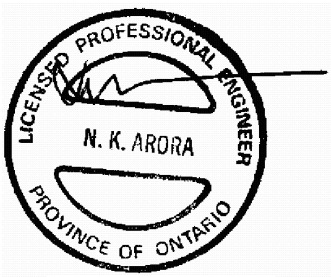
PROJECT TITLE	441 UNIVERSITY RECAPITALIZATION PROJECT 441 UNIVERSITY AVENUE WINDSOR, ON
PROJECT NUMBER	R.076516.013
PROJECT DATE	2016-10-28

Architect

Civil Engineer

Structural Engineer

Mechanical Engineer



Electrical Engineer

END OF SECTION

Division 0 - Procurement and Contracting Requirements

Division 1 - General Requirements

Division 2 - Existing Conditions

Division 3 - Concrete

Division 4 - Masonry

Division 5 - Metals

Division 6 - Wood, Plastics and Composites

Division 7 - Thermal and Moisture Protection

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Division 31 - Earthwork

Division 32 - Exterior Improvements

Division 33 - Utilities

Division 48 - Electrical Power Generation

END OF TABLE OF CONTENTS

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 02 81 16 – Hazardous Materials

1.2 DEFINITIONS

.1 Hazardous Materials Information: Information prepared by a specialist consultant hired directly by the Departmental Representative, and is included as information documents related to Project and identified in the Appendices as such, and only as specifically referenced in the Appendices.

.2 Contract Documents: All documents and information of any type and in any form, specifically prepared for use of Contract and as defined in Contractor's Agreement Form.

1.3 ADMINISTRATIVE REQUIREMENTS

.1 Status of Hazardous Materials Information: Hazardous Materials Information identified in the Appendices; or any part thereof, are not part of Contract Documents prepared by the Departmental Representative and are made available to Bidder for the purpose of providing Bidder with access to information available to Departmental Representative under the following conditions:

.1 Hazardous Materials Information shall not be considered a representation or warranty that information contained therein is accurate, complete, or appropriate.

.2 Bidder shall interpret and draw conclusions about Hazardous Materials Information and are encouraged to obtain specialist advice with regards to this information.

.3 Departmental Representative assumes no responsibility for such interpretations and conclusions.

.4 Information contained in Hazardous Materials Information may be time sensitive and dates shall be considered when interpreting Hazardous Materials Report.

.5 Bidder may rely upon data contained in Hazardous Materials Report; or parts thereof, which are specifically incorporated into Contract Documents by means of copying, transcribing or referencing, but shall draw their own conclusions from such data and shall not rely on opinions or interpretations contained therein.

.2 Designated Substances Survey: A Designated Substances Survey was prepared for this project and is attached as an Appendix, but is not incorporated into the Contract Documents:

.1 Title: Designated Substances Survey Revision A, 441 University Avenue, Windsor, Ontario

.2 Report File Number: GV-SO-028018

.3 Preparation Date: January 29, 2017

.4 Prepared By: DST Consulting Engineers

.5 Number of Pages: 43

.3 Direct inquiries during Bid period to person identified within the Contracting Authority to receive inquiries; the Departmental Representative will not accept direct enquiries with regards to hazardous materials removal.

Part 2 Products

2.1 USE OF HAZARDOUS MATERIALS INFORMATION

.1 Information presented in the Hazardous Materials Information was commissioned by the Departmental Representative; recommendations contained in the Hazardous Materials Information were used by the Departmental Representative to assess relative risk of exposure to hazardous materials and the level of involvement of all parties contributing to the Contract Documents.

.2 Information contained in the Hazardous Materials Information may be useful to the Contractor, and is made available for review with no implied or express warranty from the Departmental Representative as to the accuracy or completeness of this Document.

Part 3 Execution

3.1 HAZARDOUS MATERIALS INFORMATION

.1 A copy of the Hazardous Materials Information documents is included in the Appendix.

END OF SECTION

Part 1 GENERAL

1.1 SECTION INCLUDES

.1 Title and description of Work.

.2 Contract Method.

.3 Contractor use of premises.

.4 Phasing

.5 Owner occupancy.

.6 Owner furnished items.

.7 Alterations to existing building.

1.2 PRECEDENCE

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

1.3 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

1.4 WORK COVERED BY CONTRACT DOCUMENTS

.1 Work of this Contract comprises exterior and interior renovation of the existing Government of Canada Building at 441 University Avenue West, Windsor, Ontario N9A 5P9. Work will include but is not limited to:

.1 Demolition of interior walls, ceilings and finishes and Hazardous Materials Remediation

.2 Exterior masonry repair and cladding, door, window and roof replacement, HVAC, sprinkler, electrical, communication and life safety system upgrades, elevator modernization, new interior walls and finishes, exterior works including parking and landscaping, and new rooftop photovoltaic system.

1.5 CONTRACT METHOD

.1 Construct work under lump sum contract.

.2 Relations and responsibilities between Contractor and subcontractors as defined in Conditions of Contract. Assigned Subcontractors must, in addition:

.1 Furnish to Contractor, bonds covering faithful performance of subcontracted work and payment of obligations thereunder when Contractor is required to furnish such bonds to Departmental Representative.

.2 Purchase and maintain liability insurance to protect Contractor from claims for not less than limits of liability which Contractor is required to provide to Departmental Representative.

1.6 COST BREAKDOWN

.1 Within 48 hours of notification of acceptance of bid furnish a cost breakdown by Section aggregating contract amount.

.2 Show separately cost of equipment purchased exempt from Ontario Retail Sales Tax under your Ontario Sales Tax license number.

.3 Within 48 hours of acceptance of bid submit a list of subcontractors.

1.7 WORK SEQUENCE

.1 Contract shall be completed as one Contract.

1.8 WORK BY OTHERS

.1 The Contractor shall for the purpose of the Ontario Occupational Health and Safety Act and Regulations for Construction Projects, and for the duration of the Work of the Contract:

.1 Assume the role of Constructor in accordance with the Authority Having Jurisdictions.

.2 Agree, in the event of two or more Contractors working at the same time and space at the work site, without limiting the General Conditions GC3.7, to the Departmental Representative's order to:

.1 Assume, as the Constructor, the responsibility for the Departmental Representative's other Contractors;

1.9 CONTRACTOR USE OF PREMISES

.1 Contractor shall limit use of premises for Work, for storage, and for access, to allow;

.1 Partial owner occupancy of the remainder of the building.

.2 Public usage.

.2 Coordinate use of premises under direction of Departmental Representative.

.3 Obtain and pay for use of additional storage or work areas needed for operations under this Contract.

1.10 OWNER FURNISHED ITEMS

.1 Owner Responsibilities:

.1 Arrange for delivery of shop drawings, product data, samples, manufacturer's instructions, and certificates to Contractor.

.2 Deliver supplier's bill of materials to Contractor.

.3 Arrange and pay for delivery to site in accordance with Progress Schedule.

.4 Inspect deliveries jointly with Contractor.

.5 Submit claims for transportation damage.

.6 Arrange for replacement of damaged, defective or missing items.

.7 Arrange for manufacturer's field services; arrange for and deliver manufacturer's warranties and bonds to Contractor.

.2 Contractor Responsibilities:

.1 Designate submittals and delivery date for each product in progress schedule.

.2 Review shop drawings, product data, samples, and other submittals. Submit to Departmental Representative notification of any observed discrepancies or problems anticipated due to non-conformance with Contract Documents.

.3 Receive and unload products at site.

.4 Inspect deliveries jointly with Departmental Representative; record shortages, and damaged or defective items.

.5 Handle products at site, including uncrating and storage.

.6 Protect products from damage, and from exposure to elements.

.7 Assemble, install, connect, adjust, and finish products.

.8 Provide installation inspections required by public authorities.

.9 Repair or replace items damaged by Contractor or subcontractor on site (under his control).

.3 Schedule of Owner furnished items.

.1 Office Furniture.

.2 Communication System.

1.11 ALTERATIONS TO EXISTING BUILDING

.1 Remove and recycle, compost, anaerobic digest, sell material for reuse or dispose of:

.1 All demolition waste resulting from demolition activities as indicated on Drawings that are not designated for reinstallation or turnover to Departmental Representative in accordance with Section 01 74 20.

.2 Provide new openings required in existing construction.

.3 Block in openings where items removed with material and finish to match existing adjoining construction.

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 ACCESS AND EGRESS

.1 Design, construct and maintain temporary "access to" and "egress from" work areas, including stairs, runways, ramps or ladders and scaffolding, independent of finished surfaces and in accordance with relevant municipal, provincial and other regulations.

1.2 USE OF SITE AND FACILITIES

.1 Execute work with least possible interference or disturbance to normal use of premises. Make arrangements with Departmental Representative to facilitate work as stated.

.2 Maintain existing services to building and provide for personnel and vehicle access.

.3 Where security is reduced by work provide temporary means to maintain security.

.4 Contractor's personnel may use existing sanitary facilities until services are disconnected; after disconnection Contractor shall provide temporary sanitary facilities. Keep facilities clean.

.5 Existing elevator in building will be demolished. It will be the Contractor’s responsibility to move material and personnel through the building at their own expense.

.6 Closures: protect work temporarily until permanent enclosures are completed.

1.3 ALTERATIONS, ADDITIONS OR REPAIRS TO EXISTING BUILDING

.1 Execute work with least possible interference or disturbance to public and normal use of premises. Arrange with Departmental Representative to facilitate execution of work.

1.4 EXISTING SERVICES

.1 Notify, Departmental Representative utility companies of intended interruption of services and obtain required permission.

.2 Where Work involves breaking into or connecting to existing services, give Departmental Representative 48 hours of notice for necessary interruption of mechanical or electrical service throughout course of work. Keep duration of interruptions minimum. Carry out interruptions after normal working hours of occupants, preferably on weekends.

.3 Provide for pedestrian and vehicular traffic.

.4 Construct barriers in accordance with Section 01 56 00.

1.5 SPECIAL REQUIREMENTS

.1 Carry out noise generating Work in accordance with municipal regulations.

.2 Submit schedule in accordance with Section 01 32 16.07 - Construction Progress Schedule - Bar (GANTT) Chart.

.3 Ensure Contractor's personnel employed on site become familiar with and obey regulations including safety, fire, traffic and security regulations.

.4 Keep within limits of work and avenues of ingress and egress.

