8 TAB Standard quality assurance provisions such as performance guarantees form part of this contract.
 - .1 For systems or system components not covered in TAB Standard, use TAB procedures developed by TAB Specialist.
 - .2 Where new procedures, and requirements, are applicable to Contract requirements have been published or adopted by body responsible for TAB Standard used (AABC, NEBB, or TABB), requirements and recommendations contained in these procedures and requirements are mandatory.

1.3 PURPOSE OF TAB

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

1.4 EXCEPTIONS

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

1.5 CO-ORDINATION

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

1.6 PRE-TAB REVIEW

- .1 Review technical 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.
- .3 During construction, co-ordinate location and installation of TAB devices, equipment, accessories, measurement ports and fittings.

1.7 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.

1.8 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.

1.9 START OF TAB

- .1 Notify Departmental Representative 7 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 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.
 - .2 Air systems:
 - .1 Filters in place, clean.
 - .2 Duct systems clean.
 - .3 Ducts, air shafts, ceiling plenums are airtight to 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.
- .3 Liquid systems:
 - .1 Flushed, filled, vented.
 - .2 Correct pump rotation.
 - .3 Strainers in place, baskets clean.
 - .4 Isolating and balancing valves installed, open.
 - .5 Calibrated balancing valves installed, at factory settings.
 - .6 Chemical treatment systems complete, operational.

1.10 APPLICATION TOLERANCES

- .1 Do TAB to following tolerances of design values:
 - .1 Laboratory HVAC systems: plus 10%, minus 0%.
 - .2 Other HVAC systems: plus or minus 10%.
 - .3 Hydronic systems: plus or minus 10%.

1.11 ACCURACY TOLERANCES

- .1 Measured values accurate to within plus or minus 2% of actual values.

1.12 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 HVAC system.
- .3 Calibrate within 3 months of TAB. Provide certificate of calibration to Departmental Representative.

1.13 ACTION AND INFORMATIONAL SUBMITTALS

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

1.14 PRELIMINARY TAB REPORT

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

1.15 TAB REPORT

- .1 Format in accordance with referenced standard.
- .2 TAB report to show results in SI units and to include:
 - .1 Project record drawings.
 - .2 System schematics.
- .3 Submit 6 copies of TAB Report to Departmental Representative for verification and approval, in both official languages in D-ring binders, complete with index tabs.

1.16 VERIFICATION

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

1.17 SETTINGS

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

1.18 COMPLETION OF TAB

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

1.19 AIR SYSTEMS

- .1 Standard: TAB to most stringent of this section or TAB standards of AABC, NEBB SMACNA, ASHRAE.
- .2 Do TAB of systems, equipment, components, controls specified Division 23.
- .3 Qualifications: personnel performing TAB qualified to standards of AABC or NEBB.
- .4 Quality assurance: perform TAB under direction of supervisor qualified by AABC or 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 device.
- .7 Locations of systems measurements to include as appropriate: main ducts, main branch, sub-branch, run-out (or grille, register or diffuser).

1.20 OTHER TAB REQUIREMENTS

- .1 General requirements applicable to work specified this paragraph:
 - .1 Qualifications of TAB personnel: as for air systems specified this section.
 - .2 Quality assurance: as for air systems specified this section.
- .2 Smoke management systems:
 - .1 Test for proper operation of all smoke and fire dampers, sensors, detectors, installed as component parts of air systems specified Division 23.
 - .2 Emergency evacuation: see post-occupancy TAB activities specified below.
- .3 Measurement of noise and vibration from equipment specified in Division 23.

1.21 POST-OCCUPANCY TAB

- .1 Measure DBT, WBT (or %RH), air velocity, air flow patterns, NC levels, in occupied zone of all areas.
- .2 Emergency evacuation: participate in full scale emergency evacuation exercises. Repeat smoke management tests at this time.
- .3 Participate in systems checks twice during Warranty Period - #1 approximately 3 months after acceptance and #2 within 1 month of termination of Warranty Period.

Part 2 PRODUCTS**2.1 NOT USED**

- .1 Not used.

Part 3 EXECUTION**3.1 BALANCING, ADJUSTMENT AND START-UP**

- .1 As soon as conditions permit, conduct acceptance tests to demonstrate that the equipment and systems meet the specified requirements. Major equipment components shall have start-up procedures performed by factory trained and approved personnel. Written start-up reports shall be provided to the Departmental Representative. Prior to final tests make changes, adjustments or replacements shown to be required by results of preliminary tests, ready for performance of air and water balancing of systems.
- .2 Operate equipment for a minimum of five days. Repair defects and repeat tests until satisfactory results are obtained, lubricate bearings and adjust and set drives for proper alignment and tensions.
- .3 Calibrate and adjust thermostats, thermometers, linkages and dampers. Operate and test motors and speed switches for correct wiring sequences, check overload heaters in motor starters, replace and clean filters, flush out lines and equipment, remove and clean strainers, and flush out systems with chemically treated water to recommendations of the chemical treatment manufacturer. Fill water systems to purge air. Clean fan wheels and heating coils. Comb fins on air coils. Check all bolts and screws for tightness.
- .4 After completion of air and water balancing, vary loads to demonstrate start-up sequence and normal shut-down. Simulate emergency conditions to demonstrate safety shut-down, and automatic and/or manual reset.

- .5 Conduct final tests in the presence of the Departmental Representative. Give advance notice in writing that preliminary tests have been completed and that final tests are ready to be conducted. During the final tests demonstrate to the satisfaction of the Departmental Representative that the equipment is operating as intended, without undue noise or vibration.

END OF SECTION

Part 1 GENERAL**1.1 RELATED REQUIREMENTS**

- .1 Section 23 05 00 - Common Work Results - HVAC.
- .2 Section 23 05 93 - Testing, Adjusting and Balancing for HVAC.
- .3 Section 23 31 13.01 - Metal Ducts - Low Pressure to 500 PA.

1.2 REFERENCES

- .1 Sheet Metal and Air Conditioning Contractor's National Association (SMACNA)
 - .1 SMACNA HVAC Air Duct Leakage Test Manual.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Make submittals in accordance with Section 01 00 10 – General Instruction.
- .2 Test Reports: submit certified test reports from approved independent testing laboratories indicating compliance with specifications for specified performance characteristics and physical properties. Include pressure test information and results as follows:
 - .1 Submit proposed report form and test report format to Departmental Representative for approval at least three months before proposed date of first series of tests. Do not start tests until approval received in writing from Departmental Representative.
 - .2 Prepare report of results and submit to Departmental Representative within 24 hours of completion of tests. Include:
 - .1 Schematic of entire system.
 - .2 Schematic of section under test showing test site.
 - .3 Required and achieved static pressures.
 - .4 Orifice differential pressure at test sites.
 - .5 Permissible and actual leakage flow rate (L/s) for test sites.
 - .6 Witnessed certification of results.
 - .7 Include test reports in final TAB report.
 - .8 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
 - .9 Instructions: submit manufacturer's installation instructions.
 - .10 Manufacturer's field reports specified.

Part 2 PRODUCTS**2.1 TEST INSTRUMENTS**

- .1 Test apparatus to include:
 - .1 Fan capable of producing required static pressure.
 - .2 Duct section with calibrated orifice plate mounted and accurately located pressure taps.
 - .3 Flow measuring instrument compatible with the orifice plate.

- .4 Calibration curves for orifice plates used.
- .5 Flexible duct for connecting to ductwork under test.
- .6 Smoke bombs for visual inspections.
- .2 Test apparatus: accurate to within +/- 3% of flow rate and pressure.
- .3 Submit details of test instruments to be used to Departmental Representative at least three months before anticipated start date.
- .4 Test instruments: calibrated and certificate of calibration deposited with Departmental Representative no more than 28 days before start of tests.
- .5 Re-calibrated every six months thereafter.

2.2 EQUIPMENT LEAKAGE TOLERANCES

- .1 Equipment and system components such as VAV boxes, duct heating leakage: 2%.

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 datasheet.

3.2 TEST PROCEDURES

- .1 Maximum lengths of ducts to be tested consistent with capacity of test equipment.
- .2 Section of duct to be tested to include:
 - .1 Fittings, branch ducts, tap-ins.
- .3 Repeat tests until specified pressures are attained. Bear costs for repairs and repetition to tests.
- .4 Base partial system leakage calculations on SMACNA HVAC Air Duct Leakage Test Manual.
- .5 Seal leaks that can be heard or felt, regardless of their contribution to total leakage.

3.3 SITE TOLERANCES

- .1 System leakage tolerances specified are stated as percentage of total flow rate handled by system. Pro-rate specified system leakage tolerances. Leakage for sections of duct systems: not to exceed total allowable leakage.
- .1 Leakage tests on following systems not to exceed specified leakage rates.
 - .1 Small duct systems up to 250 Pa: leakage 2%.
 - .2 VAV box and duct on downstream side of VAV box: leakage 2%.
 - .3 Large low pressure duct systems up to 500 Pa: leakage 2%.
 - .4 HP duct systems up to 1000 Pa pressure classification, including upstream side of VAV boxes: leakage 1.
- .2 Evaluation of test results to use surface area of duct and pressure in duct as basic parameters.

3.4 TESTING

- .1 Test ducts before installation of insulation or other forms of concealment.
- .2 Test after seals have cured.
- .3 Test when ambient temperature will not affect effectiveness of seals, and gaskets.
- .4 Flexible connections to VAV boxes.

3.5 FIELD QUALITY CONTROL

- .1 Manufacturer's Field Services.
 - .1 Have manufacturer of products, supplied under this Section, review Work involved in the handling, installation/application, protection and cleaning, of its products and submit written reports, in acceptable format, to verify compliance of Work with Contract.
 - .2 Manufacturer's Field Services: 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, at stages listed:
 - .1 After delivery and storage of products, and when preparatory Work, or other Work, on which the Work of this Section depends, is complete but before installation begins.
 - .2 Twice during progress of Work at 25% and 60% complete.
 - .3 Upon completion of the Work, after cleaning is carried out.
 - .4 Obtain reports, within 3 days of review, and submit, immediately, to Departmental Representative.

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.
- .3 Section 23 31 13.01 - Metal Ducts - Low Pressure to 500 PA.

1.2 REFERENCES

- .1 Definitions:
 - .1 For purposes of this section:
 - .1 "CONCEALED" – insulated mechanical services and equipment 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.

1.3 REFERENCES STANDARDS

- .1 American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)
 - .1 ASHRAE 90.1-2013 (SI), Energy Standard for Buildings Except Low-Rise Residential Buildings (ANSI Approved; IES Co-sponsored), Errata (December 7, 2015), Addenda Supplement 2015, ASHRAE IC 90.1-2013-2 to 2013-6.
- .2 American Society for Testing and Materials (ASTM) International Inc.
 - .1 ASTM C335/C335M-10e1, Standard Test Method for Steady-State Heat Transfer Properties of Pipe Insulation.
 - .2 ASTM C449-07(2013), Standard Specification for Mineral Fiber-Hydraulic-Setting Thermal Insulating and Finishing Cement.
 - .3 ASTM C553-13, Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.
 - .4 ASTM C612-14, Standard Specification for Mineral Fiber Block and Board Thermal Insulation.
 - .5 ASTM C921-10(2015), Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.
- .3 Canadian General Standards Board (CGSB)
 - .1 CGSB 51-GP-52MA, Vapour Barrier, Jacket and Facing Material for Pipe, Duct and Equipment Thermal Insulation.
- .4 Green Seal Environmental Standards (GSES)
 - .1 Standard GS-36-13, Adhesives for Commercial Use.
- .5 National Fire Protection Association
 - .1 NFPA-90A-2015, Installation of Air Conditioning and Ventilating Systems.

DUCT INSULATION

- .6 Thermal Insulation Association of Canada (TIAC): National Insulation Standards.
 - .1 CRD: Code Round Ductwork,
 - .2 CRF: Code Rectangular Finish.
- .7 Underwriters Laboratories of Canada (ULC)
 - .1 CAN/ULC-S102-10, Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.
 - .2 CAN/ULC-S701-11, Standard for Thermal Insulation, Polystyrene, Boards and Pipe Covering.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 00 10 – General Instruction.
- .2 Product Data:
 - .1 Provide manufacturer's printed product literature and datasheets 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.

1.5 QUALITY ASSURANCE

- .1 Qualifications:
 - .1 Installer: specialist in performing work of this section, and have successful experience in this size and type of project, qualified to standards of TIAC.

1.6 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle in accordance with Section 01 00 10 – General Instruction.
- .2 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.
- .3 Packaging Waste Management: in accordance with Section 01 00 10 – General Instruction.
- .4 Store at temperatures and conditions recommended by manufacturer.

Part 2 PRODUCTS**2.1 SUSTAINABLE REQUIREMENTS**

- .1 Mechanical fasteners, adhesives, sealers, vapour coatings, mastics, laggings and bedding compounds to be compatible with materials to which they are applied and shall not soften, corrode or otherwise attack such material in either wet or dry state and shall be only those recommended by the manufacturer of the insulation as suitable for the application proposed. Apply within ambient temperatures recommended by the manufacturer.

DUCT INSULATION

2.2 FIRE AND SMOKE RATING

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

2.3 INSULATION

- .1 Mineral fibre: as specified includes glass fibre, rock wool, slag wool.
- .2 Thermal conductivity ("k" factor) not to exceed specified values at 24 degrees C mean temperature when tested in accordance with ASTM C335/C335M.
- .3 TIAC Code C-1: Rigid mineral fibre board to ASTM C612, with factory applied vapour retarder jacket to CGSB 51-GP-52Ma (as scheduled in PART 3 of this Section).
- .4 TIAC Code C-2: Mineral fibre blanket to ASTM C553 faced with factory applied vapour retarder jacket to CGSB 51-GP-52Ma (as scheduled in PART 3 of this section).
 - .1 Mineral fibre: to ASTM C553.
 - .2 Jacket: to CGSB 51-GP-52Ma.
 - .3 Maximum "k" factor: to ASTM C553.
- .5 Rigid Insulation:
 - .1 Ducting and Fittings: Rigid insulation with vapour barrier to be composed of fibrous glass or mineral wool fibres formed into rigid board having a factory applied vapour barrier, and suitable for application on exposed or concealed rectangular ducts and plenums.
 - .1 Specification Compliance:
 - .1 ASTM C612, Class 1.
 - .2 ASTM C411 to meet NBC or CUA (NFPA 90A), latest edition.
 - .2 Vapour Barrier:
 - .1 Vapour barrier shall be composed of aluminum foil minimum 0.7 mil thick, reinforced with fibreglass yarn mesh and laminated to permanently treated fire resistant kraft paper. Vapour barrier shall meet or exceed the following:
 - .1 Water Vapour Permeability: 0.3 perms max.
 - .2 Moisture Absorption: Less than 0.2% by volume.
 - .2 Fire Hazard Classification: not to exceed:
 - .1 Flame Spread: 25
 - .2 Fuel Contributed: 50
 - .3 Smoke Developed: 50
 - .3 Specification Compliance:
 - .1 ASTM-C411 to meet NBC or CUA 90A (NFPA-90A), latest edition.
 - .2 Thickness of rigid insulation with vapour barrier to be as indicated in schedule.
 - .3 Application: Thicknesses as indicated in insulation schedule.