.5 Prior to cutting or drilling horizontal or vertical surfaces including concrete, concrete block or other structural substrate, determine location of reinforcing, service lines, pipes, conduits or other items by x-ray, ground penetrating radar or other appropriate method. Submit findings to Departmental Representative prior to cutting or drilling.

1.6 BUILDING SMOKING ENVIRONMENT

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

Part 2 PRODUCTS

2.1 NOT USED

.1 Not Used.

Part 3 EXECUTION

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 GENERAL

1.1 ADMINISTRATIVE

.1 Schedule and administer project meetings throughout the progress of the work at the call of Departmental Representative.

.2 Prepare agenda for meetings.

.3 Distribute written notice of each meeting 4 days in advance of meeting date to Departmental Representative.

.4 Provide physical space and make arrangements for meetings.

.5 Preside at meetings.

.6 Reproduce and distribute copies of minutes within three days after meetings and transmit to Departmental Representative, meeting participants and affected parties not in attendance.

.7 Representative of Contractor, Subcontractor and suppliers attending meetings will be qualified and authorized to act on behalf of party each represents.

1.2 PRECONSTRUCTION MEETING

.1 Within 15 days after award of Contract, request a meeting of parties in contract to discuss and resolve administrative procedures and responsibilities.

.2 Departmental Representative, Contractor, major Subcontractors, field inspectors and supervisors will be in attendance.

.3 Establish time and location of meeting and notify parties concerned minimum 5 days before meeting.

.4 Incorporate mutually agreed variations to Contract Documents into Agreement, prior to signing.

.5 Agenda to include:

.1 Appointment of official representative of participants in the Work.

.2 Schedule of Work: in accordance with Section 01 32 16.

.3 Schedule of submission of shop drawings, samples, mock-ups, colour chips. Submit submittals in accordance with Section 01 33 00.

.4 Requirements for temporary facilities, site sign, offices, storage sheds, utilities, fences in accordance with Section 01 52 00.

.5 Site security in accordance with Section 01 56 00.

.6 Health and safety in accordance with Section 01 35 29.

.7 Proposed changes, change orders, procedures, approvals required, mark-up percentages permitted, time extensions, overtime, administrative requirements.

.8 Owner provided products.

.9 Record drawings and specifications in accordance with Sections 01 33 00 and 01 78 00.

.10 Maintenance manuals in accordance with Section 01 78 00.

.11 Take-over procedures, acceptance, warranties in accordance with Section 01 78 00.

.12 Monthly progress claims, administrative procedures, photographs, hold backs.

.13 Appointment of inspection and testing agencies or firms.

.14 Insurances, transcript of policies.

1.3 PRE-INSTALLATION MEETINGS

.1 Schedule pre-installation meetings required by technical specification Sections making reference to this Section a minimum of 1 week before starting affected work.

.2 Purpose: to discuss coordination and installation requirements for materials and assemblies installed by different Sections of the Work, and to confirm rough-ins, special installation requirements, clearances, material compatibility, protection of installed materials or assemblies, and similar issues.

.3 Location: Contractor's site offices.

.4 Minutes: Departmental Representative will record minutes, will chair the meeting and distribute minutes to parties of record prior to the next scheduled meeting.

.5 Attendees:

.1 Contractor's Representatives: Contractor's project manager, site superintendent, representatives of Subcontractors affecting construction, and others as necessary.

.2 Departmental Representative.

.6 Agenda:

.1 Introduction of supplier's, manufacturer's, Subcontractor's or other affected individual's concerns for constructability, compatibility or coordination.

.2 Review of proposed materials and methods of construction to address stated concerns, specification and drawing requirements, and any requirements for mock-ups or sample assemblies.

1.4 PROGRESS MEETINGS

.1 During course of Work and 2 weeks prior to project completion, schedule progress meetings bi-weekly.

.2 Contractor, major Subcontractors involved in Work and Departmental Representative are to be in attendance.

.3 Notify parties minimum 4 days prior to meetings.

.4 Record minutes of meetings and circulate to attending parties and affected parties not in attendance within 3 days after meeting.

.5 Agenda to include the following:

.1 Review, approval of minutes of previous meeting.

.2 Review of Work progress since previous meeting.

.3 Field observations, problems, conflicts.

.4 Problems which impede construction schedule.

.5 Review of off-site fabrication delivery schedules.

.6 Corrective measures and procedures to regain projected schedule.

.7 Revision to construction schedule.

.8 Progress schedule, during succeeding work period.

.9 Review submittal schedules: expedite as required.

.10 Maintenance of quality standards.

.11 Review proposed changes for affect on construction schedule and on completion date.

.12 Other business.

1.5 COMMISSIONING MEETINGS

.1 Convene Cx meetings following project meetings: Section 01 32 16 and as specified herein.

.2 Purpose: to resolve issues, monitor progress, identify deficiencies, relating to Cx.

.3 Continue Cx meetings on regular basis until commissioning deliverables have been addressed.

.4 At 60% construction completion stage, Departmental Representative to call a separate Cx scope meeting to review progress, discuss schedule of equipment start-up activities and prepare for Cx. Issues at meeting to include:

.1 Review duties and responsibilities of Contractor and subcontractors, addressing delays and potential problems.

.2 Determine the degree of involvement of trades and manufacturer's representatives in the commissioning process.

.5 Thereafter Cx meetings to be held until project completion and as required during equipment start-up and functional testing period.

.6 Meeting will be chaired by Departmental Representative, who will record and distribute minutes.

.7 Ensure subcontractors and relevant manufacturer representatives are present at 60% and subsequent Cx meetings and as required.

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 SECTIONS

.1 Section 01 78 00 - Closeout Submittals

1.2 ELECTRONIC COPY

.1 Submit electronic copy of colour digital photography in jpg format, fine resolution.

.2 Submit colour hard copy of digital photographs arranged on 215 mm x 279 mm paper and as follows:

.1 Project Identification: name and number of project and date of exposure indicated in header of each sheet.

.2 Photograph Identification: typewritten room number and description of photograph (i.e. “Office 124, at doorway looking northeast”).

.3 Photograph Size: 100 mm x 150 mm.

.3 Number of viewpoints: minimum twenty-four (24) viewpoints. Locations of viewpoints determined by Departmental Representative.

.4 Frequency: monthly with progress statement and at completion of framing and services before concealment as directed by Departmental Representative.

Part 2 PRODUCTS

2.1 NOT USED

.1 Not Used.

Part 3 EXECUTION

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 GENERAL

1.1 DEFINITIONS

.1 Activity: element of Work performed during course of Project. Activity normally has expected duration, and expected cost and expected resource requirements. Activities can be subdivided into tasks.

.2 Bar Chart (GANTT Chart): graphic display of schedule-related information. In typical bar chart, activities or other Project elements are listed down left side of chart, dates are shown across top, and activity durations are shown as date-placed horizontal bars. Generally Bar Chart should be derived from commercially available computerized project management system.

.3 Baseline: original approved plan (for project, work package, or activity), plus or minus approved scope changes.

.4 Construction Work Week: Monday to Friday, inclusive, will provide five day work week and define schedule calendar working days as part of Bar (GANTT) Chart submission.

.5 Duration: number of work periods (not including holidays or other nonworking periods) required to complete activity or other project element. Usually expressed as workdays or workweeks.

.6 Master Plan: summary-level schedule that identifies major activities and key milestones.

.7 Milestone: significant event in project, usually completion of major deliverable.

.8 Project Schedule: planned dates for performing activities and the planned dates for meeting milestones. Dynamic, detailed record of tasks or activities that must be accomplished to satisfy Project objectives. Monitoring and control process involves using Project Schedule in executing and controlling activities and is used as basis for decision making throughout project life cycle.

.9 Project Planning, Monitoring and Control System: overall system operated by Departmental Representative to enable monitoring of project work in relation to established milestones.

1.2 REQUIREMENTS

.1 Ensure Master Plan and Detail Schedules are practical and remain within specified Contract duration.

.2 Plan to complete Work in accordance with prescribed milestones and time frame.

.3 Limit activity durations to maximum of approximately 10 working days, to allow for progress reporting.

.4 Ensure that it is understood that Award of Contract or time of beginning, rate of progress, Certificate of Substantial Performance and Certificate of Completion as defined times of completion are of essence of this contract.

1.3 SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00.

.2 Submit to Departmental Representative within 10 working days of Award of Contract Bar (GANTT) Chart as Master Plan for planning, monitoring and reporting of project progress.

.3 Submit Project Schedule to Departmental Representative within 5 working days of receipt of acceptance of Master Plan.

1.4 MASTER PLAN

.1 Structure schedule to allow orderly planning, organizing and execution of Work as Bar Chart (GANTT).

.2 Departmental Representative will review and return revised schedules within 5 working days.

.3 Revise impractical schedule and resubmit within 5 working days.

.4 Accepted revised schedule will become Master Plan and be used as baseline for updates.

1.5 PROJECT SCHEDULE

.1 Develop detailed Project Schedule derived from Master Plan.

.2 Ensure detailed Project Schedule includes as minimum milestone and activity types as follows:

.1 Award.
.2 Shop Drawings, Samples.
.3 Permits.
.4 Mobilization.
.5 Demolition
.6 Interior Architecture (Walls, Floors and Ceiling).
.7 Plumbing.
.8 Lighting.
.9 Electrical.
.10 Piping.
.11 Controls.
.12 Heating, Ventilating, and Air Conditioning.
.13 Millwork.
.14 Fire Systems.
.15 Testing and Commissioning.
.16 Supplied equipment long delivery items.
.17 Departmental Representative supplied equipment required dates.

1.6 PROJECT SCHEDULE REPORTING

.1 Update Project Schedule on bi-weekly basis reflecting activity changes and completions, as well as activities in progress.

.2 Include as part of Project Schedule, narrative report identifying Work status to date, comparing current progress to baseline, presenting current forecasts, defining problem areas, anticipated delays and impact with possible mitigation.

1.7 PROJECT MEETINGS

.1 Discuss Project Schedule at regular site meetings specified in Section 01 31 19, identify activities that are behind schedule and provide measures to regain slippage. Activities considered behind schedule are those with projected start or completion dates later than current approved dates shown on baseline schedule.

.2 Weather related delays with their remedial measures will be discussed and negotiated.

Part 2 PRODUCTS

2.1 NOT USED

.1 Not used.

Part 3 EXECUTION

3.1 NOT USED

.1 Not used.

END OF SECTION

Part 1 GENERAL

1.1 ADMINISTRATIVE

.1 Submit to 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 co-ordinated with requirements of Work and Contract Documents. Submittals not stamped, signed, dated and identified as to specific project will be returned without being examined and considered rejected.

.6 Notify 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 co-ordinated.

.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.

.11 Submit number of hard copies specified for each type and format of submittal and also submit in electronic format as pdf files. Forward pdf, MS Word, MS Excel, MS Project and Autocad dwg files on USB compatible with PWGSC encryption requirements or through email or alternate electronic file sharing service such as ftp, as directed by Departmental Representative.

1.2 SHOP DRAWINGS AND PRODUCT DATA

.1 The term "shop drawings" means drawings, diagrams, illustrations, schedules, performance charts, brochures and other data which are to be provided by Contractor to illustrate details of a portion of Work.

.2 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Ontario of Canada.

.3 Indicate materials, methods of construction and attachment or anchorage, erection diagrams, connections, explanatory notes and other information necessary for completion of Work. Where articles or equipment attach or connect to other articles or equipment, indicate that such items have been co-ordinated, regardless of Section under which adjacent items will be supplied and installed. Indicate cross references to design drawings and specifications.

.4 Allow 10 working days for Departmental Representative's review of each submission.

.5 Adjustments made on shop drawings by Departmental Representative are not intended to change Contract Amount. If adjustments affect value of Work, state such in writing to Departmental Representative prior to proceeding with Work.

.6 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.

.7 Accompany submissions with transmittal letter, in duplicate, containing:

- .1 Date.
- .2 Project title and number.
- .3 Contractor's name and address.
- .4 Identification and quantity of each shop drawing, product data and sample.
- .5 Other pertinent data.

.8 Submissions shall include:

- .1 Date and revision dates.
- .2 Project title and number.
- .3 Name and address of:
  - .1 Subcontractor.
  - .2 Supplier.
  - .3 Manufacturer.
- .4 Contractor's stamp, signed by Contractor's authorized representative certifying approval of submissions, verification of field measurements and compliance with Contract Documents.
- .5 Details of appropriate portions of Work as applicable:
  - .1 Fabrication.
  - .2 Layout, showing dimensions, including identified field dimensions, and clearances.
  - .3 Setting or erection details.
  - .4 Capacities.
  - .5 Performance characteristics.
  - .6 Standards.
  - .7 Operating weight.
  - .8 Wiring diagrams.
  - .9 Single line and schematic diagrams.
  - .10 Relationship to adjacent work.

.9 After Departmental Representative's review, distribute copies.

.10 Submit one (1) electronic copy of shop drawings for each requirement requested in specification Sections and as Departmental Representative may reasonably request.

.11 Submit one (1) 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.

.12 Submit one (1) 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 accordance with specified requirements.

.2 Testing must have been within 3 years of date of contract award for project.

.13 Submit one (1) 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.

.14 Submit one (1) 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.

.15 Submit one (1) electronic copy of Manufacturer's Field Reports for requirements requested in specification Sections and as requested by Departmental Representative.

.16 Documentation of the testing and verification actions taken by manufacturer's representative to confirm compliance with manufacturer's standards or instructions.

.17 Submit one (1) electronic copy of Operation and Maintenance Data for requirements requested in specification Sections and as requested by Departmental Representative.

.18 Delete information not applicable to project.

.19 Supplement standard information to provide details applicable to project.

.20 If upon review by Departmental Representative, no errors or omissions are discovered or if only minor corrections are made, copies 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.

.21 The review of shop drawings by Public Works and Government Services Canada (PWGSC) is for sole purpose of ascertaining conformance with general concept.

.1 This review shall not mean that PWGSC approves detail design inherent in shop drawings, responsibility for which shall remain with Contractor submitting same, and such review shall not relieve Contractor of responsibility for errors or omissions in shop drawings or of responsibility for meeting requirements of construction and Contract Documents.

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

1.3 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 Amount. 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 Section 01 45 00.

1.5 CERTIFICATES AND TRANSCRIPTS

.1 Immediately after award of Contract, submit Workers' Safety and Insurance Board Experience Report.

1.6 FEES, PERMITS AND CERTIFICATES

.1 Provide authorities having jurisdiction with information requested.

.2 Pay fees and obtain certificates and permits required.

.3 Furnish certificates and permits.

.4 Submit acceptable certificate stating that suspended ceiling systems provide adequate support for electrical fixtures, as required by current bulletin of Electrical Safety Authority (ESA).

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 INTENT

.1 The intent of Delegated Design Submittals required by this Section is to account for professional engineering responsibility for design, review and acceptance of components of Work forming a part of permanent Work in accordance with Building Code, and that has been assigned to a design entity other than Departmental Representative including, but not limited to, the following:

.1 Design requiring structural analysis of load bearing components and connections.

.2 Design requiring compliance with fire safety regulations.

.3 Design requiring compliance with life or health safety regulations.

.2 This Section provides standard forms for submittal of Commitment to General Reviews by Architects and Engineers and Letter of General Conformance required complying with requirements of Building Code and design delegated to a professional engineer within technical Specifications Sections.

.3 Delegated Design Submittals are not required for components of Work requiring engineering for temporary Work (for example: crane hoisting, engineered lifts, false Work, shoring, concrete formwork) that would normally form a part of Contractor's scope of Work.

.4 The requirements of this Section are in general conformance with recommended Responsibilities for Engineering Services for Building Projects published by Professional Engineers of Ontario (PEO), with regards to duties of specialty professionals appointed during construction period.

.5 The requirements of this Section do not diminish responsibilities of Departmental Representative's role as Technical Authority; submittals will be used by Departmental Representative to establish that Work is substantially performed and allow declaration for Assurance of Professional Review and Compliance required by the Building Code by the Technical Authority.

1.2 RELATED REQUIREMENTS

.1 Section 01 33 00 – Submittal Procedures: Submission of required supporting documentation by Delegated Design Professional Engineers.

.2 Section 01 41 00 – Reference Standards: Requirements for governing Building Codes and Standards.

.3 Section 01 45 00 – Quality Control: Quality control and assurance responsibilities for design of shop and site fabricated components.

.4 Section 07 05 53 – Fire and Smoke Assembly Design Requirements and Identification: Quality control and assurance responsibilities for preparation of Engineered Judgements of fire resistive materials required for the project.

.5 Technical Specifications Sections make specific reference to delegated design requirements described in this Section.

1.3 DEFINITIONS

.1 Delegated Design Professional Engineer: The professional engineer hired or contracted to the fabricator or manufacturer to design specialty elements, produce delegated design submittals and Shop Drawings to meet the requirements of the Project; who is registered in the province of the Work; and who is not the Departmental Representative.

.2 Technical Authority: as defined in the General Conditions of the Contract.

.3 Commitment to General Reviews by Architects and Engineers and Letter of General Conformance: Documents prepared by the delegated design professional engineer as recommended by PEO guidelines for providing general review of construction by the professional engineer.

.4 Engineered Judgement for Fire Rated Assembly Components: A written proposal submitted by manufacturer to the Authority Having Jurisdiction arising from a variation that modifies the manufacturer's standard listed assemblies and details to account for actual site conditions and as follows:

.1 Engineered Judgements are prepared by a certified specialist that has completed a sanctioned examination and has professional accreditation in the assemblies affected by site conditions different than those forming standard listed assemblies and details.

.2 Person issuing Engineered Judgement must be directly employed by the manufacturer and have direct experience in the preparation of Engineered Judgements required for the Project.

.3 Person signing the Engineered Judgement must be a Certified Fire Protection Specialist; Engineered Judgements do not require signature and seal of a professional engineer unless required by the Authority Having Jurisdiction.

1.4 REFERENCE STANDARDS

.1 Professional Engineers of Ontario (PEO:

.1 PEO Professional Engineers Reviewing Work Prepared by another Professional Engineer

.2 PEO Use of the Professional Engineer's Seal

1.5 SUBMITTALS

.1 Provide required information in accordance with Section 01 33 00.

.2 Informational Submittals: Provide the following submittals during the course of the Work:

.1 Commitment to General Reviews by Architects and Engineers: Submit a signed and completed Engineers, Architects and Building Officials (EABO) standard form Commitment to General Review by Architects and Engineers to Departmental Representative for submission to Authority Having Jurisdiction prior to starting Work requiring design and seal of a professional engineer.

1.6 PROJECT CLOSEOUT SUBMISSIONS

.1 Record Documentation: Submit the following required information in accordance with Section 01 78 00 before application for Substantial Performance of the Work:

.1 Letter of General Conformance: Submit a signed and sealed Letter of General Conformance on company letterhead addressed to Departmental Representative in accordance with format in Appendix A attached to the end of this Section on completion of Work requiring design and seal of a professional engineer.

.2 Engineered Judgements: Submit Product literature and compliance certificates as required by Section 07 84 00, and include any required Engineered Judgements that became necessary to account for installation conditions that are different than tested assemblies.

Part 2 PRODUCTS

2.1 DELEGATED DESIGN

.1 Performance and Design Criteria: Provide Products and systems complying with specific performance and design criteria indicated where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents.

.2 Submit a written request for additional information to Departmental Representative if criteria indicated within documents are not sufficient for the Contractor to perform services or certification required.

.3 Delegated design will be required for elements designed by a specialty professional, which may include:

.1 Elements normally fabricated off-site

.2 Elements that require specialized fabrication equipment or a proprietary fabrication process not usually available at job site (for example: open web steel joists, wood trusses, combination wood and metal or plywood joists, prefabricated wood or metal buildings, noise and vibration isolation devices, elevators).

.3 Elements requiring civil engineering, not normally a part of scope of services performed by architectural; structural; mechanical; electrical; or geotechnical disciplines of Departmental Representative (for example: structural steel connection design, steel deck design).

1 Execution

2.2 IMPLEMENTATION

.1 Include Summary of Work described in technical specification section as a part of the required Commitment to General Reviews by Architects and Engineers.

.2 Prepare required submittals and present to Departmental Representative within sufficient time to allow for Departmental Representative’s detailed review and acceptance.

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APPENDIX A

LETTER OF GENERAL CONFORMANCE - ONTARIO

[Date]

[Departmental Representative's Address]
Attention: [Technical Authority]

Re: Letter of General Conformance for Delegated Design of [System of Component of Work]

[Name of Project]
[Project Number]
[City, Province]

I hereby give assurance that I have fulfilled my obligations for field review as outlined by previously submitted Engineers, Architects and Building Officials (EABO) standard form Commitment to General Review by Architects and Engineers and as required by the Ontario Building Code.