DUCT INSULATION

- .1 Fresh air intakes from louvres to mixing box and/or filter sections of air handling units.
 - .2 All rectangular exhaust air ductwork for a minimum distance of 2 meters from the terminal at the roof or exterior wall or as noted on the drawings.
 - .3 All rectangular supply air ducts from air handling units (in mechanical rooms) containing cooling coils.
 - .4 Rectangular supply ducts from corridor units, supply air. Where contained within shaft, ducts shall not be insulated.
- .6 Flexible Insulation:
- .1 Ducting and Fittings:
 - .1 Flexible insulation with factory applied vapour barrier to be composed of fibrous glass formed into a flexible blanket and be suitable for application on exterior of round ducts. Do not use on rectangular ductwork.
 - .2 Specification Compliance:
 - .1 Class 6 ASTM C411, to meet CUA-90A (NFPA 90A).
 - .2 Vapour Barrier:
 - .1 The vapour barrier shall be composed of aluminum foil min 0.7 mil thick, reinforced with fibreglass yarn mesh and laminated to permanently treated fire resistant kraft paper.
 - .2 Specification Compliance:
 - .1 ASTM-C411 to meet NBC or CUA-90A.
 - .3 Applications: Thicknesses as indicated in insulation schedule.
 - .1 Insulate circular exhaust air ducts for a minimum distance of 2 metres from the roof terminal or exterior wall opening, or as noted on drawing.
 - .2 Unheated fresh air ducts.
 - .3 Supply air ductwork, as noted on drawings.
 - .4 Finishes:
 - .1 All concealed ductwork will be left with factory applied vapour barrier facing as specified above, with no further finish required.
 - .5 Cover all exposed ductwork with a thermocanvas jacket as specified under "Jackets".

2.4 JACKETS

- .1 Canvas:
 - .1 220 gm/m² cotton, plain weave, treated with dilute fire retardant lagging adhesive to ASTM C921.
- .2 Lagging adhesive: compatible with insulation.
 - .1 Maximum VOC limit to SCAQMD Rule 1168.

2.5 ACCESSORIES

- .1 Vapour retarder lap adhesive:
 - .1 Water based, fire retardant type, compatible with insulation.
 - .1 Maximum VOC limit to SCAQMD Rule 1168.

DUCT INSULATION

- .2 Indoor Vapour Retarder Finish:
 - .1 Vinyl emulsion type acrylic, compatible with insulation.
- .3 Insulating Cement: hydraulic setting on mineral wool, to ASTM C449.
- .4 ULC Listed Canvas Jacket:
 - .1 220 gm/m² cotton, plain weave, treated with dilute fire retardant lagging adhesive to ASTM C921.
- .5 Outdoor Vapour Retarder Mastic:
 - .1 Vinyl emulsion type acrylic, compatible with insulation.
 - .2 Reinforcing fabric: Fibrous glass, untreated 305 g/m².
- .6 Tape: self-adhesive, aluminum, reinforced, 50 mm wide minimum.
- .7 Contact adhesive: quick-setting.
 - .1 Maximum VOC limit to SCAQMD Rule 1168.
- .8 Canvas adhesive: washable.
 - .1 Maximum VOC limit to SCAQMD Rule 1168.
- .9 Tie wire: 1.5 mm stainless steel.
- .10 Banding: 12 mm wide, 0.5 mm thick stainless steel.
- .11 Fasteners: 2 mm diameter pins with 35 mm diameter clips, length 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 datasheets.

3.2 PRE-INSTALLATION REQUIREMENTS

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

3.3 INSTALLATION

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

DUCT INSULATION

- .1 Ensure hangers, and supports are outside vapour retarder jacket.
- .5 Hangers and supports in accordance with Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment.
 - .1 Apply high compressive strength insulation where insulation may be compressed by weight of ductwork.
- .6 Fasteners: install at 300 mm on centre in horizontal and vertical directions, minimum 2 rows each side.

3.4 DUCTWORK INSULATION SCHEDULE

- .1 Insulation types and thicknesses: conform to following table:

	TIAC Code	Vapour Retarder	Thickness (mm)
Rectangular cold and dual temperature supply air ducts	C-1	yes	50
Round cold and dual temperature supply air ducts	C-2	yes	50
Rectangular warm air ducts	C-1	no	25
Round warm air ducts	C-1	no	25
Supply, return and exhaust ducts exposed in space being served	none		
Exhaust duct between dampers and louvres	C-1	no	25
Acoustically lined ducts	none		

- .2 Exposed round ducts 600 mm and larger, smaller sizes where subject to abuse:

- .1 Use TIAC code C-1 insulation, scored to suit diameter of duct.

3.5 CLEANING

- .1 Clean in accordance with Section 01 00 10 – General Instruction.
 - .1 Remove surplus materials, excess materials, rubbish, tools and equipment.
- .2 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 00 10 – General Instruction.

3.6 APPLICATION OF OUTDOOR INSULATION MEMBRANE

- .1 Apply waterproofing membrane in accordance with manufacturer's instructions at locations indicated on the drawings.
- .2 Apply membrane to clean, dry, primed metal ductwork and foil-faced rigid insulation boards. Do not apply over wet or non-rigid insulation.
- .3 Apply membrane in accordance with manufacturer's air, material, and surface temperature requirements.
- .4 Apply firm, uniform pressure with hand roller to entire membrane to ensure proper adhesion. Concentrate pressure at seams and on underside of ductwork.

DUCT INSULATION

- .5 Apply membrane to ducts in accordance with manufacturer's instructions.
- .6 Apply membrane shingle fashion to shed water over, not against laps.
- .7 Do not terminate membrane on bottom of duct.
- .8 Apply minimum 76 mm side laps and minimum 152 mm end laps for ductwork applications.
- .9 Embed membrane to bottom of ducts over 610 mm wide in light continuous layer of adhesive applied to insulation facer.
- .10 Apply membrane to bottom of insulated ducts over 915 mm wide using mechanical attachment, in addition to adhesive, in accordance with manufacturer's instructions. Install pins on 305 mm centres with rows staggered.
- .11 Apply adhesive to areas where special adhesion requirements exist, including duct bottoms, flashings, transitions, joints, elbows, valves, tees and other fittings.

END OF SECTION

Part 1 GENERAL**1.1 RELATED REQUIREMENTS**

- .1 Section 22 05 00 - Common Work Results for Plumbing.
- .2 Section 23 05 00 - Common Work Results for HVAC.

1.2 REFERENCES

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

Part 2 PRODUCTS**2.1 SUSTAINABLE REQUIREMENTS**

- .1 Choose products and materials with recycled content or resource efficient characteristics whenever possible. Use least toxic sealants, adhesives, sealers and finishes necessary to comply with the requirements of the project.

2.2 THERMOSTAT (LINE VOLTAGE-HEATING AND COOLING)

- .1 Line voltage, wall-mounted thermostat, for heating-cooling with:
 - .1 Full load rating: 16 A at 120 V.
 - .2 Temperature setting range: 5 degrees C to 30 degrees C.
 - .3 Thermometer range: 5 degrees C to 30 degrees C.
 - .4 Markings in 5 degree increments.
 - .5 Differential temperature fixed at 1.1 degrees C.

2.3 THERMOSTAT (LINE VOLTAGE, HEATING)

- .1 Line voltage wall mounted electric heating thermostat with:
 - .1 Full load rating: 22 A at 120 V.
 - .2 Temperature setting range: 5 degrees C to 30 degrees C.
 - .3 Double pole.
 - .4 Thermometer range: 5 degrees C to 30 degrees C.
 - .5 Scale markings: Off-5-10-15-20-25 degrees C.

2.4 THERMOSTAT (LOW VOLTAGE)

- .1 Low voltage wall thermostat:
 - .1 For use on 24 V circuit at 1.5 A capacity.
 - .2 With heat anticipator adjustable 0.1 to 1.2 A.
 - .3 Temperature setting range: 10 degrees C to 25 degrees C.
 - .4 Without sub-base.

2.5 THERMOSTAT GUARDS

- .1 Thermostat guards: lockable, clear plastic. Slots for air circulation to thermostat.

Part 3 EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION

- .1 Install control devices.
- .2 On outside wall, mount thermostats on bracket or insulated pad 25 mm from exterior wall.
- .3 Install remote sensing device and capillary tube in metallic conduit. Conduit enclosing capillary tube must not touch heater or heating cable.
- .4 Controls to be provided by the controls contractor. Mechanical contractor to coordinate with controls contractor as required.

END OF SECTION

Part 1 GENERAL

1.1 RELATED REQUIREMENTS

- .1 Section 23 05 00 - Common Work Results for HVAC.
- .2 Section 23 05 94 - Pressure Testing of Ducted Air Systems.

1.2 REFERENCES

- .1 American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE).
- .2 American Society for Testing and Materials International, (ASTM)
 - .1 ASTM A480/A480M-16, Standard Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet and Strip.
 - .2 ASTM A635/A635M-15, Standard Specification for Steel, Sheet and Strip, Heavy-Thickness Coils, Hot-Rolled, Alloy, Carbon, Structural, High-Strength Low-Alloy, and High-Strength Low-Alloy with Improved Formability, General Requirements.
 - .3 ASTM A653/A653M-15e1, Standard Specification for Steel Sheet, Zinc Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- .3 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS)
- .4 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA).
 - .1 SMACNA HVAC Duct Construction Standards - Metal and Flexible, 3rd Edition, 2005.
 - .2 SMACNA HVAC Air Duct Leakage Test Manual, 2nd Edition, 2012.
 - .3 IAQ Guideline for Occupied Buildings Under Construction, 2nd Edition, 2007.
- .5 Underwriters Laboratories of Canada (ULC)
 - .1 CAN/ULC-S109-14, Standard Method for Flame Tests of Flame-Resistant Fabrics and Films.

Part 2 PRODUCTS

2.1 MATERIAL

- .1 Choose products and materials with recycled content or resource efficient characteristics.
- .2 Use least toxic sealants, adhesives, sealers and finishes necessary to comply with the requirements of the project.

2.2 SEAL CLASSIFICATION

- .1 Use SMACNA Seal Class "C" for all ductwork up to 500 Pa maximum operating pressure.
- .2 Seal classification:

- .1 Class A: longitudinal seams, transverse joints, duct wall penetrations and connections made airtight with sealant and tape.
- .2 Class B: longitudinal seams, transverse joints and connections made airtight with sealant tape or combination thereof.
- .3 Class C: transverse joints and connections made air tight with sealant tape or combination thereof. Longitudinal seams unsealed.

2.3 SEALANT

- .1 Sealant: water-based, polymer type flame resistant duct sealant. Temperature range of minus 5 degrees C to plus 93 degrees C.

2.4 TAPE

- .1 Tape: polyvinyl treated, open weave fiberglass tape, 50 mm wide.
- .2 Meets the flame-resistance requirements of CAN/ULC-S109M.

2.5 DUCT LEAKAGE

- .1 In accordance with SMACNA HVAC Air Duct Leakage Test Manual.

2.6 FITTINGS

- .1 Fabrication: to SMACNA.
- .2 Radiused elbows.
 - .1 Rectangular: standard radius.
 - .2 Round: five piece. Centreline radius: 1.5 times diameter.
- .3 Mitred elbows, rectangular:
 - .1 To 750 mm: with single thickness turning vanes.
 - .2 Over 750 mm: with double thickness turning vanes.
- .4 Branches:
 - .1 Rectangular main and branch: with 45 degrees entry on branch.
 - .2 Round main and branch: enter main duct at 45 degrees with conical connection.
 - .3 Provide volume control damper in branch duct near connection to main duct.
- .5 Transitions:
 - .1 Diverging: 20 degrees maximum included angle.
 - .2 Converging: 30 degrees maximum included angle.
- .6 Offsets:
 - .1 Use radiused elbows unless indicated otherwise.
- .7 Obstruction deflectors: maintain full cross-sectional area.
 - .1 Maximum included angles: as for transitions.

2.7 FIRE STOPPING

- .1 Retaining angles around duct, on both sides of fire separation in accordance with Section 07 84 00 - Firestopping.
- .2 Fire stopping material and installation must not distort duct.

2.8 GALVANIZED STEEL

- .1 Lock forming quality: to ASTM A653/A653M, Z90 zinc coating.
- .2 Thickness, fabrication and reinforcement: to SMACNA.
- .3 Joints: to SMACNA proprietary manufactured duct joint. Proprietary manufactured flanged duct joint to be considered to be a class A seal.

2.9 HANGERS AND SUPPORTS

- .1 Hangers and Supports: in accordance with Section 23 05 00 - Common Work Results for HVAC.
 - .1 Strap hangers: of same material as duct but one sheet metal thickness heavier than duct.
 - .1 Maximum size duct supported by strap hanger: 500 mm wide.
 - .2 Hanger configuration: to SMACNA Standards.
 - .3 Hangers: galvanized steel angle with galvanized steel rods to SMACNA Standards.
 - .4 Upper hanger attachments:
 - .1 For concrete: manufactured concrete inserts.
 - .2 For steel joist: manufactured joist clamp and/or steel plate washer.
 - .3 For steel beams: manufactured beam clamps.

Part 3 EXECUTION**3.1 GENERAL**

- .1 Do work in accordance with SMACNA Standards unless directed otherwise by Departmental Representative.
- .2 Do not break continuity of insulation vapour barrier with hangers or rods.
- .3 Insulate strap hangers 100 mm beyond insulated duct.
- .4 Support risers in accordance with SMACNA Standards.
- .5 Install breakaway joints in ductwork on sides of fire separation.
- .6 Manufacture duct in lengths and diameter to accommodate installation of acoustic duct lining where applicable.
- .7 Coordinate ductwork installation with all other trades involved on this project. Optimize ceiling space in suspended ceilings and maintain maximum headroom under exposed ducts. Provide detailed fabrication drawings for problem areas when requested by Departmental Representative.

- .8 Seal all joints in low pressure and high pressure ductwork. Apply sealant to outside of joint to manufacturer's recommendations. Bed tape into sealant and recoat with a coat of sealant. This applies to all supply, return, outdoor air and exhaust ductwork.
- .9 Support flexible ductwork at 1.2 meters maximum centres.
- .10 Where fire-stopping is required, provide retaining angles all around duct on both sides of fire separation, and pack around duct with fire-stopping material without distorting duct.

3.2 HANGERS

- .1 Strap hangers: install in accordance with SMACNA Standards.
- .1 Angle hangers: complete with locking nuts and washers.
- .2 Hanger spacing: in accordance with SMACNA Standards.

3.3 LEAKAGE TESTS

- .1 Refer to Section 23 05 94 - Pressure Testing of Ducted Air Systems.
- .2 In accordance with SMACNA HVAC Duct Leakage Test Manual.
- .3 Perform leakage tests in sections.
- .4 Make trial leakage tests as instructed to demonstrate workmanship.
- .5 Do not install additional ductwork until trial test has been passed.
- .6 Test section minimum of 30 m long with not less than three branch takeoffs and two 90 degrees elbows.
- .7 Complete test before performance insulation or concealment Work.

END OF SECTION

Part 1 GENERAL**1.1 RELATED REQUIREMENTS**

- .1 Section 23 05 00 - Common Work Results for HVAC.
- .2 Section 23 31 13.01 - Metal Ducts - Low Pressure to 500 PA.

1.2 REFERENCES

- .1 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS)
- .2 National Fire Protection Association
 - .1 NFPA-90A-2015, Installation of Air Condition and Ventilating Systems.
- .3 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)
 - .1 SMACNA HVAC Duct Construction Standards - Metal and Flexible, 3rd Edition, 2005.

1.3 GENERAL

- .1 Manufacture in accordance with SMACNA - HVAC Duct Construction Standards.

1.4 FLEXIBLE CONNECTIONS

- .1 Frame: galvanized sheet metal frame 0.7 mm thick with fabric clenched by means of double locked seams.
- .2 Material:
 - .1 Fire resistant, self extinguishing, neoprene coated glass fabric, temperature rated at minus 40 degrees C to plus 90 degrees C, density of 1.3 kg/m².

1.5 ACCESS DOORS IN DUCTS

- .1 Non-Insulated Ducts: sandwich construction of same material as duct, one sheet metal thickness heavier, minimum 0.6 mm 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 thick complete with sheet metal angle frame and 25 mm thick rigid glass fibre insulation.
- .3 Gaskets: neoprene.
- .4 Hardware:
 - .1 Up to 300 x 300 mm: two sash locks.
 - .2 301 to 450 mm: four sash locks.
 - .3 451 to 1000 mm: piano hinge and minimum two sash locks.
 - .4 Doors over 1000 mm: piano hinge and two handles operable from both sides.
 - .5 Hold open devices.

1.6 TURNING VANES

- .1 Factory or shop fabricated single thickness with trailing edge, to recommendations of SMACNA and as indicated.