During the course of construction of this project, personnel from our firm visited the site in order to carry out general review in accordance with the performance standards of the Professional Engineers of Ontario and the requirements of the Ontario Building Code. On the basis of our review, we have determined that the construction has been carried out in general conformity with the [specify description as appropriate to define area of review for delegated design undertaken] as required by the Contract Documents which formed the basis for the issuance of the building permit.

Retained Professional Engineer

Signature

Date

(Apply seal)

END OF SECTION

Part 1 GENERAL

1.1 REFERENCES

.1 Definitions:

.1 FSC - Forest Stewardship Council.

.2 CFC - Chlorofluorocarbons.

.3 Chain-of-Custody Certification - certificates signed by manufacturers certifying that wood used to make products was obtained from FSC certified forests. Certificates include evidence that mill is certified for chain-of-custody by FSC-accredited certification body.

.4 HCFC - Hydro Chlorofluorocarbons.

.5 Rapidly Renewable Materials - materials made from agricultural products that are typically harvested within a ten-year or shorter cycle. Rapidly renewable materials include but are not limited to products made from bamboo, cotton, flax, jute, straw, sunflower seed hulls, vegetable oils, and wool.

.6 Regionally Manufactured Materials - materials that are manufactured within a radius of 800 km, if transported by truck, or 2400 km if transported by rail or water from project location. Manufacturing refers to the final assembly of components into the building product that is installed at project site.

.7 Recycled Content - percentage by weight of constituents that have been recovered or otherwise diverted from solid waste stream, either pre-consumer or post-consumer.

.1 Wastes and scraps from manufacturing process that are combined with other materials after minimal amount of reprocessing for use in further production of same product are not recycled materials.

.2 Discarded materials from one manufacturing process that are used as materials in another manufacturing process are pre-consumer recycled materials.

.2 Reference Standards:

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

.1 ANSI/ASHRAE 52.2-2012, Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size (ANSI approved).

.2 ASTM International (ASTM)

.1 ASTM C1549-09 (2014), Standard Test Method for Determination of Solar Reflectance Near Ambient Temperature Using a Portable Solar Reflectometer.

.2 ASTM C1371-15, Standard Test Method for Determination of Emittance of Materials Near Room Temperature Using Portable Emissometers.

.3 ASTM E408-13, Standard Test Methods for Total Normal Emittance of Surfaces Using Inspection-Meter Techniques.

.4 ASTM E1918-06 (2015), Standard Test Method for Measuring Solar Reflectance of Horizontal and Low-Sloped Surfaces in the Field.

.3 Canada Green Building Council (CaGBC)

.1 LEED Canada-NC 2009, LEED (Leadership in Energy and Environmental Design): Green Building Rating System Reference Package For New Construction and Major Renovations (including Addenda).

.4 CSA International (CSA)

.1 CAN/CSA-ISO 14021-00(R2014), Environmental Labels and Declarations - Self-Declared Environmental Claims (Type II Environmental Labelling).

.2 CAN/CSA-Z809-08 (R2013), Sustainable Forest Management.

.5 Carpet and Rug Institute (CRI)

.1 CRI Green Label Indoor Air Quality (IAQ) Test Program - Green Label Testing Program.

.6 Forest Stewardship Council (FSC)

.1 FSC-STD-01-001-V4-0, FSC Principle and Criteria for Forest Stewardship.

.7 Green Seal Environmental Standards (GS)

.1 GS-11-11, Paints and Coatings.

.8 Scientific Certification Systems (SCS)

.1 FloorScore Certification.

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

.1 SCAQMD Rule 1113-A2016, Architectural Coatings.

.2 SCAQMD Rule 1168-A2016, Adhesives and Sealants Applications.

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

.1 ANSI/SMACNA 008-2008, IAQ Guideline for Occupied Buildings Under Construction.

.11 U.S. Environmental Protection Agency (EPA) Compendium of Methods for the Determination of Pollutants in Indoor Air

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00.

.2 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 Submit 2 copies of WHMIS MSDS.

.3 Shop Drawings:

.1 Submit drawings stamped and signed by professional engineer registered or licensed in Ontario of Canada.

.4 Sustainable Design Submittals:

.1 Submit required letters, calculations, spreadsheets and templates prepared by Departmental Representative for submittal to CaGBC.

.2 Submit additional LEED submittal requirements included in other sections.

.1 When submitted items are duplicated to that submitted to comply with other requirements, submit duplicate copies as separate submittals for compliance with indicated LEED requirements.

.3 Submit Project Cost Data: provide statement for total cost for building materials used for project. Include cost breakdown indicating total cost of mechanical and electrical components.

.4 Submit: LEED Action Plans: provide preliminary submittals within 14 days of date for start of Work indicating how the following requirements will be met.

.1 Materials and Resources Credit MR-2.1 Construction Waste Management: Divert 50% From Landfill and MR-2.2 Construction Waste Management: Divert 75% From Landfill prepare Construction Waste Management plan in accordance with Section 01 74 20.

.2 Materials and Resources Credit MR-4.1 Recycled Content 10% (post consumer + ½ post-industrial) and MR-4.2 Recycle Content 20% (post consumer + ½ post-industrial) Recycled Content.

.1 Submit list of recycled content products used, including details of required percentages or recycled content materials and products, showing costs and percentages of post-consumer and post-industrial content, and total cost of materials for project.

.2 Submit verification documentation, when Supplementary Cementing Materials (SCMs) are used, certifying reduction in cement from Base Mix to Actual SCMs Mix, as percentage.

.3 Materials and Resources Credit MR-5.1 Regional Materials: 10% Extracted and Manufactured Regionally and MR-5.2 Regionally Materials: 20% Extracted and Manufactured Regionally Regional Materials Submit list of proposed regionally manufactured materials and regionally extracted, harvested, and recovered materials.

.1 Submit verification that project incorporates required percentage of regional materials/products, showing cost, distance from project to furthest site of extraction or manufacture, and total cost of materials for project.

.4 Wood Certification: submit vendor's Chain-of-Custody Certificate number for CAN/CSA-Z809 or FSC or SFI certified wood.

.1 Submit vendor's FSC Chain-of-Custody Certificate number.

.1 Provide list of products containing wood.

.1 Indicate cost.

.5 Environment Quality Credit IEQ-3.1 Construction IAQ Management Plan. Submit Indoor Air Quality (IAQ) Plan for construction and pre-occupancy phases of construction.

.6 Low-Emitting Materials:

.1 Submit list of adhesives and sealants and paints and coatings and flooring used in building, showing compliance with VOC and chemical component limits or restriction requirements.

.2 Submit list of composite wood products used in building, stating that they contain no added urea-formaldehyde resins, and laminate adhesives used in building, stating that they contain no urea-formaldehyde.

.7 Submit LEED Progress Reports: with Applications for Progress Payments, submit reports comparing actual construction and purchasing activities with LEED action plans for the following:

.1 Materials and Resources Credit MR-2.1 Construction Waste Management: Divert 50% From Landfill and MR-2.2 Construction Waste Management: Divert 75% From Landfill Construction Waste Management. Submit Waste reduction progress reports in accordance with 01 74 20.

.2 Materials and Resources Credit MR-4.1 Recycled Content: 10% (post Consumer + ½ post-industrial) and 4.2 Recycle Content: 20% (post consumer + ½ post-industrial. Submit list of recycled content of materials.

.3 Materials and Resources Credit MR-5.1 Regionally Materials: 10 % Extracted and Manufactured Regionally and 5.2 Regionally Materials: 20% Extracted and Manufactured Regionally. Submit list of regionally manufactured materials and regionally extracted, harvested, or recovered materials.

.8 LEED Documentation Submittals:

.1 Submit product data for roofing materials for Sustainable Sites Credit SS-7.2 Heat Island Effect: Roof indicating Solar Reflective Index (SRI) of roofing materials as per ASTM E1980.

.2 Submit product data for lighting fixtures for Sustainable Sites Credit SS-8.0 Light Pollution Reduction. Submit data for exterior lighting fixtures.

.3 Submit product data for plumbing fixture for Water Efficiency Credits WEp1; WE-3.1 Water Use Reduction: 20% Reduction WE-3.2 Water Use Reduction: 30% Reduction. Submit Data for plumbing fixtures indicating water flow rates.

.4 Submit product data for Energy and Atmosphere Prerequisite EA-p3 CFC Reduction in HVAC&R Equipment and Elimination of Halons.

.1 Include product data for new HVAC equipment indicating absence of CFC refrigerants and Phase-out plan to replace CFC refrigerants in HVAC&R systems with CFC-free refrigerants within the Construction Period.

.5 Submit product data for Energy and Atmosphere Credit EA-4 Ozone Protection. Submit product data for new HVAC equipment indicating absence of HCFC refrigerants.

.6 Submit product data for Energy and Atmosphere Credit EA-5 Measurement and Verification. Submit product data and wiring diagrams for meters and data collection systems for metering of building energy and water consumption performance.

.7 Submit Construction Waste Management Plan for Materials and Resources Credit MR-2.1 Construction Waste Management: Divert 50% From Landfill and MR 2.2 Construction and Waste Management: Divert 75% From Landfill. Comply with Section 01 74 21 - Construction/Demolition Waste Management and Disposal. Include the following submittals:

.1 Submit product data and certification letters for Materials and Resources Credit MR-4.1 Recycled Content: 10% and MR-4.2 Recycled Content: 20%. Submit product data and certification letter indicating percentages by weight of post-consumer and pre-consumer recycled content for products having recycled content. Include statement indicating costs for products having recycled content.

.2 Submit product data for Materials and Resources Credit MR-5.1 Regional Materials: 10% Extracted and Manufactured Regionally and MR-5.2 Regional Materials: 20% Extracted and Manufactured Regionally. Submit product data indicating location of material manufacturer for regionally manufactured materials. Include the following:

.2 Statement indicating material cost, distance and mode of transportation from manufacturer to project for each regionally manufactured material.

.3 Statement indicating cost and distance from point of extraction, harvest, or recovery to project for each raw material used in regionally manufactured materials.

.3 Submit product data and certificates for Materials and Resources Credit MR-7 Certified Wood. Submit product data and certificates of chain-of-custody for products containing certified wood.

.4 Include statement indicating costs for products containing certified wood.

.5 Include statement indicating total cost for wood-based materials used for project.

.8 Submit product data and shop drawing for Indoor Environmental Quality Credit EQ-1 Carbon Dioxide (CO_2) Monitoring product data and shop drawings for carbon dioxide monitoring system.

.9 Provide submittals for Indoor Environmental Quality Credit EQ-3.1 Construction IAQ Management Plan. Include the following:

.1 Construction indoor air quality management plan.

.2 MERV rating for temporary filtration media as per ASHRAE 52.2. used during construction period.

.3 Product data for filtration media installed before occupancy.

.4 Construction documentation submit 6 photographs at 3 different times during construction along with description of utilized IAQ measures in accordance with SMACNA, documenting protection of ducts and on-site stored or installed absorptive materials from moisture.

.10 Provide submittals for Indoor Environmental Quality Credit EQ-3.2 Construction IAQ Management plan: Testing Before Occupancy. Include the following:

.1 Signed statement describing building air flush-out procedures including start and completion dates of flush out and statement that filtration media was replaced after flush-out.

.2 Product data for filtration media used during flush-out and during occupancy.

.3 Report from testing and inspecting agency indicating results of IAQ testing and documentation showing conformance with IAQ testing procedures and requirements as per the US Environmental Protection Agency Compendium for the Determination of Indoor Air Pollutants.

.11 Submit product data for Indoor Environmental Quality Credit EQ-4.1 Low-Emitting Materials: Adhesives and Sealants. Submit product data for interior adhesives and sealants indicating VOC content of product used. Indicate VOC content in g/L calculated in accordance with SCAQMD Rule 1168.

.12 Submit product data for Indoor Environmental Quality Credit EQ-4.2 Low-Emitting Materials: Paints and Coatings. Submit product data for interior paints and coatings indicating chemical composition and VOC content for products used. Indicate VOC content in g/L calculated in accordance with GS-11 and SCAQMD Rule 1113.

.13 Submit product data for indoor Environmental Quality Credit EQ-4.3 Low-Emitting Materials: Flooring. Submit product data for carpet products indicating VOC content in accordance with CRI Green Label Indoor Air Quality Test Program.

.14 Submit product data for Indoor Environmental Quality Credit EQ-4.4 Low-Emitting Materials: Composite Wood and Laminates Adhesives. Submit product data for composite wood and agrifiber products indicating products contain no urea-formaldehyde resins.

.1 Include product data for adhesives use in fabrication of laminated assemblies.

.15 Submit product data and shop drawing for Indoor Environmental Quality Credit EQ-6.2 Controllability of Systems: Non-Perimeter Spaces. Submit product data and shop drawings for sensors and control systems used for individual airflow, temperature and lighting equipment.

.16 Submit product data and shop drawings for Indoor Environmental Quality Credit EQ-7.2 Thermal Comfort: Monitoring. Submit product data and shop drawings for permanent monitoring sensors and controls system for temperature and humidity.

Part 2 PRODUCTS

2.1 RECYCLED CONTENT OF MATERIALS

.1 Materials and Resources Credit MR-4.1 Recycled Content: 10% (post-consumer + ½ post industrial). Supply building materials with a minimum post-consumer recycled content of 5% of cost of project materials or with a minimum post-consumer recycled content plus 1/2 pre-consumer recycled content of 10% of cost of project materials.

.2 Materials and Resources Credits MR4-1 Recycled Content: 10 % (post-consumer + ½ post industrial) and MR4-2 Recycled Content: 20% (post-consumer + ½ post industrial). Supply building materials with a minimum post-consumer recycled content of 10% of cost of project materials or with a minimum post-consumer recycled content plus 1/2 pre-consumer recycled content of 20% of cost of project materials.

.1 Cost of post consumer recycled content plus one-half of pre-consumer recycled content of materials will be determined by dividing weight of post-consumer recycled content plus one-half of pre-consumer recycled content in material by total weight of material and multiplying by cost of material.

.2 Do not include mechanical and electrical components in calculations.

.3 Recycled content of materials in accordance with CAN/CSA-ISO 1402.

2.2 REGIONAL MATERIALS

.1 Materials and Resources Credit MR5-1 Regional Materials: 20 % Extracted and Manufactured Regionally. Supply 20% of building materials (by cost) that are regionally manufactured.

.2 Materials and Resources Credit MR5-2 Regional Materials: 30% Extracted and Manufactured Regionally. Regionally manufactured materials required by paragraph 2.3.1, supply 50% (by cost) of building materials that are regionally extracted, harvested, or recovered.

2.3 CERTIFIED WOOD

.1 Materials and Resources Credit MR-7 Certified Wood. Supply a minimum of 50% (by cost) of wood-based materials that are produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC Principles and Criteria.

.1 Wood-based materials include but not limited to the following materials when made from made wood, engineered wood products, or wood-based panel products:

.1 Rough carpentry.

.2 Miscellaneous carpentry.

.3 Wood decking.

.4 Finish carpentry.

.5 Architectural woodwork.

.6 Wood flooring.

.7 Non-rented temporary construction, including bracing, concrete formwork, pedestrian barriers, and temporary protection.

2.4 LOW-EMITTING MATERIALS

.1 Indoor Environmental Quality Credit EQ4-1 Low-Emitting Materials: Adhesives and Sealants. Interior applications requiring adhesives, sealants and sealant primers must comply with SCAQMD Rule 1168.

.2 Indoor Environmental Quality Credit EQ4-2 Low-Emitting Materials: Paints and Coatings. Interior applications use paints and coatings must comply with the following limits for VOC content when calculated according to GS-11 and SCAQMD Rule 1113.

.3 Indoor Environmental Quality Credit EQ4-3 Low-Emitting Materials: Flooring.

.1 All carpet must be in compliance with the Carpet and Rug Institute's Green Label Certification Program.

.2 Hard surface flooring is to be in compliance with the Scientific Certification Systems FloorScore Program.

.4 Indoor Environmental Quality Credit EQ4-4 Low Emitting Materials: Composite Wood and Laminate Adhesives. Do not use composite wood and agrifiber products that contain urea-formaldehyde resins.

Part 3 EXECUTION

3.1 REFRIGERANTS AND CLEAN-AGENT FIRE-EXTINGUISHING- AGENTS REMOVAL

.1 Prerequisite EA-3 CFC Reduction in HVAC&R Equipment and Elimination of Halons.

.1 Remove CFC-based refrigerants from existing HVAC and refrigeration equipment indicated to remain and replace with non CFC based refrigerants.

.2 Replace or adjust existing equipment to accommodate new refrigerant as described in Division 23.

.2 Credit EA-4 Ozone Protection. Remove HCFC-based refrigerants from existing HVAC and refrigeration equipment indicated to remain and replace with non HCFC based refrigerants.

.1 Replace or adjust equipment to accommodate new refrigerant.

.2 Remove clean-agent fire-extinguishing agents that contain HCFCs or halons, and replace with agent that does not contain HCFCs or halons.

.3 Refer to Division 23 and 42 Sections.

.4 Refer to Section 21 22 00 for additional requirements.

3.2 CONSTRUCTION WASTE MANAGEMENT

.1 Credit MR-2.1 Construction Waste Management: Divert 50% From Landfill and MR-2.2 Divert 75% From Landfill. Comply with Section 01 74 20.

3.3 CONSTRUCTION INDOOR AIR QUALITY MANAGEMENT

.1 Credit EQ3-1 Construction IAQ Management Plan: During Construction. Comply with SMACNA IAQ Guideline for Occupied Buildings under Construction.

.2 Obtain written approval from Departmental Representative to operate permanent HVAC systems during construction. Operate permanent HVAC systems in accordance with Section 23 05 01. Install MERV-8 filter media in accordance with ASHRAE 52.2 at return-air inlets

.1 Replace air filters immediately prior to building air flush-out. Replacement air filters to be MERV-8 in accordance with ASHRAE 52.2.

.3 Credit EQ-3.2 Construction IAQ Management Plan: Testing Before Occupancy.

.1 Conduct 2-week building air flush-out upon construction completion with new air filters and 100 % outdoor air. Replace air filters after air flush-out. Replacement air filters to have a MERV-8 according to ASHRAE 52.2.

END OF SECTION

Part 1 GENERAL

1.1 REFERENCES

.1 Canadian Standards Association (CSA): Canada

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

.2 National Building Code 2015 (NBC):

.1 NBC 2015, Division B, Part 8 Safety Measures at Construction and Demolition Sites.

.3 National Fire Code 2015 (NFC):

.1 NFC 2015, Division B, Part 5 Hazardous Processes and Operations, subsection 5.6.1.3 Fire Safety Plan.

.4 Province of Ontario:

.1 Occupational Health and Safety Act Revised Statutes of Ontario 1990, Chapter O.1 as amended, and Regulations for Construction Projects, O. Reg. 213/91 as amended.

.2 O. Reg. 490/09, Designated Substances.

.3 Workplace Safety and Insurance Act, 1997.

.4 Municipal statutes and authorities.

.5 Treasury Board of Canada Secretariat (TBS):

.1 Treasury Board, Fire Protection Standard April 1, 2010 www.tbs-sct.gc.ca/pol/doc-eng.aspx ?id=17316&section=text.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00.

.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 Measures and controls to be implemented to address identified safety hazards and risks.

.3 Provide a Fire Safety Plan, specific to the work location, in accordance with NBC, Division B, Article 8.1.1.3 prior to commencement of work. The plan shall be coordinated with, and integrated into, the existing Building, Facility, Tenant's Emergency Procedures and Evacuation Plan in place at the site. Departmental Representative will provide Building, Facility, Tenant's Emergency Procedures and Evacuation Plan. Deliver two copies of the Fire Safety Plan to the Departmental Representative not later than 14 days before commencing work.

.4 Contractor's and Sub-contractors' Safety Communication Plan.

.5 Contingency and Emergency Response Plan addressing standard operating procedures specific to the project site to be implemented during emergency situations. Coordinate plan with existing Building, Facility, Tenant's Emergency Response requirements and procedures provided by Departmental Representative.

.6 Departmental Representative will review Contractor's site-specific Health and Safety Plan and provide comments to Contractor within 10 days after receipt of plan. Revise plan as appropriate and resubmit plan to Departmental Representative within 5 days after receipt of comments from Departmental Representative.

.7 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.

.8 Submit names of personnel and alternates responsible for site safety and health.

.9 Submit records of Contractor's Health and Safety meetings when requested.