1.7 INSTRUMENT TEST

- .1 1.6 mm thick steel zinc plated after manufacture.
- .1 Cam lock handles with neoprene expansion plug and handle chain.
- .2 28 mm minimum inside diameter. Length to suit insulation thickness.
- .3 Neoprene mounting gasket.

1.8 SPIN-IN COLLARS

- .1 Conical galvanized sheet metal spin-in collars with lockable butterfly damper.
- .1 Sheet metal thickness to co-responding round duct standards.

Part 2 PRODUCTS**2.1 MANUFACTURER'S INSTRUCTIONS**

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

2.2 INSTALLATION

- .1 Flexible Connections:
 - .1 Install in following locations:
 - .1 Inlets and outlets to supply air units and fans.
 - .2 Inlets and outlets of exhaust and return air fans.
 - .3 As indicated.
 - .2 Length of connection: 100 mm.
 - .3 Minimum distance between metal parts when system in operation: 75 mm.
 - .4 Install in accordance with recommendations of SMACNA.
 - .5 When fan is running:
 - .1 Ducting on sides of flexible connection to be in alignment.
 - .2 Ensure slack material in flexible connection.
- .2 Access Doors and Viewing Panels:
 - .1 Size:
 - .1 625 x 350 mm for person size entry.
 - .2 625 x 425 mm for servicing entry.
 - .3 450 x 250 mm for viewing.
 - .4 As indicated.
 - .2 Locations:
 - .1 Fire and smoke dampers.
 - .2 Control dampers.
 - .3 Devices requiring maintenance.
 - .4 Required by code.
 - .5 Reheat coils.
 - .6 Elsewhere as indicated.

AIR DUCT ACCESSORIES

- .3 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 Ducted inlets to roof and wall exhausters.
 - .2 Inlets and outlets of other fan systems.
 - .3 Main and sub-main ducts.
 - .4 And as indicated.
 - .2 For temperature readings:
 - .1 At outside air intakes.
 - .2 In mixed air applications in locations as approved by Departmental Representative.
 - .3 At inlet and outlet of coils.
 - .4 Downstream of junctions of two converging air streams of different temperatures.
 - .5 And as indicated.
- .4 Turning vanes:
 - .1 Install in accordance with recommendations of SMACNA and as indicated.

2.3 WORK FOR OTHER SECTIONS

- .1 Install all motorized dampers, fire stats, thermostats, EP switches, PE switches, limit switches, sail switches, safety controls, and instrument wells required for control and alarm systems. Coordinate this work with Controls Coordinator.
- .2 Smoke detectors are to be installed inside ductwork where required by NFPA-90A (generally in systems larger than 2000cfm that serve more than one level of the building, and other systems that are required to be shut down by the fire alarm system). The smoke detectors will be supplied and installed by Division 26, with the assistance of Division 23 regarding exact locations, access doors, etc. Smoke detectors will be generally positioned in the duct on the discharge side of the supply air fan, and for systems on 15,000 cfm capacity and above, a second detector will be installed in the return air duct or plenum at each floor level. The smoke detectors are to be located where air flow is representative and stable, i.e. in straight lengths of ducts away from bends and fittings, and away from corners at the top or sides of the duct. Detectors may be mounted inside the ductwork, or mounted outside with sampling tubes penetrating the side of the duct, installed in accordance with manufacturer's recommendations.
- .3 Controls to be provided by the controls contractor. Mechanical contractor to coordinate with controls contractor as required.

Part 3 EXECUTION

3.1 NOT USED

.1 Not used.

END OF SECTION

Part 1 GENERAL

1.1 RELATED REQUIREMENTS

- .1 Section 23 05 00 - Common Work Results for HVAC.

1.2 REFERENCES

- .1 Sheet Metal and Air Conditioning National Association (SMACNA)
 - .1 SMACNA HVAC Duct Construction Standards - Metal and Flexible, 3rd Edition, 2005.
- .2 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS)

Part 2 PRODUCTS

2.1 GENERAL

- .1 Manufacture to SMACNA standards.

2.2 SINGLE BLADE DAMPERS

- .1 Fabricate from same material as duct, but one sheet metal thickness heavier. V-groove stiffened.
- .1 Size and configuration to recommendations of SMACNA, except maximum height as indicated.
- .2 Locking quadrant with shaft extension to accommodate insulation thickness.
- .3 Inside and outside nylon or bronze end bearings.
- .4 Channel frame of same material as adjacent duct, complete with angle stop.
- .5 Vibration-free operation.

Part 3 EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION

- .1 Install where indicated.
- .1 Install in accordance with recommendations of SMACNA and in accordance with manufacturer's instructions.

DAMPERS - BALANCING

- .2 Locate balancing dampers in each branch duct, for supply, return and exhaust systems.
- .3 Runouts to registers and diffusers: install single blade damper located as close as possible to main ducts.
- .4 Dampers: vibration free.
- .5 Ensure damper operators are observable and accessible.

END OF SECTION

Part 1 GENERAL

1.1 RELATED REQUIREMENTS

- .1 Section 23 05 00 - Common Work Results for HVAC.
- .2 Section 23 33 00 - Air Duct Accessories.

1.2 REFERENCES

- .1 Health Canada/Workplace Hazardous Materials Information System (WHMIS):
 - .1 Material Safety Data Sheets (MSDS)
- .2 National Fire Protection Association (NFPA)
 - .1 NFPA-90A-2015, Installation of Air Condition and Ventilating Systems.
- .3 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)
- .4 Underwriters Laboratories of Canada (ULC)
 - .1 CAN/ULC S112-10, Standard Methods of Fire Test of Fire-Damper Assemblies.
 - .2 CAN/ULC-S112.2-07, Standard Method of Fire Test of Ceiling Firestop Flap Assemblies.
 - .3 ULC S505-2004, Fusible Links for Fire Protection Services.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submittals in accordance with Section 01 00 10 – General Instructions.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle in accordance with Section 01 00 10 – General Instructions.
- .2 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.
- .3 Packaging Waste Management: in accordance with Section 01 00 10 – General Instructions.
- .4 Store at temperatures and conditions recommended by manufacturer.

Part 2 PRODUCTS

2.1 FIRE DAMPERS

- .1 Fire dampers: arrangement Type B or C, listed and bear label of ULC Warnock Hersey, meet requirements of Fire Commissioner of Canada (FCC) and ANSI/NFPA 90A. Fire damper assemblies fire tested in accordance with CAN/ULC-S112.

- .2 Mild steel, factory fabricated for fire rating requirement to maintain integrity of fire wall and/or fire separation.
 - .1 Fire rating to suit the rating of the wall.
 - .2 Automatic operating type and have dynamic rating suitable for maximum air velocity and pressure differential to which it will be subjected.
- .3 Interlocking type; sized to maintain full duct cross section.
- .4 Fusible link actuated, weighted to close and lock in closed position when released or having negator-spring-closing operator for multi-leaf type or roll door type in horizontal position with vertical air flow.
- .5 Retaining angle iron frame, on full perimeter of fire damper, on both sides of fire separation being pierced, as required by manufacturer to maintain listing.
- .6 Equip fire dampers with steel sleeve or frame installed disruption ductwork or impair damper operation.
- .7 Equip sleeves or frames with perimeter mounting angles attached on both sides of wall or floor opening. Construct ductwork in fire-rated floor-ceiling or roof-ceiling assembly systems with air ducts that pierce ceiling to conform with ULC.
- .8 Design and construct dampers to not reduce duct or air transfer opening cross-sectional area.
- .9 Dampers shall be installed so that the centerline of the damper depth or thickness is located in the centerline of the wall, partition of floor slab depth or thickness.
- .10 Unless otherwise indicated, the installation details given in SMACNA Install Fire Damp HVAC and in manufacturer's instructions for fire dampers shall be followed.

Part 3 EXECUTION**3.1 MANUFACTURER'S INSTRUCTIONS**

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

3.2 INSTALLATION

- .1 Install in accordance with NFPA 90A and in accordance with conditions of ULC listing.
- .2 Maintain integrity of fire separation.
- .3 After completion and prior to concealment obtain approvals of complete installation from authority having jurisdiction.
- .4 Install access door adjacent to each damper. See Section 23 33 00 - Air Duct Accessories.
- .5 Co-ordinate with installer of fire stopping.
- .6 Ensure access doors/panels, fusible links, damper operators are easily observed and accessible.

- .7 Install break-away joints of approved design on each side of fire separation.

END OF SECTION

Part 1 GENERAL

1.1 RELATED REQUIREMENTS

- .1 Section 23 05 00 - Common Work Results for HVAC.

1.2 REFERENCES

- .1 American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE).
- .1 Health Canada/Workplace Hazardous Materials Information System (WHMIS):
 - .1 Material Safety Data Sheets (MSDS).
- .2 National Fire Protection Association (NFPA)
- .3 NFPA-90A-2015, Installation of Air Condition and Ventilating Systems.
- .4 NFPA-90B-2015, Standard for the Installation of Warm Air Heating and Air-Conditioning Systems.
- .5 Sheet Metal and Air-Conditioning Contractors' National Association (SMACNA)
 - .1 SMACNA HVAC Duct Construction Standards - Metal and Flexible, 3rd Edition, 2005.
 - .2 IAQ Guideline for Occupied Buildings Under Construction, 2nd Edition, 2007.
- .6 Underwriters' Laboratories Inc. (UL)
 - .1 UL 181-2013, Factory-Made Air Ducts and Connectors.
- .7 Underwriters' Laboratories of Canada (ULC)
 - .1 CAN/ULC S110-2013, Standard Methods of Test for Air Ducts.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Make submittals in accordance with Section 01 00 10 – General Instructions.

Part 2 PRODUCTS

2.1 GENERAL

- .1 Factory fabricated to CAN/ULC-S110.
- .2 Pressure drop coefficients listed below are based on relative sheet metal duct pressure drop coefficient of 1.00.
- .3 Flame spread rating not to exceed 25. Smoke developed rating not to exceed 50.

2.2 METALLIC - UNINSULATED

- .1 Type 1: spiral wound flexible aluminum, as indicated.

FLEXIBLE DUCTS

- .2 Performance:
 - .1 Factory tested to 2.5 kPa without leakage.
 - .2 Maximum relative pressure drop coefficient: 3.

2.3 METALLIC - INSULATED

- .1 Type 2: spiral wound flexible aluminum with factory applied, 37 mm thick flexible glass fibre thermal insulation with vapour barrier and vinyl jacket, as indicated.
- .2 Performance:
 - .1 Factory tested to 2.5 kPa without leakage.
 - .2 Maximum relative pressure drop coefficient: 3.

2.4 NON-METALLIC - UNINSULATED

- .1 Type 3: non-collapsible, coated mineral base fabric type, mechanically bonded to, and helically supported by, external steel wire, as indicated.
- .2 Performance:
 - .1 Factory tested to 2.5 kPa without leakage.
 - .2 Maximum relative pressure drop coefficient: 3.

2.5 NON-METALLIC - INSULATED

- .1 Type 4: non-collapsible, coated mineral base fabric type mechanically bonded to, and helically supported by, external steel wire with factory applied, 37 mm thick flexible mineral fibre thermal insulation with vapour barrier and vinyl jacket, as indicated.
- .2 Performance:
 - .1 Factory tested to 2.5 kPa without leakage.
 - .2 Maximum relative pressure drop coefficient: 3.

2.6 METALLIC ACOUSTIC INSULATED - MEDIUM PRESSURE

- .1 Type 5: Spiral wound, flexible perforated aluminum with factory applied 37 mm thick flexible mineral fibre thermal insulation and sleeved by aluminum foil/mylar laminate vapour barrier, as indicated.
- .2 Performance:
 - .1 Factory tested to 2.5 kPa without leakage.
 - .2 Maximum relative pressure drop coefficient: 3.
 - .3 Acoustical performance: Minimum attenuation (dB/m) to following table:

FLEXIBLE DUCTS

Duct Diameter:	Frequency (Hz)				
	125	250	500	1000	2000
100	0.6	3	12	27	0
150	1.2	3	12	22	27
200	2.0	5	12	19	20
300	2.4	5	12	16	15

2.7 NON-METALLIC - ACOUSTIC INSULATED

- .1 Type 7: non-collapsible, coated mineral base perforated fabric type helically supported by and mechanically bonded to steel wire with factory applied flexible mineral fibre acoustic insulation and encased in aluminum foil/mylar laminate vapour barrier, as indicated.
- .2 Performance:
 - .1 Factory tested to 2.5 kPa without leakage.
 - .2 Maximum relative pressure drop coefficient: 3.
 - .3 Acoustical performance: Minimum attenuation (dB/m) to following table:

Duct Diameter:	Frequency (Hz)				
	125	250	500	1000	2000
100	0.6	3	12	27	0
150	1.2	3	12	22	27
200	2.0	5	12	19	20
300	2.4	5	12	16	15

Part 3 EXECUTION**3.1 DUCT INSTALLATION**

- .1 Install in accordance with: CAN/ULC-S110, UL-181, NFPA 90A, NFPA 90B and SMACNA.
- .2 Use gear drive clamps for attaching flexible ducts to equipment and fittings.
- .3 Maximum flexible duct length is to be 900 mm.

END OF SECTION

Part 1 GENERAL**1.1 RELATED REQUIREMENTS**

- .1 Section 23 05 00 - Common Work Results for HVAC.
- .2 Section 23 31 13.01 - Metal Ducts - Low Pressure to 500 PA.

1.2 REFERENCES

- .1 American Society for Testing and Materials International (ASTM)
 - .1 ASTM C177-13, Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus.
 - .2 ASTM C423-09a Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method.
 - .3 ASTM C916-14, Standard Specification for Adhesives for Duct Thermal Insulation.
 - .4 ASTM C1071-12, Standard Specification for Fibrous Glass Duct Lining Insulation (Thermal and Sound Absorbing Material).
 - .5 ASTM C1338-14, Standard Test Method for Determining Fungi Resistance of Insulation Materials and Facings.
 - .6 ASTM G21-15, Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi.
- .2 Department of Justice Canada (Jus)
 - .1 Canadian Environmental Protection Act (CEPA).
- .3 Health Canada/Workplace Hazardous Materials Information System (WHMIS):
 - .1 Material Safety Data Sheets (MSDS).
- .4 National Fire Protection Association (NFPA).
 - .1 NFPA-90A-2015, Installation of Air Condition and Ventilating Systems.
 - .2 NFPA-90B-2015, Standard for the Installation of Warm Air Heating and Air-Conditioning Systems.
- .5 North American Insulation Manufacturers Association (NAIMA)
 - .1 NAIMA AH116, Fibrous Glass Duct Construction Standards, 5th Edition, 2002.
- .6 Sheet Metal and Air Conditioning Contractor's National Association (SMACNA)
 - .1 SMACNA HVAC Duct Construction Standards - Metal and Flexible, 3rd Edition, 2005
 - .2 IAQ Guideline for Occupied Buildings Under Construction, 2nd Edition, 2007
- .7 Transport Canada (TC)
 - .1 Transportation of Dangerous Goods Act (TDGA), 1992
- .8 Underwriter's Laboratories of Canada (ULC)

DUCT LINERS

- .1 CAN/ULC S102-10, Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.

1.3 DUCT LINER

- .1 General:
 - .1 Mineral Fibre duct liner: air surface coated mat facing.
 - .2 Flame spread rating shall not exceed 25. Smoke development rating shall not exceed 50 when tested in accordance with CAN/ULC-S102, NFPA 90A and NFPA 90B.
 - .3 Recycled Content: EcoLogo certified with minimum 35% by weight recycled content.
 - .4 Fungi resistance: to ASTM C1338 and ASTM G21.
- .2 Rigid:
 - .1 Use on flat surfaces where indicated.
 - .2 25 mm thick, to ASTM C1071, Type 2, fibrous glass rigid board duct liner.
 - .3 Density: 48 kg/m³ minimum.
 - .4 Thermal resistance to be minimum 0.76 (m².degrees C)/W for 25 mm thickness, 1.15 (m².degrees C)/W for 38 mm thickness, 1.53 (m².degrees C)/W for 50 mm thickness when tested in accordance with ASTM C177, at 24 degrees C mean temperature.
 - .5 Maximum velocity on faced air side: 20.3 m/sec.
 - .6 Minimum NRC of 0.70 at 25 mm thickness based on Type A mounting to ASTM C423.
 - .7 Recycled Content: EcoLogo certified containing minimum 45% by weight recycled content.
- .3 Provide lining in following locations:
 - .1 Return air transfer ducts.
 - .2 Supply and return air ductwork as indicated.
 - .3 Exhaust air ductwork as indicated.