.10 Submit one (1) electronic copy of Contractor's authorized representative's work site health and safety inspection reports to Departmental Representative weekly.

.11 Submit copies of orders, directions or reports issued by health and safety inspectors of the authorities having jurisdiction.

.12 Submit copies of incident and accident reports within 72 hours of incident.

.13 Submit Material Safety Data Sheets (MSDS).

.14 Submit Workplace Safety and Insurance Board (WSIB) - Experience Rating Report.

1.3 FILING OF NOTICE

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

.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 WORK PERMIT

.1 Obtain Hot Work Permit from Departmental Representative.

1.5 SAFETY ASSESSMENT

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

1.6 MEETINGS

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

1.7 REGULATORY REQUIREMENTS

.1 Comply with the Acts and regulations of the Province of Ontario.

.2 Comply with specified standards and regulations to ensure safe operations at site.

1.8 PROJECT/SITE CONDITIONS

.1 Work at site may involve contact with:

.1 Silica in concrete and concrete block.

.2 Mercury in fluorescent light tubes, boiler and air handling unit control equipment and laboratory drain pipes.

.3 Asbestos in pipe covering, vinyl sheet flooring, vinyl composition tiles, gypsum board joint compound, plaster and parging cement.

.4 Lead in paint, solder caulking in ball fittings of cast iron pipes, lead acid batteries and solder used on domestic water lines.

1.9 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 either accepting or requesting improvements.

.3 Relief from or substitution for any portion or provision of minimum Health and Safety standards specified herein or reviewed site-specific Health and Safety Plan shall be submitted to Departmental Representative in writing.

1.10 COMPLIANCE REQUIREMENTS

.1 Comply with Ontario Occupational Health and Safety Act, R.S.O. 1990 Chapter 0.1, as amended.

1.11 RESPONSIBILITY

.1 Be responsible for health and safety of persons on site, safety of property on site and for protection of persons adjacent to site and environment to extent that they may be affected by conduct of Work.

.2 Comply with and enforce compliance by employees with safety requirements of Contract Documents, applicable federal, provincial, territorial and local statutes, regulations, and ordinances, and with site-specific Health and Safety Plan.

.3 Where applicable the Contractor shall be designated "Constructor", as defined by Occupational Health and Safety Act and Regulations for Construction Projects for the Province of Ontario.

1.12 UNFORSEEN HAZARDS

.1 Should any unforeseen or peculiar safety-related factor, hazard, or condition become evident during performance of Work, immediately stop work and advise Departmental Representative verbally and in writing.

.2 Follow procedures in place for Employees Right to Refuse Work as specified in the Occupational Health and Safety Act for the Province of Ontario.

1.13 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.

.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 and report directly to and be under direction of site supervisor.

1.14 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 Contractor's Safety Policy.

.2 Constructor's Name.

.3 Notice of Project.

.4 Name, trade, and employer of Health and Safety Representative or Joint Health and Safety Committee members (if applicable).

.5 Ministry of Labour Orders and reports.

.6 Occupational Health and Safety Act and Regulations for Construction Projects for Province of Ontario.

.7 Address and phone number of nearest Ministry of Labour office.

.8 Material Safety Data Sheets.

.9 Written Emergency Response Plan.

.10 Site Specific Safety Plan.

.11 Valid certificate of first aider on duty.

.12 WSIB "In Case of Injury At Work" poster.

.13 Location of toilet and cleanup facilities.

1.15 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.

1.16 POWDER ACTUATED DEVICES

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

1.17 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 Assign responsibility and obligation to Health and Safety Coordinator or Competent Supervisor to stop or start Work when, at Health and Safety Coordinator's or Competent Supervisor's discretion, it is necessary or advisable for reasons of health or safety. Departmental Representative may also stop Work for health and safety considerations.

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 GENERAL

.1 This section specifies general requirements and procedures for fire safety. Additional requirements may be specified in individual sections elsewhere in specifications.

1.2 REPORTING FIRES

.1 The Departmental Representative will co-ordinate arrangements for the Contractor to be briefed at the pre-construction meeting concerning Building's fire safety protocol.

.2 Departmental Representative will supply a copy of "Fire Safety Emergency Evacuation Plan" in effect for this building. Contractor shall comply with outlined fire safety requirements.

.3 Know location of nearest fire alarm box and telephone, including emergency phone number.

.4 Report immediately all fire incidents to Fire Department as follows:

.1 activate nearest fire alarm box; or

.2 telephone.

.5 Person activating fire alarm box will remain at box to direct Fire Department to scene of fire.

.6 When reporting fire by telephone, give location of fire, name or number of building and be prepared to verify the location.

1.3 FIRE WATCH

.1 Appoint a Fire Watch at locations where welding and soldering, torching or roofing is to take place.

.2 A dedicated Fire Watch is not required. A competent person from the workforce on site may be assigned as Fire Watch for duration of work.

.3 Assign a person who is knowledgeable in the correct use of fire extinguishers on the project.

.4 Have work inspected by the Fire Watch up to 1.5 hours after work stoppage for each work period.

1.4 INTERIOR AND EXTERIOR FIRE PROTECTION AND ALARM SYSTEMS

.1 Fire protection and alarm system will not be:

.1 obstructed;

.2 shut-off; or

.3 left inactive at end of working day or shift.

.2 Fire hydrants, standpipes and hose systems will not be used for other than fire-fighting purposes unless authorized by Departmental Representative.

.3 Provide and maintain free access to fire extinguishing equipment. Maintain exit facilities. Keep means of egress free from materials, equipment and obstructing.

1.5 FIRE EXTINGUISHERS

.1 Supply fire extinguishers, as necessary to protect work in progress and contractor's physical plant on site.

1.6 INSTALLATION AND/OR REPAIR OF ROOF TO INCLUDE CONTRACTORS PHYSICAL PLANT AT SITE

.1 Ensure personnel use and take precautions as follows:

.1 Use kettles equipped with thermometers or gauges in good working order.

.2 Locate kettles in safe place outside of building. Locate to avoid danger of igniting combustible material.

.3 Maintain continuous supervision while kettles are in operation and provide metal covers for kettles to smother any flames in case of fire. Fire extinguishers shall be provided as required in 1.5.

.4 Prior to start of work, demonstrate container capacities to Departmental Representative.

.5 Use only glass fibre roofing mops.

.6 Used roofing mops will not be left unattended on roof and shall be stored away from building and combustible materials.

.7 All roofing materials will be stored in location no closer than 3 m to any structures.

1.7 BLOCKAGE OF ROADWAYS

.1 Advise Departmental Representative of any work that would impede fire apparatus response. This includes violation of minimum required overhead clearance and coordinate with City of St. Catharines.

1.8 SMOKING PRECAUTIONS

.1 Smoking is not permitted within areas of work or site storage.

1.9 RUBBISH AND WASTE MATERIALS

.1 Rubbish and waste materials are to be kept to a minimum.

.2 Burning of rubbish is prohibited.

.3 Remove all rubbish from work site at end of work day or shift or as directed.

.4 Storage:

.1 Store oily waste in approved receptacles to ensure maximum cleanliness and safety.

.2 Deposit greasy or oily rags and materials subject to spontaneous combustion in approved receptacles and remove from site daily or at the end of each shift.

1.10 FLAMMABLE AND COMBUSTIBLE LIQUIDS

.1 Handling, storage and use of flammable and combustible liquids are to be governed by the current National Fire Code of Canada.

.2 Flammable and combustible liquids such as gasoline, kerosene and naphtha will be kept for ready use in quantities not exceeding 45 litres provided they are stored in approved safety cans bearing Underwriters' Laboratory of Canada or Factory Mutual seal of approval. Storage of quantities of flammable and combustible liquids exceeding 45 litres for work purposes requires permission of Departmental Representative.

.3 Transfer of flammable and combustible liquids is prohibited within buildings or jetties.

.4 Transfer of flammable and combustible liquids will not be carried out in vicinity of open flames or any type of heat-producing devices.

.5 Flammable liquids having a flash point below 38°C such as naphtha or gasoline will not be used as solvents or cleaning agents.

.6 Flammable and combustible waste liquids, for disposal, will be stored in approved containers located in a safe ventilated area. Quantities are to be kept to a minimum and Fire Department is to be notified when disposal is required.

1.11 HAZARDOUS SUBSTANCES

.1 Work entailing use of toxic or hazardous materials, chemicals and/or explosives, or otherwise creating hazard to life, safety or health, will be in accordance with National Fire Code of Canada.

.2 Obtain from Departmental Representative a "Hot Work" permit for work involving welding, burning or use of blow torches and salamanders, in buildings or facilities.

.3 When Work is carried out in dangerous or hazardous areas involving use of heat, provide fire watchers equipped with sufficient fire extinguishers. Determination of dangerous or hazardous areas along with level of protection necessary for Fire Watch is at discretion of the Departmental Representative. Contractors are responsible for providing fire watch service for work on a scale established and in conjunction with Departmental Representative at pre-construction meeting.

.4 Where flammable liquids, such as lacquers or urethanes are to be used, proper ventilation will be assured and all sources of ignition are to be eliminated. Departmental Representative is to be informed prior to and at cessation of such work.

1.12 WELDING, BURNING AND CUTTING

.1 Contractor performing work of this section must notify Departmental Representative in advance of commencing work.

.2 Use non-combustible shields for electric and gas welding or cutting executed within 3 m of combustible material or in occupied spaces.

.3 Place cylinders supplying gases as close to work as possible. Secure cylinders in upright position, free from exposure to sun or high temperature.

.4 Locate fire extinguishing equipment near all welding, cutting and soldering operations.

.5 Contractor's mechanics shall be properly equipped with required protective clothing, including goggles or welding hood or face mask, gloves, etc.

.6 Contractor is responsible for the protection of his work and the Departmental Representative's property.

.7 Provide Fire Watch on standby with approved fire extinguisher while burning or welding is in progress.

1.13 QUESTIONS AND/OR CLARIFICATIONS

.1 Direct any questions or clarification on Fire Safety in addition to above requirements to Departmental Representative.

1.14 FIRE INSPECTION

.1 Site inspections by Departmental Representative will be coordinated through Departmental Representative and PWGSC Fire Protection Engineer.

.2 Allow Departmental Representative unrestricted access to work site.

.3 Co-operate with Departmental Representative during routine fire safety inspection of work site.

.4 Immediately remedy all unsafe fire situations observed by Departmental Representative.