1.4 ADHESIVE

- .1 Adhesive: to NFPA 90A and NFPA 90B.
 - .1 Flame spread rating shall not exceed 25. Smoke development rating shall not exceed 50. Temperature range minus 29 degrees C to plus 93 degrees C.
 - .2 Water-based fire retardant type.

1.5 FASTENERS

- .1 Weld pins 2.0 mm diameter, length to suit thickness of insulation. Metal retaining clips, 32 mm square.

1.6 JOINT TAPE

- .1 Poly-Vinyl treated open weave fiberglass membrane 50 mm wide.

1.7 SEALER

- .1 Meet requirements of NFPA 90A and NFPA 90B.
- .1 Flame spread rating shall not exceed 25. Smoke development rating shall not exceed 50. Temperature range minus 68 degrees C to plus 93 degrees C.

Part 2 PRODUCTS**2.1 NOT USED**

- .1 Not Used

Part 3 EXECUTION**3.1 GENERAL**

- .1 Do work in accordance with SMACNA HVAC DCS except as specified otherwise.
- .1 Line inside of ducts where indicated.
- .2 Duct dimensions, as indicated, are clear inside duct lining.

3.2 DUCT LINER

- .1 Install in accordance with manufacturer's recommendations, and as follows:
 - .1 Fasten to interior sheet metal surface with 100% coverage of adhesive to ASTM C916.
 - .1 Exposed leading edges and transverse joints to be factory coated or coated with adhesive during fabrication.
 - .2 In addition to adhesive, install weld pins not less than 2 rows per surface and not more than 425 mm on centres, impact driven mechanical fasteners to compress duct liner sufficiently to hold it firmly in place.
 - .1 Spacing of mechanical fasteners in accordance with SMACNA HVAC DCS.
- .2 In systems, where air velocities exceeds 20.3 m/sec, install galvanized sheet metal noising to leading edges of duct liner.

3.3 JOINTS

- .1 Seal butt joints, exposed edges, weld pin and clip penetrations and damaged areas of liner with joint tape and sealer. Install joint tape in accordance with manufacturer's written recommendations, and as follows:
 - .1 Bed tape in sealer.
 - .2 Apply two coats of sealer over tape.
- .2 Replace damaged areas of liner at discretion of Departmental Representative.

- .1 Protect leading and trailing edges of duct sections with sheet metal nosing having 15 mm overlap and fastened to duct.

END OF SECTION

Part 1 GENERAL**1.1 RELATED REQUIREMENTS**

- .1 Section 23 05 00 - Common Work Results for HVAC.
- .2 Section 23 05 93 - Testing, Adjusting and Balancing for HVAC.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submittals in accordance with Section 01 00 10 – General Instructions.

1.3 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle in accordance with Section 01 00 10 – General Instructions.
- .2 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.
- .3 Packaging Waste Management: in accordance with Section 01 00 10 – General Instructions.
- .4 Store at temperatures and conditions recommended by manufacturer.

Part 2 PRODUCTS**2.1 GENERAL**

- .1 To meet capacity, pressure drop, terminal velocity, throw, noise level, neck velocity as indicated.
- .1 Frames:
 - .1 Full perimeter gaskets.
 - .2 Plaster frames where set into plaster or gypsum board.
 - .3 Concealed fasteners.
- .2 Concealed manual volume control damper operators.
- .3 Colour: Baked off-white polyester powder coat unless otherwise directed by the Departmental Representative.

2.2 MANUFACTURED UNITS

- .1 Grilles, registers and diffusers of same generic type, products of one manufacturer.

2.3 SUPPLY GRILLES AND REGISTERS

- .1 General: as identified in equipment schedules.

2.4 RETURN AND EXHAUST GRILLES AND REGISTERS

- .1 General: as identified in equipment schedules.

2.5 DIFFUSERS

- .1 General: as identified in equipment schedules.

2.6 LINEAR GRILLES

- .1 General: as identified in equipment schedules.

Part 3 EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION

- .1 Install in accordance with manufacturer's instructions.
- .1 Install with flat head or oval head screws in countersunk holes where fastenings are visible.
- .2 Fit frames tightly to prevent leakage and smudging, and to completely cover openings.
- .3 Furnish mounting frames to suit construction finish schedule, with concealed fastenings.
- .4 Install grilles plumb with building lines, in alignment where several grilles occur in line, and centrally in ceiling tiles unless otherwise indicated.
- .5 Bolt grilles, registers and diffusers, in place, in gymnasium and similar game rooms.
- .6 Adjust locations of air inlets and outlets to conform to architectural features, symmetry and lighting arrangement. Obtain approval of Departmental Representative prior to installation.

END OF SECTION

Part 1 GENERAL**1.1 RELATED REQUIREMENTS**

- .1 Section 23 05 00 - Common Work Results for HVAC.
- .1 Section 26 05 00 - Common Work Results for Electrical.

1.2 DEFINITIONS

- .1 Downtime: results whenever EMCS is unable to fulfill required functions due to malfunction of equipment defined under responsibility of EMCS Contractor. Downtime is measured by duration, in time, between time that Contractor is notified of failure and time system is restored to proper operating condition. Downtime not to include following:
 - .1 Outage of main power supply in excess of back-up power sources, provided that:
 - .1 Automatic initiation of back-up was accomplished.
 - .2 Automatic shut-down and re-start of components was as specified.
 - .2 Failure of communications link, provided that:
 - .1 Controller automatically and correctly operated in stand-alone mode.
 - .2 Failure was not due to failure of any specified EMCS equipment.
 - .3 Functional failure resulting from individual sensor inputs or output devices, provided that:
 - .1 System recorded said fault.
 - .2 Equipment defaulted to fail-safe mode.
 - .3 AEL of total of all input sensors and output devices is at least 99% during test period.

1.3 DESIGN REQUIREMENTS

- .1 Commissioning personnel to be fully aware of and qualified to interpret Design Criteria and Design Intents.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submittals in accordance with Section 23 05 00 - Common Work Results for HVAC.
- .2 Final Report: submit report to Departmental Representative.
 - .1 Include measurements, final settings and certified test results.
 - .2 Bear signature of commissioning technician and supervisor
 - .3 Report format to be approved by Departmental Representative before commissioning is started.
 - .4 Revise "as-built" documentation, commissioning reports to reflect changes, adjustments and modifications to EMCS as set during commissioning and submit to Departmental Representative.
 - .5 Recommend additional changes and/or modifications deemed advisable in order to improve performance, environmental conditions or energy consumption.

1.5 COMMISSIONING

- .1 Carry out commissioning under direction of Departmental Representative and in presence of Departmental Representative.
- .1 Correct deficiencies; re-test in presence of Departmental Representative until satisfactory performance is obtained.
- .2 Acceptance of tests will not relieve Contractor from responsibility for ensuring that complete systems meet every requirement of Contract.
- .3 Load system with project software.
- .4 Perform tests as required.

1.6 COMPLETION OF COMMISSIONING

- .1 Commissioning to be considered as satisfactorily completed when objectives of commissioning have been achieved and reviewed by Departmental Representative and PWGSC Commissioning Manager.

1.7 ISSUANCE OF FINAL CERTIFICATE OF COMPLETION

- .1 Final Certificate of Completion will not be issued until receipt of written approval indicating successful completion of specified commissioning activities including receipt of commissioning documentation.

Part 2 PRODUCTS**2.1 EQUIPMENT**

- .1 Provide sufficient instrumentation to verify and commission the installed system.
- .2 Instrumentation accuracy tolerances to be higher order of magnitude than equipment or system being tested.
- .3 Independent testing laboratory to certify test equipment as accurate to within approved tolerances no more than 2 months prior to tests.
- .4 Locations to be approved and readily accessible.

Part 3 EXECUTION**3.1 PROCEDURES**

- .1 Test each system independently and then in unison with other related systems.
- .2 Commission each system using procedures prescribed by the Departmental Representative.
- .3 Commission integrated systems using procedures prescribed by the Departmental Representative.

- .4 Debug system software.
- .5 Optimize operation and performance of systems by fine-tuning PID.
- .6 Test full scale emergency evacuation and life safety procedures including operation and integrity of smoke management systems under normal and emergency power conditions as applicable.

3.2 FIELD QUALITY CONTROL

- .1 Completion Testing.
 - .1 General: test after installation of each part of system and after completion of mechanical and electrical hook-ups, to verify correct installation and functioning.
 - .2 Include following activities:
 - .1 Test and calibrate field hardware including stand-alone capability of each controller.
 - .2 Test each DI to ensure proper settings and switching contacts.
 - .3 Test each DO to ensure proper operation and lag time.
 - .4 Test operating software.
 - .5 Test application software and provide samples of logs and commands.
 - .6 Verify each CDL including energy optimization programs.
 - .7 Debug software.
 - .8 Provide point verification list in table format including point identifier, point identifier expansion, point type and address, low and high limits and engineering units. This document will be used in final startup testing.
 - .3 Final Startup Testing: Upon satisfactory completion of tests, perform point-by-point test of entire system under direction of Departmental Representative and provide:
 - .1 2 technical personnel capable of re-calibrating field hardware and modifying software.
 - .2 Detailed daily schedule showing items to be tested and personnel available.
 - .3 Departmental Representative's acceptance signature to be on executive and applications programs.
 - .4 Commissioning to commence during final startup testing.
 - .5 O&M personnel to assist in commissioning procedures as part of training.
 - .6 Commissioning to be supervised by qualified supervisory personnel and Departmental Representative.
 - .7 Commission systems considered as life safety systems before affected parts of the facility are occupied.
 - .8 Operate systems as long as necessary to commission entire project.
 - .9 Monitor progress and keep detailed records of activities and results.
 - .4 Perform Final Operational Testing to demonstrate that EMCS functions in accordance with contract requirements.
 - .1 Prior to beginning of 30 day test demonstrate that operating parameters (setpoints, alarm limits, operating control software, sequences of operation, trends, graphics and CDL's) have been implemented to ensure proper operation and operator notification in event of off-normal operation.

- .1 Repetitive alarm conditions to be resolved to minimize reporting of nuisance conditions.
- .2 Test to last at least 30 consecutive days.
- .3 Tests to include:
 - .1 Demonstration of correct operation of monitored and controlled points.
 - .2 Operation and capabilities of sequences, reports, special control algorithms, diagnostics, software.
- .4 System will be accepted when:
 - .1 EMCS equipment operates to meet overall performance requirements. Downtime as defined in this Section must not exceed allowable time calculated for this site.
 - .2 Requirements of Contract have been met.
- .5 In event of failure to attain specified AEL during test period, extend test period on day-to-day basis until specified AEL is attained for test period.
- .6 Correct defects when they occur and before resuming tests.

3.3 ADJUSTING

- .1 Upon completion of commissioning as reviewed by Departmental Representative, set and lock devices in final position and permanently mark settings.

3.4 DEMONSTRATION

- .1 Demonstrate to Departmental Representative operation of systems including sequence of operations in regular and emergency modes, under normal and emergency conditions, start-up, shut-down interlocks and lock-outs.

END OF SECTION

Part 1 GENERAL

1.1 RELATED REQUIREMENTS

- .1 Section 23 05 00 - Common Work Results for HVAC.
- .2 Section 25 05 02 - EMCS: Submittals and Review Process.
- .3 Section 25 05 54 - EMCS: Identification.
- .4 Section 25 90 01 - EMCS: Site Requirements, Applications and System Sequences of Operation.
- .5 Section 26 05 00 - Common Work Results for Electrical.

1.2 REFERENCES

- .1 Institute of Electrical and Electronics Engineers (IEEE)
 - .1 IEEE 260.1-2004, IEEE Standard Letter Symbols for Units of Measurement (SI Customary Inch-Pound Units, and Certain Other Units).
- .2 American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE)
 - .1 ASHRAE 135-2012, BACnet - A Data Communication Protocol for Building Automation and Control Networks (ANSI Approved).
- .3 Consumer Technology Association (Formerly CEA)
 - .1 CTA 709.1-D-2014, Control Network Protocol Specification (Formerly ANSI/CEA-709.1-D).
- .4 Department of Justice Canada (Jus):
 - .1 Canadian Environmental Assessment Act (CEAA), 2012
 - .2 Canadian Environmental Protection Act (CEPA), 1999
- .5 Health Canada/Workplace Hazardous Materials Information System (WHMIS):
 - .1 Material Safety Data Sheets (MSDS)
- .6 The International Society of Automation
 - .1 ISA 5.5-1985, Graphic Symbols for Process Displays.
- .7 Transport Canada (TC):
 - .1 Transportation of Dangerous Goods Act (TDGA), 1992

1.3 ACRONYMS AND ABBREVIATIONS

- .1 Acronyms used in EMCS:
 - .1 AEL – Average Effectiveness Level.
 - .2 AI – Analog Input.
 - .3 AIT – Agreement on International Trade.

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

1.4 DEFINITIONS

- .1 Point: may be logical or physical.

- .1 Logical points: values calculated by system such as setpoints, totals, counts, derived corrections and may include, but not limited to result of and statements in CDL's.
- .2 Physical points: inputs or outputs which have hardware wired to controllers which are measuring physical properties, or providing status conditions of contacts or relays which provide interaction with related equipment (stop, start) and valve or damper actuators.
- .2 Point Name: composed of two parts, point identifier and point expansion.
 - .1 Point identifier: comprised of three descriptors, "area" descriptor, "system" descriptor and "point" descriptor, for which database to provide 25 character field for each point identifier. "System" is system that point is located on.
 - .1 Area descriptor: building or part of building where point is located.
 - .2 System descriptor: system that point is located on.
 - .3 Point descriptor: physical or logical point description. For point identifier "area", "system" and "point" will be shortforms or acronyms. Database must provide 25 character field for each point identifier.
 - .2 Point expansion: comprised of three fields, one for each descriptor. Expanded form of shortform or acronym used in "area", "system" and "point" descriptors is placed into appropriate point expansion field. Database must provide 32 character field for each point expansion.
 - .3 Bilingual systems to include additional point identifier expansion fields of equal capacity for each point name for second language.
 - .1 System to support use of numbers and readable characters including blanks, periods or underscores to enhance user readability for each of the above strings.
- .3 Point Object Type: points fall into following object types:
 - .1 AI (analog input).
 - .2 AO (analog output).
 - .3 DI (digital input).
 - .4 DO (digital output).
 - .5 Pulse inputs.
- .4 Symbols and engineering unit abbreviations utilized in displays: to ISA 5.5.
 - .1 Printouts: to IEEE 260.1.
 - .2 Refer also to Section 25 05 54 - EMCS: Identification.

1.5 SYSTEM DESCRIPTION

- .1 Refer to control schematics and specifications for system architecture.
- .2 Work covered by sections referred to above consists of fully operational EMCS, including, but not limited to, following:
 - .1 Building Controllers.
 - .2 Control devices as listed in I/O point summary tables.
 - .3 OWS(s).
 - .4 Data communications equipment necessary to effect EMCS data transmission system.
 - .5 Field control devices.