Part 2 PRODUCTS

2.1 NOT USED

.1 Not used.

Part 3 EXECUTION

3.1 NOT USED

.1 Not used.

END OF SECTION

Part 1 GENERAL

1.1 RELATED REQUIREMENTS

.1 Section 01 35 21 - LEED Requirements

1.2 DEFINITIONS

.1 Environmental Pollution and Damage: presence of chemical, physical, biological elements or agents which adversely affect human health and welfare; unfavourably alter ecological balances of importance to human life; affect other species of importance to humans; or degrade environment aesthetically, culturally and/or historically.

.2 Environmental Protection: prevention/control of pollution and habitat or environment disruption during construction.

1.3 REFERENCES

.1 Canada Green Building Council (CaGBC)

.1 LEED Canada 2009 for Design and Construction, LEED Canada 2009 for Design and Construction Leadership in Energy and Environmental Design Green Building Rating System Reference Guide

1.4 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00.

.2 Sustainable Design Submittals:

.1 LEED Canada submittals: in accordance with Section 01 35 21.

.3 Before commencing construction activities or delivery of materials to site, submit Environmental Protection Plan for review by Departmental Representative.

.4 Environmental Protection Plan must include comprehensive overview of known or potential environmental issues to be addressed during construction.

.5 Address topics at level of detail commensurate with environmental issue and required construction tasks.

.6 Include in Environmental Protection Plan:

.1 Names of persons responsible for ensuring adherence to Environmental Protection Plan.

.2 Names and qualifications of persons responsible for manifesting hazardous waste to be removed from site.

.3 Names and qualifications of persons responsible for training site personnel.

.4 Descriptions of environmental protection personnel training program.

.5 Erosion and sediment control plan identifying type and location of erosion and sediment controls to be provided including monitoring and reporting requirements to assure that control measures are in compliance with erosion and sediment control plan, Federal, Provincial, and Municipal laws and regulations.

.6 Drawings indicating locations of proposed temporary excavations or embankments for haul roads, stream crossings, material storage areas, structures, sanitary facilities, and stockpiles of excess or spoil materials including methods to control runoff and to contain materials on site.

.7 Traffic Control Plans including measures to reduce erosion of temporary roadbeds by construction traffic, especially during wet weather.

.1 Plans to include measures to minimize amount of material transported onto paved public roads by vehicles or runoff.

.8 Work area plan showing proposed activity in each portion of area and identifying areas of limited use or non-use.

.1 Plan to include measures for marking limits of use areas and methods for protection of features to be preserved within authorized work areas.

.9 Spill Control Plan to include procedures, instructions, and reports to be used in event of unforeseen spill of regulated substance.

.10 Non-Hazardous solid waste disposal plan identifying methods and locations for solid waste disposal including clearing debris.

.11 Air pollution control plan detailing provisions to assure that dust, debris, materials, and trash, are contained on project site.

.12 Contaminant Prevention Plan identifying potentially hazardous substances to be used on job site; intended actions to prevent introduction of such materials into air, water, or ground; and detailing provisions for compliance with Federal, Provincial, and Municipal laws and regulations for storage and handling of these materials.

.13 Waste Water Management Plan identifying methods and procedures for management and discharge of waste waters which are directly derived from construction activities, such as concrete curing water, clean-up water, dewatering of ground water, disinfection water, hydrostatic test water, and water used in flushing of lines.

.14 Historical, archaeological, cultural resources biological resources and wetlands plan that defines procedures for identifying and protecting historical, archaeological, cultural resources, biological resources and wetlands.

.15 Pesticide treatment plan to be included and updated, as required.

1.5 FIRES

.1 Fires and burning of rubbish on site is not permitted.

1.6 DRAINAGE

.1 Develop and submit erosion and Sediment Control Plan (ESC) identifying type and location of erosion and sediment controls provided. Plan to include monitoring and reporting requirements to assure that control measures are in compliance with erosion and sediment control plan, Federal, Provincial, and Municipal laws and regulations.

.2 Storm Water Pollution Prevention Plan (SWPPP) to be substituted for erosion and sediment control plan.

.3 Provide temporary drainage and pumping required to keep excavations and site free from water.

.4 Ensure pumped water into waterways, sewer or drainage systems is free of suspended materials.

.5 Control disposal or runoff of water containing suspended materials or other harmful substances in accordance with local authority requirements.

1.7 SITE CLEARING AND PLANT PROTECTION

.1 Protect trees and plants on site and adjacent properties as indicated.

.2 Protect trees and shrubs adjacent to construction work, storage areas and trucking lanes, and encase with protective wood framework from grade level to height of 2 m minimum.

.3 Protect roots of designated trees to dripline during excavation and site grading to prevent disturbance or damage.

.1 Avoid unnecessary traffic, dumping and storage of materials over root zones.

.4 Minimize stripping of topsoil and vegetation.

1.8 POLLUTION CONTROL

.1 Maintain temporary erosion and pollution control features installed under this Contract.

.2 Control emissions from equipment and plant in accordance with local authorities' emission requirements.

.3 Prevent sandblasting and other extraneous materials from contaminating air and waterways beyond application area.

.1 Provide temporary enclosures where directed by Departmental Representative.

.4 Cover or wet down dry materials and rubbish to prevent blowing dust and debris. Provide dust control for temporary roads.

1.9 HISTORICAL/AND ARCHAEOLOGICAL CONTROL

.1 Provide historical, archaeological, cultural resources, biological resources, and wetlands plan that defines procedures for identifying and protecting historical, archaeological, cultural resources, biological resources and wetlands known to be on project site: and identifies procedures to be followed if historical archaeological, cultural resources, biological resources and wetlands not previously known to be onsite or in area are discovered during construction.

.2 Plan: include methods to assure protection of known or discovered resources and identify lines of communication between Contractor personnel and Departmental Representative.

1.10 NOTIFICATION

.1 Departmental Representative will notify Contractor in writing of observed noncompliance with Federal, Provincial or Municipal environmental laws or regulations, permits, and other elements of Contractor's Environmental Protection plan.

.2 Contractor: after receipt of such notice, inform Departmental Representative of proposed corrective action and take such action for approval by Departmental Representative.

.1 Take action only after receipt of written approval by Departmental Representative.

.3 Departmental Representative will issue stop order of work until satisfactory corrective action has been taken.

.4 No time extensions granted or equitable adjustments allowed to Contractor for such suspensions.

Part 2 PRODUCTS

2.1 NOT USED

.1 Not Used.

Part 3 EXECUTION

3.1 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11.

.1 Leave Work area clean at end of each day.

.2 Bury rubbish and waste materials on site where directed after receipt of written approval from Departmental Representative.

.3 Ensure public waterways, storm and sanitary sewers remain free of waste and volatile materials disposal.

.4 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11.

.5 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 20.

.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

Part 1 GENERAL

1.1 REFERENCES AND CODES

.1 Perform Work in accordance with National Building Code of Canada (NBC) 2015, National Fire Code of Canada (NFC) 2015 and Ontario Building Code (OBC) 2012, including all amendments up to bid closing date and other codes of provincial or local application provided that in case of conflict or discrepancy, more stringent requirements apply as directed by the Departmental Representative.

.2 Meet or exceed requirements of:

.1 Contract documents.

.2 Specified standards, codes and referenced documents.

1.2 HAZARDOUS MATERIAL DISCOVERY

.1 Stop work immediately and notify Departmental Representative if materials which may contain designated substances or PCB's, other than those identified in Section 01 35 29 are discovered in course of work.

1.3 BUILDING SMOKING ENVIRONMENT

.1 Comply with smoking restrictions.

1.4 IAQ - INDOOR AIR QUALITY

.1 Comply with CSA-Z204-94(R1999), Guideline for Managing Indoor Air Quality in Office Buildings and CSA B651-12 including Annex A.

1.5 ACCESSIBLE DESIGN

.1 Comply with CSA B651-12, Accessible Design for the Built Environment, unless specified otherwise. In any case of conflict or discrepancy between the building codes and CSA B651, the requirements of CSA B651 shall apply.

1.6 STATISTICAL INFORMATION

.1 Provide statistical information to Departmental Representative:

.1 Within ten working days after March 31 and September 30 occurring between commencement of work and final completion

.2 Within ten working days after final completion.

.2 Include in statistical information:

.1 Statement of total person days of labour used on site in performance of contract, including labour provided under sub-contracts.

.2 Estimate of total value in dollars of material delivered to site and installed, including material provided and installed under sub-contracts.

.3 This information is required by Government of Canada solely to provide statistics that will aid in assessing socio-economic benefits of this project.

1.7 TAXES

.1 Pay applicable Federal, Provincial and Municipal taxes.

1.8 EXAMINATION

.1 Examine existing conditions and determine conditions affecting work.

.2 Conduct concrete floor moisture testing using Calcium Chloride moisture tests.

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 ABBREVIATIONS AND ACRONYMS

.1 The abbreviations and acronyms are commonly found in the Project Manual and represent the associated organizations or terms.

1.2 MATERIALS, EQUIPMENT AND METHODS

.1 A:

.1 AB: anchor bolt.
.2 AC: acoustic.
.3 AC PAN: acoustic panel.
.4 ACU: acoustic unit ceiling.
.5 AFF: above finished floor.
.6 AC PLAS: acoustic plaster.
.7 ACT: acoustic tile.
.8 ACR CU LVR: acrylic cube louvre.
.9 ADH: adhesive.
.10 ADJ: adjustable.
.11 A/C: air conditioner.
.12 AHU: air handling unit.
.13 AL: aluminum.
.14 ANOD: anodized.
.15 APPROX: approximate.
.16 ARCH: architecture.
.17 ARCH BLK: architectural block.
.18 AVB: air vapour barrier.

.2 B:

.1 B: base.
.2 BEAST: benthic assessment of sediment.
.3 BH: bore hole.
.4 BHP: brake horse power.
.5 BL: bottom layer.
.6 BLK: block.
.7 BLKD: bulkhead.
.8 BM: beam.
.9 BOT: bottom.
.10 BMP: best management practice.
.11 B PL: base plate.

.12 BRG: bearing.
.13 BRK: brick.
.14 BSMT: basement.
.15 BTEX: benzene, toluene, ethylbenzene and xylenes.
.16 BUR: built-up roof.