- .6 Software/Hardware complete with full documentation.
- .7 Complete operating and maintenance manuals.
- .8 Training of personnel.
- .9 Acceptance tests, technical support during commissioning, full documentation.
- .10 Wiring interface co-ordination of equipment supplied by others.
- .11 Miscellaneous work as specified in these sections and as indicated.
- .3 Design Requirements:
 - .1 Design and provide conduit and wiring linking elements of system.
 - .2 Supply sufficient programmable controllers of types to meet project requirements.
- .4 Language Operating Requirements:
 - .1 Provide English or French operator selectable access codes.
 - .2 Use non-linguistic symbols for displays on graphic terminals wherever possible. Other information to be in English and French.
 - .3 Operating system executive: provide primary hardware-to-software interface specified as part of hardware purchase with associated documentation to be in English and or French.
 - .4 System manager software: include in English and or French system definition point database, additions, deletions or modifications, control loop statements, use of high level programming languages, report generator utility and other OS utilities used for maintaining optimal operating efficiency.
 - .5 Include, in English and French:
 - .1 Input and output commands and messages from operator-initiated functions and field related changes and alarms as defined in CDL's or assigned limits (i.e. commands relating to day-to-day operating functions and not related to system modifications, additions, or logic re-definitions).
 - .2 Graphic "display" functions, point commands to turn systems on or off, manually override automatic control of specified hardware points. To be in French and English at specified OWS and to be able to operate one terminal in English and second in French. Point name expansions in both languages.
 - .3 Reporting function such as trend log, trend graphics, alarm report logs, energy report logs, maintenance generated logs.

1.6 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Make submittals in accordance with Section 01 00 10 – General Instructions and 25 05 02 - EMCS: Submittals and Review Process.
- .1 Submit for review:
 - .1 Equipment list and systems manufacturers at time of tender within 48 h after award of contract.
- .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 in accordance with Section 25 05 02 - EMCS: Submittals and Review Process. Label or listing of specified organization is acceptable evidence.
- .4 In lieu of such evidence, submit certificate from testing organization, approved by Departmental Representative, certifying that item was tested in accordance with their test methods and that item conforms to their standard/code.
- .5 For materials whose compliance with organizational standards/codes/ specifications is not regulated by organization using its own listing or label as proof of compliance, furnish certificate stating that material complies with applicable referenced standard or specification.
- .6 Permits and fees: in accordance with general conditions of contract.
- .7 Submit certificate of acceptance from Authority Having Jurisdiction to Departmental Representative.
- .8 Existing devices intended for re-use: submit test report.

1.7 QUALITY ASSURANCE

- .1 Ensure qualified supervisory personnel continuously direct and monitor Work and attend site meetings.

1.8 DESIGNATED CONTRACTOR

- .1 Hire the services of Siemens or its authorised representative to complete the work of all EMCS sections.

Part 2 PRODUCTS**2.1 MATERIALS**

- .1 There is an existing Siemens system presently installed in the building. All materials must be selected to ensure compatibility with the existing Siemens system.

2.2 ADAPTORS

- .1 Provide adaptors between metric and imperial components.

Part 3 EXECUTION**3.1 MANUFACTURER'S RECOMMENDATIONS**

- .1 Installation: to manufacturer's recommendations.

END OF SECTION

Part 1 General**1.1 RELATED SECTIONS**

- .1 Section 25 05 01 – EMCS: General Requirements.
- .2 Section 26 05 00 – Common Work Results for Electrical.
- .3 Section 25 01 11 – EMCS: Start-up, Verification and Commissioning.

1.2 DESIGN REQUIREMENTS

- .1 Preliminary Design Review: to contain following contractor and systems information.
 - .1 Description and location of installing and servicing technical staff.
 - .2 Location and qualifications of programming design and programming support staff.
 - .3 Names of sub-contractors and site-specific key personnel.
 - .4 Sketch of site-specific system architecture.
 - .5 Specification sheets for each item including memory provided, programming language, speed, type of data transmission.
 - .6 Descriptive brochures.
 - .7 Sample CDL and graphics (systems schematics).
 - .8 Response time for each type of command and report.
 - .9 Item-by-item statement of compliance.

1.3 PRELIMINARY SHOP DRAWING REVIEW

- .1 Submit preliminary shop drawings within 30 working days of award of contract and include following:
 - .1 Specification sheets for each item. To include manufacturer's descriptive literature, manufacturer's installation recommendations, specifications, drawings, diagrams, performance and characteristic curves, catalogue cuts, manufacturer's name, trade name, catalogue or model number, nameplate data, size, layout, dimensions, capacity, other data to establish compliance.
 - .2 Detailed system architecture showing all points associated with each controller including signal levels, pressures where new EMCS ties into existing control equipment.
 - .3 Spare point capacity of each controller by number and type.
 - .4 Controller locations.
 - .5 Auxiliary control cabinet locations.
 - .6 Single line diagrams showing cable routings, conduit sizes, spare conduit capacity between control centre, field controllers and systems being controlled.

1.4 DETAILED SHOP DRAWING REVIEW

- .1 Submit detailed shop drawings within 60 working days after award of contract and before start of installation and include following:
 - .1 Corrected and updated versions (hard copy only) of submissions made during preliminary review.
 - .2 Wiring diagrams.
 - .3 Piping diagrams and hook-ups.
 - .4 Interface wiring diagrams showing termination connections and signal levels [for equipment to be supplied by others].
 - .5 Shop drawings for each input/output point, sensors, transmitters, showing information associated with each particular point including:
 - .1 Sensing element type and location.
 - .2 Transmitter type and range.
 - .3 Associated field wiring schematics, schedules and terminations.
 - .4 Complete Point Name Lists.
 - .5 Setpoints, curves or graphs and alarm limits (high and low, 3 types critical, cautionary and maintenance), signal range.
 - .6 Software and programming details associated with each point.
 - .7 Manufacturer's recommended installation instructions and procedures.
 - .8 Input and output signal levels or pressures where new system ties into existing control equipment.
 - .6 Control schematics, narrative description, CDL's fully showing and describing automatic and manual procedure required to achieve proper operation of project, including under complete failure of EMCS.
 - .7 Complete system CDL's including companion English language explanations on same sheet but with different font and italics. CDL's to contain specified energy optimization programs.
 - .8 Listing and example of specified reports.
 - .9 Listing of time of day schedules.
 - .10 Mark up to-scale construction drawing to detail control room showing location of equipment and operator work space.
 - .11 Type and size of memory with statement of spare memory capacity.
 - .12 Full description of software programs provided.
 - .13 Sample of "Operating Instructions Manual" to be used for training purposes.
 - .14 Outline of proposed start-up and verification procedures. Refer to Section 25 01 11 – EMCS: Start-up, Verification and Commissioning.

Part 2 Products**2.1 NOT USED**

- .1 Not Used.

Part 3 **Execution**

3.1 **NOT USED**

 .1 Not Used.

END OF SECTION

Part 1 GENERAL

1.1 RELATED REQUIREMENTS

- .1 Section 22 05 00 - Common Work Results for Plumbing.
- .2 Section 23 05 00 - Common Work Results for HVAC.
- .1 Section 26 05 00 - Common Work Results for Electrical.

1.2 REFERENCES

- .1 Canadian Standards Association (CSA International)
 - .1 CSA C22.1-15, Canadian Electrical Code, Part 1 (23rd Edition), Safety Standard for Electrical Installations.

Part 2 PRODUCTS

2.1 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 Sizes: 25 x 67 mm minimum.
- .3 Lettering: minimum 7 mm high, black.
- .4 Inscriptions: machine engraved to identify function.

2.2 NAMEPLATES FOR FIELD DEVICES

- .1 Identify by plastic encased cards attached by chain.
- .2 Sizes: 50 x 100 mm minimum.
- .3 Lettering: minimum 5 mm high produced from laser printer in black.
- .4 Data to include: point name and point address.
- .5 Companion cabinet: identify interior components using plastic enclosed cards with point name and point address.

2.3 NAMEPLATES FOR ROOM SENSORS

- .1 Identify by stick-on labels using point identifier.
- .2 Location: as directed by Departmental Representative.
- .3 Letter size: to suit, clearly legible.

2.4 WARNING SIGNS

- .1 Equipment including motors, starters under remote automatic control: supply and install orange coloured signs warning of automatic starting under control of EMCS.
- .1 Sign to read: "Caution: This equipment is under automatic remote control of EMCS" as reviewed by Departmental Representative's.

2.5 WIRING

- .1 Supply and install numbered tape markings on wiring at panels, junction boxes, splitters, cabinets and outlet boxes.
- .1 Colour coding: to CSA C22.1. Use colour coded wiring in communications cables, matched throughout system.
- .2 Power wiring: identify circuit breaker panel/circuit breaker number inside each EMCS panel.

2.6 PNEUMATIC TUBING

- .1 Numbered tape markings on tubing to provide uninterrupted tracing capability.

2.7 CONDUIT

- .1 Colour code EMCS conduit.
- .2 Pre-paint box covers and conduit fittings.

Part 3 EXECUTION

3.1 NAMEPLATES AND LABELS

- .1 Ensure that manufacturer's nameplates, CSA labels and identification nameplates are visible and legible at all times.

3.2 EXISTING PANELS

- .1 Correct existing nameplates and legends to reflect changes made during Work.

END OF SECTION

Part 1 GENERAL

1.1 RELATED REQUIREMENTS

- .1 Section 23 05 00 - Common Work Results for HVAC.
- .2 Section 25 01 11 - EMCS: Start-Up, Verification and Commissioning.
- .3 Section 25 05 01 - EMCS: General Requirements.
- .4 Section 25 05 54 - EMCS: Identification.
- .5 Section 25 90 01 - EMCS: Site Requirements Applications and Systems Sequences of Operation.
- .6 Section 26 05 00 - Common Work Results for Electrical.
- .7 Section 26 27 26 - Wiring Devices.

1.2 SEQUENCE OF OPERATION

- .1 Transfer/Exhaust Fans
 - .1 New transfer and exhaust fans to operate based on occupancy schedule. Fans to be on during occupied periods and are to be off during unoccupied periods.
 - .2 Fan on/off status are to be monitored through EMCS system.

Part 2 PRODUCTS

2.1 NOT USED

Part 3 EXECUTION

3.1 NOT USED

END OF SECTION

Part 1 General**1.1 REFERENCES**

- .1 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.
- .2 Reference Standards:
 - .1 CSA Group
 - .1 CSA C22.1-15, Canadian Electrical Code, Part 1 (26th Edition), Safety Standard for Electrical Installations.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets and include product characteristics, performance criteria, physical size, finish and limitations.
- .2 Shop drawings:
 - .1 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.
 - .2 Identify on wiring diagrams circuit terminals and indicate internal wiring for each item of equipment and interconnection between each item of equipment.
 - .3 Indicate of drawings clearances for operation, maintenance, and replacement of operating equipment devices.
 - .4 If changes are required, notify Departmental Representative of these changes before they are made.
- .3 Certificates:
 - .1 Provide CSA certified equipment or material.
 - .2 Where CSA certified equipment or material are not available, submit such equipment or material to authority having jurisdiction for special 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.
- .4 Manufacturer's Field Reports: submit to Departmental Representative manufacturer's written report, within 3 days of review, verifying compliance of Work and electrical system and instrumentation testing.

1.3 CLOSEOUT SUBMITTALS

- .1 Operation and Maintenance Data: submit operation and maintenance data for incorporation into manual. Four (4) hard copies and one (1) electronic copy (PDF) of the manual to be submitted to the Departmental Representative.
- .2 Provide in French (if available; if not available, the manufacturer is required to state that) and English for incorporation into manual:
 - .1 Provide for each system and principal item of equipment as specified in technical sections for use by operation and maintenance personnel.
 - .2 Operating instructions to include following:
 - .1 Wiring diagrams, control diagrams, and control sequence for each principal system and item of equipment.
 - .2 Start up, proper adjustment, operating, lubrication, and shutdown procedures.
 - .3 Safety precautions.
 - .4 Procedures to be followed in event of equipment failure.
 - .5 Other items of instruction as recommended by manufacturer of each system or item of equipment.
 - .3 Print or engrave operating instructions and frame under glass or in approved laminated plastic.
 - .4 Post instructions where directed.
 - .5 For operating instructions exposed to weather, provide weather-resistant materials or weatherproof enclosures.
 - .6 Ensure operating instructions will not fade when exposed to sunlight and are secured to prevent easy removal or peeling.
- .3 Provide updated building single line diagrams upon project completion in both the main electrical room and generator room.
 - .1 Two (2) updated single line diagrams printed in standard ISO A1 size shall be framed and protected behind framed plexiglass shall be provided to the Departmental Representative.
 - .2 Existing single line diagram CAD file shall be provided by the Departmental Representative.

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 from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.

- .4 Packaging Waste Management: remove for reuse and return of pallets, crates, padding, packaging materials.

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 and labels for control items in English and French.
- .4 Use one nameplate or label for each language.

2.2 MATERIALS AND EQUIPMENT

- .1 Material and equipment to be CSA certified. Where CSA certified material or equipment are not available, obtain special approval from authority having jurisdiction before delivery to site and submit such approval.
- .2 Factory assemble control panels and component assemblies.
- .3 All new equipment in sprinklered areas shall be sprinkler-proof. Contractor shall review the site for sprinkler locations, prior to ordering materials.

2.3 ELECTRIC MOTORS, EQUIPMENT AND CONTROLS

- .1 Verify installation and co-ordination responsibilities related to motors, equipment and controls.

2.4 WARNING SIGNS

- .1 Warning Signs: in accordance with requirements of authority having jurisdiction and Departmental Representative.
- .2 Decal 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 and labels as follows:
 - .1 Nameplates: lamacoid 3 mm melamine, black face, white core, lettering accurately aligned and engraved into core mechanically attached with self tapping screws.
 - .2 Sizes as follows:

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

- .2 Labels: embossed plastic labels with 6 mm high letters unless specified otherwise.
- .3 Wording on nameplates and labels to be approved by Departmental Representative prior to manufacture.
- .4 Allow for minimum of twenty-five (25) letters per nameplate or label.
- .5 Nameplates for terminal cabinets and junction boxes to indicate system and/or voltage characteristics.
- .6 Identify equipment as directed by 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, coloured plastic tapes, on both ends of phase conductors of feeders and branch circuit wiring.
- .2 Maintain phase sequence and colour coding throughout.
- .3 Colour coding: to CSA C22.1.
- .4 Use colour coded wires in communication cables, matched throughout system.

2.8 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.

Prime	Auxiliary	
up to 600 V	Yellow	Green
Telephone	Green	
Other Communication Systems	Green	Blue
Fire Alarm	Red	
Emergency Voice	Red	Blue
Other Security Systems	Red	Yellow

Part 3 Execution**3.1 EXAMINATION****3.2 INSTALLATION**

- .1 Do complete installation in accordance with CSA C22.1 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 Sleeves through concrete: plastic, sized for free passage of conduit, and protruding 53 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 Do not install outlets back-to-back in wall; allow minimum 150 mm horizontal clearance between boxes.
- .2 Change location of outlets at no extra cost or credit, providing distance does not exceed 3000 mm, and information is given before installation.

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 Wall receptacles:
 - .1 General: 300 mm.
 - .2 In mechanical rooms: to be coordinated with Departmental Representative.
 - .2 Panelboards: as required by Code or as indicated.
 - .3 Telephone and interphone outlets: 300 mm.

3.7 COORDINATION OF PROTECTIVE DEVICES

- .1 Ensure circuit protective devices such as overcurrent trips, relays and fuses are installed to required values and settings.
- .2 Existing coordination study for the building shall be provided.

3.8 FIELD QUALITY CONTROL

- .1 Load Balance:
 - .1 Measure phase current to panelboards with normal loads (lighting) 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 3% 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 panelboards, 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:
 - .1 Power distribution system including phasing, voltage, grounding and load balancing.
 - .2 Circuits originating from branch distribution panels.
 - .3 Lighting and its control.
 - .4 Systems: fire alarm and communications.
 - .5 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 1000 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 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.

3.9 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 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment.
- .3 Waste Management: separate waste materials for reuse and recycling.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

Part 1 General**1.1 REFERENCES**

- .1 CSA International
 - .1 CAN/CSA-C22.2 No.18, Outlet Boxes, Conduit Boxes and Fittings.
 - .2 CAN/CSA-C22.2 No.65, Wire Connectors (Tri-National Standard with UL 486A-486B and NMX-J-543-ANCE-03).
- .2 National Electrical Manufacturers Association (NEMA)

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 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 CLOSEOUT SUBMITTALS

- .1 Operation and Maintenance Data: submit operation and maintenance data for wire and box connectors for incorporation into manual.
- .2 Provide in French (if available; if not available, the manufacturer is required to state that) and English for incorporation into 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 in dry location 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 and return of pallets, crates, padding, packaging materials.

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 to consist of:
 - .1 Connector body and stud clamp for stranded and round copper conductors.
 - .2 Clamp for round copper conductors.
 - .3 Stud clamp bolts.
 - .4 Bolts for copper conductors.
 - .5 Sized for conductors as indicated.
- .4 Clamps or connectors for TECK cable as required to: CAN/CSA-C22.2 No.18.

Part 3 Execution**3.1 INSTALLATION**

- .1 Remove insulation carefully from ends of conductors cables and:
 - .1 Install mechanical pressure type connectors and tighten screws with appropriate compression tool recommended by manufacturer. Installation shall meet secureness tests in accordance with 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 NEMA.

3.2 CLEANING

- .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment.
- .3 Waste Management: separate waste materials for reuse and recycling.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

Part 1 General**1.1 DELIVERY, STORAGE AND HANDLING**

- .1 Packaging Waste Management: remove for reuse and return of pallets, crates, padding, packaging materials.

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 600V insulation of cross-linked thermosetting polyethylene material rated RW90 XLPE, Jacketed.
- .3 Neutral supported cable: One neutral conductor of Copper steel reinforced, size as indicated. Type: NS90 Insulation: Type NSF-2 flame retardant rated 600 V.

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.
- .3 Insulation:
 - .1 Cross-linked polyethylene XLPE.
 - .2 Rating: 600V.
- .4 Inner jacket: polyvinyl chloride material.
- .5 Armour: interlocking.
- .6 Overall covering: thermoplastic polyvinyl chloride, compliant to applicable Building Code classification for this project.
- .7 Fastenings:
 - .1 One hole steel straps to secure surface cables 53 mm and smaller. Two hole steel straps for cables larger than 53 mm.
 - .2 Channel type supports for two or more cables at 2m centers.
 - .3 Threaded rods: 6 mm diameter to support suspended channels.
- .8 Connectors:
 - .1 Approved for TECK cable.

2.3 MINERAL-INSULATED CABLES

- .1 Conductors: solid bare soft-annealed copper, size as indicated.
- .2 Insulation: compressed powdered magnesium oxide or silicon dioxide to form compact homogeneous mass throughout entire length of cable.
- .3 Outer covering: annealed seamless copper sheath, Type M1 rated 600 V, 250 degrees C.
- .4 Overall jacket: none.
- .5 Two hour fire rating.
- .6 Connectors: field installed approved for MI cable.
- .7 Termination kits: field installed approved for MI cable

2.4 CONTROL CABLES

- .1 Type: LVT: 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: stranded annealed copper conductors sized as indicated
LVT: soft annealed copper conductors, sized as indicated:
 - .1 Insulation: polyethylene.
 - .2 Shielding: wire braid over each conductor.
 - .3 Overall covering: polyethylene jackets.

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 tests before energizing electrical system.

3.2 GENERAL CABLE INSTALLATION

- .1 Terminate cables in accordance with Section 26 05 20 - Wire and Box Connectors - (0-1000 V).
- .2 Cable Colour Coding: to Section 26 05 00 - Common Work Results for Electrical.
- .3 Conductor length for parallel feeders to be identical.
- .4 Lace or clip groups of feeder cables at distribution centres, pull boxes, and termination points.
- .5 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.
- .6 Branch circuit wiring for surge suppression receptacles and permanently wired computer and electronic equipment to be 2-wire circuits only, i.e. common neutrals not permitted.

- .7 Provide numbered wire collars for control wiring. Numbers to correspond to control shop drawing legend. Obtain wiring diagram for control wiring.

3.3 INSTALLATION OF BUILDING WIRES

- .1 Install wiring as follows:
 - .1 In conduit systems in accordance with Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings.

3.4 INSTALLATION OF TECK90 CABLE (0 -1000 V)

- .1 Group cables wherever possible on channels.
- .2 Install cable exposed, securely supported by straps and hangers.

3.5 INSTALLATION OF MINERAL-INSULATED CABLES

- .1 Install cable exposed, securely supported by straps and hangers.
- .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 Do not splice cables unless indicated.

3.6 INSTALLATION OF CONTROL CABLES

- .1 Install control cables in conduit.
- .2 Ground control cable shield.

END OF SECTION

Part 1 General**1.1 REFERENCES**

- .1 CSA Group
 - .1 CSA C22.1, Canadian Electrical Code, Part 1 (26th Edition), Safety Standard for Electrical Installations.
 - .2 CSA C22.2 No.41, Grounding and Bonding Equipment (Tri-National Standard, with NMX-J-590ANCE and UL 467).
 - .3 CSA C22.2 No.65, Wire connectors (Tri-National Standard, with UL 486A-486B NMX-J-543-ANCE).

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for connectors and terminations and include product characteristics, performance criteria, physical size, finish and limitations.

1.3 CLOSEOUT SUBMITTALS

- .1 Operation and Maintenance Data: submit operation and maintenance data for connectors and terminations for incorporation into manual.
- .2 Provide in French (if available; if not available, the manufacturer is required to state that) and English for incorporation into 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 in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect connectors and terminations from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.
- .4 Packaging Waste Management: remove for reuse and return of pallets, crates, padding, packaging materials.

CONNECTORS AND TERMINATIONS

Part 2 Products

2.1 CONNECTORS AND TERMINATIONS

- .1 Copper long barrel compression connectors to CSA C22.2 No.65 as required sized for conductors.
- .2 Contact aid for aluminum cables where applicable.
- .3 Joint boxes dry location type.

Part 3 Execution

3.1 INSTALLATION

- .1 Bond and ground as required to CSA C22.2No.41.

3.2 CLEANING

- .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment.
- .3 Waste Management: separate waste materials for reuse and recycling.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

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

- .1 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for grounding equipment and include product characteristics, performance criteria, physical size, finish and limitations.

1.2 CLOSEOUT SUBMITTALS

- .1 Operation and Maintenance Data: submit operation and maintenance data for grounding equipment for incorporation into manual.
- .2 Provide in French (if available; if not available, the manufacturer is required to state that) and English for incorporation into manual.

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 off ground indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect grounding equipment from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.
- .4 Packaging Waste Management: remove for reuse and return of pallets, crates, padding, packaging materials.

Part 2 Products**2.1 EQUIPMENT**

- .1 Grounding conductors: bare stranded copper, soft annealed, size as required by code.
- .2 Insulated grounding conductors: green, copper conductors, size as required by code.
- .3 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 INSTALLATION GENERAL

- .1 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 Soldered joints not permitted.
- .5 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.
- .6 Connect building structural steel and metal siding to ground.

3.2 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.

3.3 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 Department Representative and local authority having jurisdiction over installation.
- .3 Perform tests before energizing electrical system.
- .4 Disconnect ground fault indicator during tests.

3.4 CLEANING

- .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment.
- .3 Waste Management: separate waste materials for reuse and recycling in accordance.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

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

- .1 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for hangers and supports and include product characteristics, performance criteria, physical size, finish and limitations.

1.2 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 hangers and supports from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.
- .4 Packaging Waste Management: remove for reuse and return of pallets, crates, padding, packaging materials.

Part 2 Products**2.1 SUPPORT CHANNELS**

- .1 U shape, size 41 x 41 mm, 2.5 mm thick, surface mounted suspended.

Part 3 Execution**3.1 INSTALLATION**

- .1 Secure equipment to solid masonry, tile and plaster surfaces with lead anchors.
- .2 Secure equipment to poured concrete with expandable inserts.
- .3 Support equipment, conduit or cables using clips, spring loaded bolts, cable clamps designed as accessories to basic channel members.
- .4 Fasten exposed conduit or cables to building construction or support system using straps.
 - .1 One-hole steel straps to secure surface conduits and cables 53 mm and smaller.
 - .2 Two-hole steel straps for conduits and cables larger than 53 mm.
 - .3 Beam clamps to secure conduit to exposed steel work.

- .5 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 channels supported by 6 mm diameter threaded rod hangers where direct fastening to building construction is impractical.
- .6 For surface mounting of two or more conduits use channels at 2 m on centre spacing.
- .7 Provide metal brackets, frames, hangers, clamps and related types of support structures where indicated or as required to support conduit and cable runs.
- .8 Ensure adequate support for raceways and cables dropped vertically to equipment where there is no wall support.
- .9 Do not use wire lashing or perforated strap to support or secure raceways or cables.
- .10 Do not use supports or equipment installed for other trades for conduit or cable support except with permission of other trade and approval of Departmental Representative.
- .11 Install fastenings and supports as required for each type of equipment cables and conduits, and in accordance with manufacturer's installation recommendations.

3.2 CLEANING

- .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment.
- .3 Waste Management: separate waste materials for reuse and recycling.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 Canadian Standards Association (CSA International)
 - .1 CSA C22.1-15, Canadian Electrical Code, Part 1, 26th Edition.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Product Data:
 - .1 Provide manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.

1.3 DELIVERY, STORAGE AND HANDLING

- .1 Waste Management and Disposal:
 - .1 Separate waste materials for reuse and recycling.

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: main and branch lugs to match required size and number of incoming and outgoing conductors as indicated.
- .3 Spare Terminals: minimum three spare terminals or lugs on each connection or lug block.

2.2 JUNCTION AND PULL BOXES

- .1 Construction: welded steel enclosure.
- .2 Covers Flush Mounted: 25 mm minimum extension all around.
- .3 Covers Surface Mounted: screw-on covers.

2.3 CABINETS

- .1 Construction: welded sheet steel hinged door, handle, latch, lock 2 keys and catch
- .2 Type T Terminal: flush overlapping sides mounting containing sheet steel, 19 mm G1S plywood backboard. Plywood to be fire retardant.

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 Mount cabinets with top not higher than 2 m above finished floor except where indicated otherwise.
- .3 Install terminal block as required in Type T cabinets.
- .4 Only main junction and pull boxes are indicated. Install additional pull boxes as required by CSA C22.1.

3.3 IDENTIFICATION

- .1 Equipment Identification: to Section 26 05 00 - Common Work Results for Electrical.
- .2 Identification Labels: size 2 indicating system name, voltage and phase.

END OF SECTION

Part 1 General**1.1 REFERENCES**

- .1 Canadian Standards Association (CSA International)
 - .1 CSA C22.1-15, Canadian Electrical Code, Part 1, 23rd Edition.

1.2 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with manufacturer's recommendations.
- .2 Waste Management and Disposal:
 - .1 Separate waste materials for reuse and recycling.

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 Combination boxes with barriers where outlets for more than one system are grouped.

2.2 GALVANIZED STEEL OUTLET BOXES

- .1 One-piece electro-galvanized construction.
- .2 Utility boxes for outlets connected to surface-mounted EMT conduit, minimum size 102 x 54 x 48 mm.

2.3 CONDUIT BOXES

- .1 Cast FD boxes with factory-threaded hubs and mounting feet for surface wiring of devices.

2.4 FITTINGS - GENERAL

- .1 Bushing and connectors with nylon insulated throats.
- .2 Knock-out fillers to prevent entry of debris.
- .3 Conduit outlet bodies for conduit up to 35mm 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 Provide correct size of openings in boxes for conduit, mineral insulated and armoured cable connections. Do not install reducing washers.
- .4 Vacuum clean interior of outlet boxes before installation of wiring devices.
- .5 Identify systems for outlet boxes as required.

END OF SECTION

Part 1 General**1.1 REFERENCES**

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

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Product data: submit manufacturer's printed product literature, specifications and datasheets.
 - .1 Submit cable manufacturing data.
- .2 Quality assurance submittals:
 - .1 Test reports: submit certified test reports.
 - .2 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
 - .3 Instructions: submit manufacturer's installation instructions.

1.3 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate waste materials for reuse and recycling.
- .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.

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.

2.2 CONDUITS

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

2.3 CONDUIT FASTENINGS

- .1 One hole steel straps to secure surface conduits 53 mm and smaller.
 - .1 Two hole steel straps for conduits larger than 53 mm.
- .2 Beam clamps to secure conduits to exposed steel work.
- .3 Channel type supports for two or more conduits at 2 m on centre.
- .4 Threaded rods, 6 mm diameter, to support suspended channels.

2.4 CONDUIT FITTINGS

- .1 Fittings: manufactured for use with conduit specified. Coating: same as conduit.
- .2 Ensure factory "ells" where 90 degrees bends for 27 mm and larger conduits.

2.5 FISH CORD

- .1 Polypropylene

Part 3 Execution**3.1 MANUFACTURER'S INSTRUCTIONS**

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

3.2 INSTALLATION

- .1 Install conduits to conserve headroom in exposed locations and cause minimum interference in spaces through which they pass.
- .2 Surface mount conduits.
- .3 Use electrical metallic tubing (EMT) for interior installations.
- .4 Use rigid PVC conduit for exterior installations.
- .5 Use flexible metal conduit for connection to motors in dry areas.
- .6 Use liquid tight flexible metal conduit for connection to motors or vibrating equipment in damp, wet or corrosive locations.
- .7 Minimum conduit size for lighting and power circuits: 21 mm.
- .8 Bend conduit cold:
 - .1 Replace conduit if kinked or flattened more than 1/10th of its original diameter.
- .9 Mechanically bend steel conduit over 21 mm diameter.
- .10 Field threads on rigid conduit must be of sufficient length to draw conduits up tight.
- .11 Install fish cord in empty conduits.
- .12 Remove and replace blocked conduit sections.

- .1 Do not use liquids to clean out conduits.
- .13 Dry conduits out before installing wire.

3.3 SURFACE CONDUITS

- .1 Run parallel or perpendicular to building lines.
- .2 Locate conduits behind infrared or gas fired heaters with 1.5 m clearance.
- .3 Run conduits in flanged portion of structural steel.
- .4 Group conduits wherever possible on suspended 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 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

1 GENERAL**1.01 SUBMITTALS**

- .1 Submit shop drawings of products specified in this Section.
- .2 Submit copies of documents requested herein, testing reports, certificate of approvals, and commissioning sheets.

2 PRODUCTS**2.01 VIBRATION CONTROL AND SEISMIC RESTRAINT**

- .1 Electrical equipment installation is to meet local governing authority having jurisdiction and code seismic requirements and additional requirements for vibration isolation.
- .2 Provide labour, materials, and equipment required and necessary to seismically restrain electrical equipment and equipment bases including concrete pads, and guarantee function of materials and equipment supplied.
- .3 Make electrical connections to vibration-isolated equipment with flexible conduit or other flexible means acceptable to Department Representative and local governing authority having jurisdiction so as not to restrict maximum anticipated movement of equipment under seismic excitation movement.
- .4 In event that inadequate isolation is provided by isolation product manufacturer's isolation package, be responsible for improving isolation to an acceptable standard at no additional cost to contract. Isolation product manufacturer's seismic restraint engineer to verify that seismic restraints and combination isolator/restraints intended for use on project are fit for intended purpose. Be responsible for ensuring that manufacturer's seismic restraints are in compliance with applicable local building code requirements for Place of Work.
- .5 Provide additional seismic requirements for suspended electrical raceways, luminaires, and other equipment as per governing local authority requirements and requirements of current codes and by-laws.

2.02 SEISMIC RESTRAINTS FOR CONTAINERIZED GENSETS

- .1 Electrical equipment installed inside containerized genset enclosure to comply with local governing authority and code seismic requirements and additional requirements outlined herein.
- .2 Supply labour, materials, and equipment required and necessary to seismically restrain electrical equipment and guarantee function of materials and equipment supplied.
- .3 Make electrical connections to vibration-isolated equipment with flexible conduit or other flexible means acceptable to Department Representative so as not to restrict maximum anticipated movement of equipment under seismic excitation movement.

- .4 Provide seismic restraining devices to restrain mechanical, electrical, and related equipment, and equipment bases including concrete pads, as per governing local authority requirements and requirements of current codes and by-laws.
- .5 In event that inadequate isolation is provided by isolation product manufacturer's isolation package, genset vendor to be responsible for improving isolation to an acceptable standard at no additional cost to contract. Isolation product manufacturer's seismic restraint engineer to verify that seismic restraints and combination isolator/restraints intended for use on project are fit for intended purpose. Be responsible for ensuring that manufacturer's seismic restraints are in compliance with applicable local governing building code requirements for Place of Work.
- .6 Include for manufacturer of vibration control products, to develop/design a seismic restraint system and perform seismic calculations in accordance with latest requirements enforced by local governing building code, requirements of local governing authority having jurisdiction, and additional requirements specified in this article. Design of seismic restraints to include requirements to withstand forces of site classification rating and importance category level as per local governing building code requirements.
- .7 Submit for review by Department Representative, seismic design drawings and product shop drawings with calculations approved and sealed by a Professional Engineer licensed and registered in Place of Work and experienced in such Work. Be responsible for costs for services of this Professional Engineer. Shop drawings to identify equipment type, manufacturer's name, model number, and weight of equipment to be restrained.
- .8 Shop drawings to additionally include placement drawings for electrical equipment and equipment assemblies including runs of cable trays and conduit/cable racks showing methods of attachment to particular structure for each piece of equipment and assembly and provide anchorage/attachment details. Submit samples of materials required to complete seismic restraint work for review if and when required. Include for Professional Engineer to inspect same on site (note that multiple inspections to be required as work progresses) and to provide typewritten Inspection Reports to Department Representative throughout construction and to provide "Letters of Assurance and Conformance" with specified Codes, Standards and Bylaws. Additionally, include copies of documents in Operating and Maintenance Manuals.
- .9 Following electrical equipment require seismic protection:
 - .1 dry type distribution transformers;
 - .2 switchboards/switchgear;
 - .3 panelboards;
 - .4 engine/generator and associated components/accessories installed within enclosure, such as exhaust system and fuel system;
 - .5 generator control panel;
 - .6 fire alarm system, cabinets and devices;
 - .7 luminaires;

- .8 conduit and duct banks.
- .10 Neoprene Isolators:
 - .1 Neoprene isolators to be bridge bearing rated type manufactured from bridge bearing quality neoprene, CAN/CSA-S6-88 Section 11.5.8.
 - .2 Where a ribbed pad is used, height of ribs is not to exceed 0.7 times width of rib. A steel layer to be used to distribute load in a multi-layered unit.
 - .3 Select neoprene pads or elements at supplier's optimum recommended loading and do not load beyond limit specified in neoprene manufacturer's literature.
 - .4 Test neoprene isolators to ASTM specifications. Submit to Department Representative, following test data to verify performance of neoprene isolators:
 - .1 a data sheet listing ASTM test results;
 - .2 load deflection curves for isolator indicating deflection to full compression for both laterally restrained and unrestrained isolators.
- .11 Open Steel Spring Isolators:
 - .1 Springs to be "Iso-Stiff" type with spring coefficient from 1.0 to 1.5.
 - .2 Spring mounts to be complete with levelling devices, minimum 6 mm (1/4") thick neoprene sound pads.
- .12 Seismic restraints to restrain equipment in all directions and to be sized to meet appropriate Sp factor defined in Table 4.1.9.D of current National Building Code and Commentary J of Supplement to current Code. Calculations bearing seal of a qualified Professional Engineer to be submitted with shop drawings to justify stated seismic restraint requirements.
- .13 Attachment points and fasteners to be capable of withstanding a load of 3 times sized capacity of restraint. Equipment suppliers to provide proof of conformance with this clause by means of shop drawings certified by a qualified Professional Engineer.
- .14 Submit test data to Department Representative, showing load deflection curves up to 1.5 times rated capacity of restraint, and certifying that neither neoprene elements nor restraint body sustained any deformation after release of load.
- .15 Adjust restraints to have clearances between 3mm and 6mm (1/8" – 1/4") under normal operating conditions of equipment.

2.03 VIBRATION CONTROL AND SEISMIC RESTRAINT

- .1 Electrical equipment installation is to meet local governing authority having jurisdiction and code seismic requirements and additional requirements outlined herein.

- .2 Provide labour, materials, and equipment required and necessary to seismically restrain electrical equipment and equipment bases including concrete pads, and guarantee function of materials and equipment supplied.
- .3 Make electrical connections to vibration-isolated equipment with flexible conduit or other flexible means acceptable to Department Representative and local governing authority having jurisdiction so as not to restrict maximum anticipated movement of equipment under seismic excitation movement.
- .4 In event that inadequate isolation is provided by isolation product manufacturer's isolation package, be responsible for improving isolation to an acceptable standard at no additional cost to contract. Isolation product manufacturer's seismic restraint engineer to verify that seismic restraints and combination isolator/restraints intended for use on project are fit for intended purpose. Be responsible for ensuring that manufacturer's seismic restraints are in compliance with applicable local building code requirements for Place of Work.
- .5 Provide additional seismic requirements for suspended electrical raceways, luminaires, and other equipment as per governing local authority requirements and requirements of current codes and by-laws.
- .6 Include for manufacturer of vibration control products, to develop/design a seismic restraint system and perform seismic calculations in accordance with latest requirements enforced by local governing building code, requirements of local governing authority having jurisdiction, and additional requirements specified in this article. Design of seismic restraints to include provisions to withstand forces of site classification rating and importance category level as per governing building code requirements.
- .7 Submit for Department Representative's review, seismic design drawings and product shop drawings with calculations approved and sealed by a Professional Engineer licensed and registered in Place of Work and experienced in such Work. Be responsible for costs for services of this Professional Engineer. Shop drawings to identify equipment type, manufacturer's name, model number and weight of equipment to be restrained.
- .8 Shop drawings to additionally include placement drawings for electrical equipment and equipment assemblies including runs of cable trays and conduit/cable racks showing methods of attachment to particular structure for each piece of equipment and assembly and provide anchorage/attachment details. Submit samples of materials required to complete seismic restraint work for review if and when required. Include for Professional Engineer to inspect same on site (note that multiple inspections to be required as work progresses) and to provide typewritten Inspection Reports to Department Representative throughout construction and to provide "Letters of Assurance and Conformance" with specified Codes, Standards and Bylaws. Additionally, include copies of documents in Operating and Maintenance Manuals.
- .9 Use of manufacturer's isolation package is acceptable providing it meets requirements of this Specification.
- .10 Provide vibration isolation for equipment or parts connected rigidly to isolated equipment.

- .11 Provide vibration isolation for transformers by means of bridge bearing neoprene isolators or open steel spring isolators. Static deflection of vibration isolators for electrical transformers is indicated below. Isolators requiring a static deflection greater than 13 mm (1/2") to be open spring isolators unless otherwise specified.

POWER RANGE (kVA)	ON GRADE (Isolated Slab)	LOCATION ON GRADE (Continuous Slab)	UPPER Floor (Suspended Slab)
Under 10	6mm	6mm	18mm
10 - 100	6mm	12mm	25mm
Over 100	6mm	25mm	38mm

- .12 Standard vibration isolation requirements of equipment such as gensets, power transformers and distribution equipment, to comply with following:
- .1 choose equipment isolation mounts on basis of achieving 98% vibration isolation efficiency at lowest operating speed. Natural frequency of each vibration isolation system to be at least 1/10 of lowest excitation frequency of rotating machinery, whenever practicable, but in no case less than 1/7. Where structural floor deflection exceeds 1/10 of determined static deflection of isolator, increase isolator static deflection to maintain this minimum ratio of floor to isolator deflection. Where static deflections are shown on drawings, Specifications, or schedules, they are to be used as a guide only. Actual isolators are to achieve required static deflection under load, with at least 50% reserve deflection;
 - .2 submit shop drawings identifying equipment, lowest operating speed, weight, brand, type and location of isolators prior to ordering or fabrication.
- .13 Following typical electrical equipment require seismic protection (where applicable to Project):
- .1 transformers;
 - .2 switchboards/switchgear;
 - .3 panelboards;
 - .4 engine/generator and generator control panel;
 - .5 automatic transfer switch;
 - .6 fire alarm system, cabinets and devices;
 - .7 luminaires;
 - .8 mobile generator connection box;
 - .9 conduit and duct banks;
 - .10 genset control system and cabinet;

- .11 other electrical equipment, as required.
- .14 Neoprene Isolators:
 - .1 Neoprene isolators to be bridge bearing rated type manufactured from bridge bearing quality neoprene, CAN/CSA-S6-88 Section 11.5.8.
 - .2 Where a ribbed pad is used, height of ribs is not to exceed 0.7 times width of rib. A steel layer to be used to distribute load in a multi-layered unit.
 - .3 Select neoprene pads or elements at supplier's optimum recommended loading and do not load beyond limit specified in neoprene manufacturer's literature.
 - .4 Test neoprene isolators to ASTM specifications. Submit to Department Representative, following test data to verify performance of neoprene isolators:
 - .1 A data sheet listing all of ASTM test results.
 - .2 Load deflection curves for isolator indicating deflection to full compression for both laterally restrained and unrestrained isolators.
- .15 Open Steel Spring Isolators:
 - .1 Springs to be "Iso-Stiff" (spring coefficient 1.0 to 1.5) with a working deflection between 0.3 and 0.6 of solid deflection.
 - .2 Spring mounts to be complete with levelling devices, minimum 6mm (1/4") thick neoprene sound pads, and zinc chromate plated hardware.
 - .3 Sound pads to be sized for a minimum deflection of 1.2 mm (0.0472") and meet requirements for neoprene isolators.
- .16 Seismic restraints to restrain equipment in all directions and to be sized to meet appropriate Sp factor defined in Table 4.1.9.D of current National Building Code and Commentary J of Supplement to current Code. Calculations bearing seal of a qualified Professional Engineer to be submitted with shop drawings to justify stated seismic restraint requirements.
- .17 Attachment points and fasteners to be capable of withstanding a load of 3 times sized capacity of restraint. Equipment suppliers to provide proof of conformance with this clause by means of shop drawings certified by a qualified Professional Engineer.
- .18 Submit test data to Department Representative, showing load deflection curves up to 1.5 times rated capacity of restraint, and certifying that neither neoprene elements nor restraint body sustained any deformation after release of load.
- .19 Adjust restraints to have clearances between 3mm (1/8") and 6mm (1/4") under normal operating conditions of equipment.

3 EXECUTION

3.01 INSTALLATION

- .1 Comply with seismic restraint Engineer's and manufacturer's installation and adjustment recommendations. Refer to detailed shop drawings.
- .2 Obtain required training from manufacturer's representative on any special installation procedures. Install components in accordance with manufacturer's instructions to suit specific installation requirements.
- .3 Refer to Part 2 for additional specific installation requirements.

3.02 INSPECTION AND TESTING

- .1 Inspect for removal of breakaway hardware to ensure proper torques of installed systems.
- .2 Test, adjust, and certify installation.
- .3 Comply with local governing authority requirements for testing, certification, documenting and labeling of seismic restraints.
- .4 For non-visually verifiable product, manufacturers to verify proper torque for a minimum 10% of application, unless otherwise directed by local governing authorities. Document torques for applications per manufacturer's instructions.
- .5 Submit copies of test report to Department Representative.

END OF SECTION

Part 1 General**1.1 REFERENCES**

- .1 CSA International
 - .1 CSA C22.2 No.29, Panelboards and Enclosed Panelboards.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 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.
- .2 Shop Drawings:
 - .1 Include on drawings:
 - .1 Electrical detail of panel, branch breaker type, quantity, ampacity and enclosure dimension.

1.3 CLOSEOUT SUBMITTALS

- .1 Operation and Maintenance Data: submit operation and maintenance data for panelboards for incorporation into manual.
- .2 Provide in French (if available; if not available, the manufacturer is required to state that) and English for incorporation into 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 in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect panelboards from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.
- .4 Packaging Waste Management: remove for reuse and return of pallets, crates, padding, packaging materials.

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.
- .2 600 V panelboards: bus and breakers rated for minimum 65kA (symmetrical) interrupting capacity or as required as calculated from the existing coordination study from Project 1 – to be provided.
- .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 2 flush locks for each panel board.
- .6 Two keys for each panelboard and key panelboards alike.
- .7 Copper bus with neutral of double ampere rating of mains.
- .8 Mains: suitable for bolt-on breakers.
- .9 Trim with concealed front bolts and hinges.
- .10 Trim and door finish: baked enamel as per colour schedule.
- .11 Isolated ground bus.
- .12 Include grounding busbar with 3 of terminals for bonding conductor equal to breaker capacity of the panel board.
- .13 New 1200A rated panel shall be suitable for installation of motorized operators over breakers for load shedding control.

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 as 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.

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.
- .3 Nameplate for each circuit in distribution panelboards size 2 engraved.

- .4 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 INSTALLATION

- .1 Locate panelboards as indicated and mount securely, plumb, true and square, to adjoining surfaces.
- .2 Install surface mounted panelboards on flame retardant plywood backboards. 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.

3.2 CLEANING

- .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment.
- .3 Waste Management: separate waste materials for reuse and recycling.
 - .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 panelboard installation.

END OF SECTION

MOULDED CASE CIRCUIT BREAKERS

Part 1 General**1.1 REFERENCES**

- .1 CSA International
 - .1 CSA C22.2 No. 5, Molded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures (Tri-national standard with UL 489, and NMX-J-266-ANCE-2010).

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 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.
 - .2 Include time-current characteristic curves for breakers.
 - .3 Certificates:
 - .1 Prior to installation of circuit breakers in either new or existing installation, Contractor must submit 3 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:
 - .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 and 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:

1.3 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 circuit breakers off ground indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect circuit breakers from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.
- .4 Packaging Waste Management: remove for reuse and return of pallets, crates, padding, packaging materials.

Part 2 Products

2.1 BREAKERS GENERAL

- .1 Moulded-case circuit breakers: to CSA C22.2 No. 5
- .2 Bolt-on moulded case circuit breaker: quick- make, quick-break type, for manual and automatic operation.
- .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 with interchangeable trips.
- .6 Circuit breakers to have minimum 42kA symmetrical rms interrupting capacity rating or as required to suit the findings from the coordination study completed in Project 1 – to be provided.

2.2 THERMAL MAGNETIC BREAKERS

- .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

- .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:

MOULDED CASE CIRCUIT BREAKERS

- .1 Shunt trip.
- .2 Auxiliary switch.
- .3 Motor-operated mechanism
- .4 Under-voltage release.
- .5 On-off locking device.
- .6 Handle mechanism.

Part 3 Execution

3.1 INSTALLATION

- .1 Install circuit breakers.

3.2 CLEANING

- .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment.
- .3 Waste Management: separate waste materials for reuse and recycling.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

Part 1 General**1.1 PAYMENT**

- .1 Payment for field testing of ground fault equipment performed by Contractor.

1.2 REFERENCES

- .1 CSA International
 - .1 CAN/CSA C22.2 No. 144, Ground Fault Circuit Interrupters.
- .2 National Electrical Manufacturers Association (NEMA)
 - .1 NEMA PG 2.2, Application Guide for Ground Fault Protection Devices for Equipment.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for ground fault equipment protection and include product characteristics, performance criteria, physical size, finish and limitations.
- .2 Test and Evaluation Reports: submit test report for field testing of ground fault equipment to Department Representative and certificate that system as installed meets criteria specified.

1.4 CLOSEOUT SUBMITTALS

- .1 Operation and Maintenance Data: submit operation and maintenance data for ground fault equipment protection for incorporation into manual.
- .2 Provide in French (if available; if not available, the manufacturer is required to state that) and English 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 off ground indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect ground fault equipment protection from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.
- .4 Packaging Waste Management: remove for reuse and return of pallets, crates, padding, packaging materials.

Part 2 Products**2.1 EQUIPMENT**

- .1 Ground fault protective equipment: components of one manufacturer.
- .2 Provide ground fault protection on 1200A, 347/600V, 4 wire, 3 phase service: to CAN/CSA C22.2 No. 144.
- .3 Ground fault unit to contain:
 - .1 Ground sensing relay suitable for operation factory set.
 - .2 Ammeter with scale 0 to 1.0 A to indicate ground current value.
 - .3 Three position sensitivity control switch to select value of leakage current at which relay will operate.
 - .4 Indicating lamp illuminated when no ground fault exists, extinguished on ground fault or test.
 - .5 Switch:
 - .1 SPDT contacts for alarm and trip.
 - .2 Mechanical target indication.
 - .3 Manual reset.
 - .6 Reset button for contacts and target.
 - .7 Suitable for surface mounting.
- .4 Zero sequence transformer toroidal type with 300 - 3000 mA range.
- .5 Neutral:
 - .1 Use an artificial neutral and grounding resistor.
 - .2 Use neutral ground resistor unit.
- .6 System to operate instantaneously at ground current setting.

2.2 FABRICATION

- .1 Install following components in equipment specified in other Sections and as indicated.
 - .1 Zero sequence transformer.
 - .2 Ground fault relay.
 - .3 Ground resistor unit.

Part 3 Execution**3.1 INSTALLATION**

- .1 Do not ground neutral on load side of sensor.
- .2 Install phase conductors including neutral through zero sequence transformer.
- .3 Install ground fault protection system.

- .4 Make connections as indicated and in accordance with manufacturer's written recommendations.

3.2 FIELD QUALITY CONTROL

- .1 Perform tests in accordance with Section 26 05 00 - Common Work Results for Electrical.
- .2 Arrange for field testing of ground fault equipment by ground fault equipment manufacturer and contractor before commissioning service.
- .3 Demonstrate simulated ground fault tests.

3.3 CLEANING

- .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment.
- .3 Waste Management: separate waste materials for reuse and recycling.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

EMERGENCY LIGHTING**1 GENERAL****1.01 SUBMITTALS**

- .1 Submit shop drawings for products specified in this Section.

2 PRODUCTS**2.01 EMERGENCY LIGHTING UNITS**

- .1 CSA approved, Units and remotes heads to be certified to CSA C22.2 No.141.
- .2 Room housing genset and automatic transfer switch to be equipped with emergency lighting battery units and lamps to ensure a minimum lighting level of 50 lux for a period of minimum 2 hours, at equipment locations requiring service and adjustment. Circuit feeding battery unit to be equipped with a transient voltage surge protective device (SPD). Provide SPD unit in accordance with battery unit manufacturer's recommendations to suit CSA C282 requirements. SPD unit to comply with latest requirements of ANSI/IEEE C62.41, cUL 1449, and have maximum surge current of 125 kA/phase.
- .3 Batteries to be long life sealed lead, maintenance free and have a capacity to supply sufficient output power to lamp loads and to exit sign emergency loads for a period of time in accordance with latest requirements of local governing building code but be a minimum of 30 minutes. Additionally include 20% future spare capacity. Also include in capacity for limits on loading of circuits as specified in Part 3. Batteries to be designed for and guaranteed for at least 10 years of life expectancy.

2.02 COMBINATION EMERGENCY LIGHTING BATTERY UNITS AND EXIT SIGNS

- .1 CSA C22.2 No.141 certified, CSA-C860 approved, combination emergency lighting battery units and exit signs. System to be designed to provide emergency lighting levels in accordance with local governing building requirements.
- .2 Units are complete with batteries, charger, dual lamp heads per unit and features as follows:
 - .1 one-piece unit frame and face plates made of injection-moulded white durable high-impact thermoplastic;
 - .2 snap in/out chevrons; no screws are necessary to hold the faceplate or backplate to housing;
 - .3 faceplates feature uniformly illuminated legend using LEDs to provide illumination in normal and emergency operation and mounted inside housing; LED-sensitive diffuser is mounted behind legend to provide the 150 mm (6") high by 20 mm (3/4") stroke letters with even illumination;
 - .4 equipped with self-testing / self-diagnostic features that automatically self-tests for one minute every 30 days, 10 minutes in 6th month and 30 minutes annually; when a fault is detected, bi-colour pilot light turns from green to red and flash, identifying source of failure (battery, charger circuitry, lamp load, LED strip);
 - .5 unit suitable for wall or ceiling mount.

EMERGENCY LIGHTING

- .3 Chargers are fully automatic, solid-state type that automatically and instantaneously energizes lamp load upon failure of AC supply. Battery protection circuit automatically shuts down lamp load when battery reaches full discharge. Chargers to fully recharge battery in 12-24 hours and be current limited and short circuit proof.
- .4 Batteries to be long life sealed lead, maintenance free and have a capacity to supply sufficient output power to lamp loads and to exit sign emergency loads for a period of time in accordance with latest requirements of local governing building code but be a minimum of 30 minutes. Additionally include 20% future spare capacity. Also include in capacity for limits on loading of circuits as specified in Part 3. Batteries to be designed for and guaranteed for at least 10 years of life expectancy.
- .5 Units include test switch and a green pilot light, located on face plate above legend.

3 EXECUTION**3.01 INSTALLATION OF EMERGENCY LIGHTING UNITS**

- .1 Provide emergency lighting battery units and lighting heads as specified herein and on Schedule of Luminaires, and mount where required. Connect battery units complete to dedicated emergency circuit of local power panels designated for this purpose or where identified on drawings, plug into designated adjacent receptacle. Provide wiring in conduit and connections to remote lamp heads and extend to central battery unit serving area.
- .2 Install units such that units to be automatically actuated upon failure of power supply to normal lighting in area covered by that unit equipment.
- .3 Connect exit signs to battery units' circuits in applications where exit signs require constant or backup DC supply.
- .4 Install combination units in locations and connect complete.
- .5 Note that drawings identify location for battery units and generally identify circuiting of remote heads. In absence of direction of circuiting, provide wiring in conduit to feed remote heads and exit lights from nearest battery unit with sufficient capacity in area, in accordance with application requirements, manufacturer's requirements, and applicable codes. Multiple battery units may be required to accommodate connection of remote heads in some areas. Provide sufficient battery units to accommodate connected lamp loads and system design time of operation. Where more than one battery unit is installed in same immediate location, only one unit is required to be provided with integral lampheads.
- .6 Where battery model number is noted, it is for general reference and exact capacity may be required to be increased to suit connected loads and required battery output time duration to suit local governing codes. Ensure that emergency lighting operates at lighting levels and for duration to meet local governing codes.
- .7 For units serving genset room, provide SPD unit to line side of power supply to battery unit and install and connect in accordance with manufacturer's instructions.
- .8 Provide wiring in conduit and install devices in accordance to manufacturer's instructions. Comply with local governing codes and authority requirements with regards to providing fire rated conductors (MI) for life safety applications.

EMERGENCY LIGHTING

- .9 Unless otherwise noted in Contract Documents, do not load device circuits more than 80% capacity.
- .10 Provide minimum one hard bound copy and electronic copy of signed test report.

END OF SECTION

Part 1 General**1.1 RELATED SECTIONS**

- .1 Division 26 - Electrical

1.2 REFERENCES

- .1 Canadian Standards Association International (CSA).
 - .1 CAN/CSA C22.2 Canadian Electrical Code.
 - .1 CSA C22.1-15. Canadian electrical code, part I (23rd edition). Safety standard for electrical installations.
 - .2 All components and cabling to be UL listed.

1.3 SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Provide product data. Submit manufacturer's product data sheets including installation details, material descriptions, dimensions of individual components and profiles, fabrication, operational descriptions and finishes. Submit product literature including datasheet and drawing pack for specific model, including options.
- .3 Submit manufacturer's shop drawings.
 - .1 Submit drawings detailing product placement, arrangement, and wiring.
- .4 Submit manufacturer's installation instructions.

1.4 QUALITY ASSURANCE

- .1 Pre-installation Meetings: conduct pre-installation meeting to review existing devices and verify project requirements.
- .2 Review conduit pathways.
- .3 Departmental Representative may from time to time, with or without notice, on any business day, at its own expense, conduct quality control audits to assess the materials and installation practices of the Contractor. A list of deficiencies will be generated and submitted to the Contractor for remediation within 48 hours (2 working days). The Contractor is to return deficiency list with an estimated date of completion.

1.5 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. Separate waste materials for reuse and recycling in accordance with Section 01 74 19 - Waste Management and Disposal.

ACCESS CONTROL SYSTEMS**1.6 HOUR OF WORK**

- .1 Carry out all work during times as indicated in Section 01 00 10 – General Instructions.

1.7 MANDATORY DAILY SITE READINESS

- .1 It is mandatory that the site's Access Control and Intrusion systems are totally functional at the end of each day's work once activated. The Contractor is responsible for this requirement.

1.8 PERMITS, LICENSE, INSPECTIONS AND FEES

- .1 The Contractor is responsible where materials are specified which require special inspection and approval of the Departmental Representative and/or local authorities obtain such approval for the particular installation with the co-operation of the material supplier; and obtain and pay for permits and inspection required for work performed.

1.9 PERSONNEL REQUIREMENTS

- .1 It is expected that the Contractor will provide project management and installation personnel to guarantee a complete, functional system in compliance with the intent of this specification. This must include:
 - .1 A full-time project site lead;
 - .2 A project manager assigned and responsible to the project to ensure adherence to the project schedule;
 - .3 The Contractor and all sub-contractors must provide all personnel safety equipment, including but not limited to CSA safety footwear, hard hats and eyewear;

Part 2 Products**2.1 MATERIALS**

- .1 There is an existing security system presently installed in the building. All materials must be selected to ensure compatibility with the existing security system.
- .2 The only acceptable materials are:
 - .1 Credential Readers:
 - .1 HID Multiclass RP40 (model to be confirmed by Contractor.)
 - .1 Supply and installation a HID RP40 credential reader at each of the two associated doors (2) doors listed on the drawing (D200b, D200c)
 - .2 Commission and test.
 - .2 Door Contact:
 - .1 Interlogix – 1078 series - Recessed Door Contact or equivalent, Recessed Mount, Closed Loop, 100 Volt AC/DC, 0.5 Ampere, 7.5 Watt, 13mm gap, 25mm diameter, with lead wire.
 - .1 Supply and install a recessed door contacts at the two (2) associated doors, D200b and D200c.
 - .2 Install end of line resistor for supervision of line.

ACCESS CONTROL SYSTEMS

- .3 Commission and test.
- .3 Request to Exit:
 - .1 Kantech T-REX LT Request to Exit PIR Motion Detector, White
 - .1 Supply, install and configure a T-REX-LT request-to-exit motion detector at each of the two (2) associated doors D200b and D200c.
 - .2 Commission and test.
- .4 Door Strikes:
 - .1 HES 9600 – Electric Rim Strike
 - .1 Supply and installation a HES 9600 at the two (2) associated doors, D200b and D200c.
 - .2 Commission and test.
- .5 Door Controllers:
 - .1 AMAG Symmetry – Model to be confirmed by Contractor.
 - .1 Supply, install and configure access control door controller to enable full control and operation of the required two (2) doors as per locations D200b and D200c on drawing.
 - .2 Commission and test.
- .3 End of Line Resistors
 - .1 Supply, install and configure end of line resistors to all associated door input points, at point device.
- .4 Cabling
 - .1 Provide all cabling for a fully functional and integrated system.
 - .2 All cabling must meet fire code requirements.
 - .3 Supply and run banana style access control cabling or equivalent from and to each controller and associated two (2) doors. Cable is to be run within existing conduit installed by others. Banana style cable should include associated cables to properly connect and powered (as required) a credential reader, door contact, door exit request device and electric strike.
 - .4 Cabling from credential readers and output dry for passage confirmation to input to the access control system:
 - .1 8 conductor 22awg
 - .5 Cabling to Door Contacts:
 - .1 4 conductor 22awg
 - .6 Cabling to the Request to Exit Detectors:
 - .1 4 conductor 22awg
 - .7 Cabling to the Electric Door Strikes
 - .1 2 conductor 18awg
 - .8 Cabling to the Barrier-Free Interface:
 - .1 6 conductor 22awg

ACCESS CONTROL SYSTEMS**Part 3 Execution****3.1 MANUFACTURER'S INSTRUCTIONS**

- .1 Comply with manufacturer's written data, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.

3.2 EXAMINATION

- .1 Examine roughing-in for all conduits to verify actual locations to allow of wiring connections.
- .2 Ensure the all power supplies can provide required power to security devices and provide if needed.
- .3 Proceed only after such discrepancies or conflicts have been resolved.

3.3 INSTALLATION

- .1 Install security credential readers and coordinate installation of cables in the frames of the wall installation and door strike installation and the credential reader.
- .2 Install and integrate electric strikes.
- .3 Install and integrate request to exit devices.
- .4 Install and integrate door contacts.
- .5 Install and integrate CX-12 with barrier free operators.
- .6 Supply, install and configure AMAG Symmetry control panels, cabinets, power supply modules, batteries as required for the new doors to be added to the existing system onsite for a fully functional system.
- .7 Provide all cabling required for a fully functional system. Terminate all cabling to and from access controllers and associated door devices.
- .8 Supply, install and configure backup power at each controller to ensure door functionality for 1 hour in the event of a power loss.
- .9 Configure all doors within system for five (5) second unlock and additional fifteen (15) second held open / (30) second for handicap operated doors.
- .10 Program door configuration and credential access group access to the new doors, as required. Coordinate with the Departmental Representative to provide the applicable parameter list.
- .11 Ensure all door components and complete operation comply with National and Provincial Building Codes.
- .12 Test and commission. Coordinate with the Departmental Representative prior to completion for scheduling.

3.4 COMMISSIONING

- .1 Completion and acceptance of the installation, commissioning of the security access control components and software and receipt of as-built documentation will constitute completion of the installation.

ACCESS CONTROL SYSTEMS

- .2 Submit documentation within ten (10) working days upon completion of the project work which must include:
 - .1 A final drawing set of CAD files that accurately depicts the as-built status of the security system and complete line diagrams of connectivity from all devices. It must also reflect final placement of customer supplied equipment;
 - .2 All operation manuals for all components, head end equipment and software;
 - .3 A written warranty.
- .3 The Contractor shall develop a testing and commissioning checklist for the system and submit to the Departmental Representative for approval 10 business days before commissioning commences.
- .4 The Departmental Representative must approve the testing and commissioning procedure prior to the commencement of testing and commissioning and may request to be present.
- .5 The Departmental Representative shall be invited to witness field testing and commissioning and shall be notified of the start date of the testing phase 10 business days before testing and commissioning commences.

3.5 WARRANTY AND MAINTENANCE

- .1 Provide a Warranty
 - .1 The Contractor shall warrant any of the supplied security systems to be free from faults and defects in system design and workmanship. The warranty coverage shall include all custom designed equipment and the overall security system design and installation.
 - .2 Warranty shall be effective for a period of one (1) year from the date of system acceptance by Departmental Representative for the all systems, or from date system is put into use, whichever occurs first. Within the period of Warranty coverage, individual manufacturers' equipment warranties shall apply to all purchased equipment.
 - .3 In the event that the manufacturer's warranty has expired on a failed device (equipment warranty of less than one (1) year), the Contractor shall be responsible for the actual cost of any required repairs.
 - .4 All manufacturers' equipment warranties shall be effective as of the date of acceptance test completion.
 - .5 If equipment modification by the Contractor voids the manufacturers' warranty, the winning Contractor shall assume the equivalent equipment warranty.
 - .6 Response time for Warranty service work shall be no longer than the next business day from date of request for service.
 - .7 The Contractor shall warrant that all equipment, materials and components will be new. No used or reconditioned equipment will be acceptable;

3.6 CLEANING

- .1 The Contractor is responsible for the daily cleanup of any and all materials associated within their scope. There will be no cost to Departmental Representative related to this cleanup. Failure to do so may result in waste fees being levied upon the Contractor.

ACCESS CONTROL SYSTEMS

- .2 Perform cleaning after installation to remove construction and accumulated environmental dirt. Clean adjacent surfaces soiled by installation.
- .3 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

3.7 TRAINING

- .1 No training on any of the systems provided is required for this project.

END OF SECTION