.3 C:

.1 CAL: caliper.
.2 CANTIL: cantilever.
.3 CB: catch basin.
.4 CC: centre to centre.
.5 CCN: contemplated change notice.
.6 CDF: controlled density fill.
.7 CEC: Canadian Electrical Code.
.8 CF: chair fabric.
.9 CHAN: channel.
.10 CHS: Canadian hydrographic service.
.11 CJ: construction joint.
.12 CL: centreline.
.13 CK: cork.
.14 CLG: ceiling.
.15 CLR: clear.
.16 COL: column.
.17 CONC: concrete.
.18 CONC BLK: concrete block.
.19 CONC BRK: concrete brick.
.20 CONT: continuous.
.21 CONT J: control joint.
.22 COMPL: complete.
.23 CM: centimetre. (Nursery stock).
.24 CP: circulating pump.
.25 CPL: cement plaster.
.26 CPM: critical path method.
.27 CPT: carpet.
.28 CPTT: carpet tile.
.29 CT: ceramic tile.
.30 CTE: connect to existing.
.31 CV: control valve.
.32 CVT: conductive vinyl tile.
.33 C/W: complete with.

.4 D:

.1 D: deep.
.2 dB: decibels.
.3 DB: dry-bulb.
.4 DD: dutch door.
.5 DEG: degree.
.6 DF: drinking fountain.
.7 DIA: diameter.
.8 DIM: dimension.
.9 DL: dead load.
.10 DMNT: demountable.
.11 DP: dampproofing.
.12 DR: door.
.13 DRP: drapery.
.14 DWL: dowel.

.5 E:

.1 EA: each.
.2 EC: epoxy coating.
.3 ECF: engineered containment facility.
.4 EE: each end.
.5 EF: each face (architectural/structural).
.6 EF: exhaust fan (mechanical/electrical).
.7 EL: elevation.
.8 ELEC: electric.
.9 ELEV: elevator.
.10 EM: expanded metal.
.11 ENCL: enclosure.
.12 EQ: equal.
.13 ET: expansion tank.
.14 EXH: exhaust.
.15 EXIST: existing.
.16 EXPJ: expansion joint.
.17 EXP STRUCT: exposed structure.
.18 EXT: exterior.
.19 EW: each way.
.20 EWT: entering water temperature.

.6 F:

.1 FC: fuel contributed.
.2 FD: floor drain.

.3 FDN: foundation.
.4 FEAT W: feature wall.
.5 FEXT: fire extinguisher.
.6 FH: fire hose.
.7 FHC: fire hose cabinet.
.8 FHR: fire hose rack.
.9 FIN: finish.
.10 FIP: federal identity program.
.11 FL: floor.
.12 FLD: field.
.13 FLUOR: fluorescent.
.14 FR: frame.
.15 FRR: fire resistance rating.
.16 FTG: footing.

.7 G:

.1 GALV: galvanized steel.
.2 GB: grab bar.
.3 GBD: gypsum board.
.4 GC: General Conditions.
.5 GF: ground floor.
.6 GFCI: ground fault circuit interrupter.
.7 GL: glass or glazing.
.8 GL BLK: glass block.
.9 GPC: gypsum plaster ceiling.
.10 GPW: gypsum plaster wall.
.11 GT: glass tile.

.8 H:

.1 HB: hose bib.
.2 HC: hollow core.
.3 HCWD: hollow core wood door.
.4 HD: hand dryer.
.5 HDW: hardware.
.6 HDWD: hardwood.
.7 HEX: heat exchanger.
.8 HM: hollow metal.
.9 HOR: horizontal.
.10 HOR EF: horizontal each face.
.11 HP: hydro pole.
.12 HPA: Hamilton Port Authority.

.13 HR: hour.
.14 HRV: heat recovery ventilator.
.15 HT: height.
.16 HTR: heater.
.17 HUM: humidifier.
.18 HWT: hot water tank.
.19 HYD: hydrant.
.20 HZ: Hertz frequency, cycles per second.

.9 I:

.1 ICF: insulated concrete formwork.
.2 ID: inside diameter.
.3 INS: insulation.
.4 INTLK: interlock.

.10 J:

.1 JT: joint.

.11 K:

.1 KPL: kick plate.

.12 L:

.1 LAT: leaving air temperature.
.2 LAV: lavatory.
.3 LDG: landing.
.4 LG: long.
.5 LINO: linoleum.
.6 LL: live load.
.7 LT: light.
.8 LWT: leaving water temperature.

.13 M:

.1 MAS: masonry.
.2 MAS FL: masonry flashing.
.3 MAX: maximum.
.4 MBG: metal bar grating.
.5 MCL: metal cube louvre.
.6 MECH: mechanical.
.7 MET: metal.
.8 MET DK: metal deck.
.9 MET FL: metal flashing.
.10 MET GRID CLG: metal grid ceiling.
.11 MET GRTG: metal grating.

.12 MET LIN CLG: metal linear ceiling.
.13 MET T PTN: metal toilet partition.
.14 MH: maintenance hole.
.15 MIN: minimum.
.16 MLP: metal lath and plaster.
.17 MO: masonry opening.
.18 MR: marble.
.19 MT: metal threshold.
.20 MWP: membrane waterproofing.

.14 N:

.1 NBC: national building code.
.2 NC: normally closed.
.3 NF: near face.
.4 NFC: national fire code.
.5 NIC: not in contract.
.6 NO: number.
.7 NRC: noise reduction coefficient.
.8 NRP: non removable pin.
.9 NTS: not to scale.

.15 O:

.1 OA: outside air.
.2 OBC: Ontario building code.
.3 OC: on centre.
.4 OD: outside diameter.
.5 OPNG: opening.
.6 OPR: operator.
.7 OVHD: overhead.
.8 OWSJ: open web steel joist.

.16 P:

.1 P: prefinished.
.2 PAH: polynuclear aromatic hydrocarbons.
.3 PARG: parging.
.4 PCC: precast concrete.
.5 PCT: porcelain ceramic tile.
.6 PED ACS FLG: pedestal access flooring.
.7 PF: panel fabric.
.8 PH: phase.
.9 PL: plate.
.10 PLAM: plastic laminate.

.11 PLAS: plaster.
.12 PLYWD: plywood.
.13 PR: pair.
.14 PREFAB: prefabricated.
.15 PREFIN: prefinished.
.16 PRESS: pressure.
.17 PRFL: profile.
.18 PRV: pressure regulating valve.
.19 PT: paint.
.20 PTD: paper towel dispenser.
.21 PTN: partition.
.22 PVC: polyvinyl cholide.

.17 Q:

.1 QTB: quarry tile base.
.2 QTF: quarry tile floor.
.3 QTR: quarry tile roof.

.18 R:

.1 R: radius.
.2 RA: return air.
.3 RAD: return air damper.
.4 RB: resilient base.
.5 RC: reinforced concrete.
.6 RCPT: receptacle.
.7 RD: roof drain.
.8 REINF: reinforced/reinforcing.
.9 REQD: required.
.10 REQT: requirement.
.11 RFT: rubber floor tile.
.12 RM: room.
.13 RO: rough opening.
.14 RP: radiant panel.
.15 RRS: recycled rubber sheet.
.16 RRT: recycled rubber tile.
.17 RSD: rolling steel door.
.18 RSF: rubber sheet flooring.
.19 RT: rubber tile.
.20 RTU: roof top unit.
.21 RWL: rain water leader.

.19 S:

.1 SA: supply air.
.2 SAN SEW: sanitary sewer.
.3 SCHED: schedule.
.4 SC: solid core.
.5 SCRN: screen.
.6 SCWD: solid core wood door.
.7 SD: smoke developed.
.8 SDT: static dissipative tile.
.9 SECT: section.
.10 SH: sill height.
.11 SIM: similar.
.12 SL: sliding.
.13 SLR: sealer.
.14 SPEC: specification.
.15 SS: stainless steel.
.16 STD: standard.
.17 STL: steel.
.18 STL BM: steel beam.
.19 STC: sound transmission class.
.20 STL FL DK: steel floor deck.
.21 STL PL: steel plate.
.22 STN: stone.
.23 STR: structure or structural.
.24 ST SEW: storm sewer.
.25 S&U: stain and urethane.
.26 S&V: stain and varnish.
.27 SVT: solid vinyl tile.

.20 T:

.1 T: top.
.2 T&B: top and bottom.
.3 TCB: turbidity control plan.
.4 TEL: telephone.
.5 TER: terrazzo.
.6 TERT: terrazzo tile.
.7 THKNS: thickness.
.8 THR: threshold.
.9 TMPD: tempered.
.10 TOPG: topping.

.11 TRANSV: transverse.

.12 TYP: typical.

.21 U:

.1 U: urethane.

.2 U/C: undercut.

.3 UGRD: underground.

.4 UNO: unless noted otherwise.

.5 UOS: unless otherwise specified.

.6 U/S: underside.

.7 UR: urinal.

.22 V:

.1 V: volt.

.2 VCF: vinyl coated fabric.

.3 VCT: vinyl composition tile.

.4 VEL: velocity.

.5 VERT: vertical.

.6 VERT B: vertical blinds.

.7 VERT EF: vertical each face.

.8 VSF: vinyl sheet flooring.

.9 VPT: vinyl plank flooring.

.10 VT: vinyl tile.

.11 VWC: vinyl wall covering.

.23 W:

.1 WB: wet-bulb.

.2 WC: water closet.

.3 W-C: wall connectors.

.4 WD: wood.

.5 WDV: wood veneer.

.6 WG: water gauge.

.7 WH: wall hydrant.

.8 WHMIS: workplace hazardous materials information system.

.9 WP: waterproofing.

.10 WR: washroom.

.11 WSIB: workplace safety and insurance board.

.12 WT: weight.

.13 WTP: water treatment plant.

1.3 STANDARDS ORGANIZATIONS

.1 Standards writing organizations:

.1 AA - Aluminum Association.

.2 ACPA - American Concrete Pipe Association.

.3 ANSI - American National Standards Institute.

.4 ASHRAE - American Society of Heating and Refrigerating and Air-Conditioning Engineers.

.5 ASTM - American Society for Testing and Materials.

.6 AWI/AWMAC - Architectural Woodwork Institute/Architectural Woodwork Manufacturers Association of Canada.

.7 AWPA - American Wood Preservers' Association.

.8 AWWA - American Water Works Association.

.9 BHMA - Builders Hardware Manufacturers Association.

.10 CCDC - Canadian Construction Documents Committee.

.11 CCMPA - Canadian Concrete Masonry Producers Association.

.12 CGSB - Canadian General Standards Board.

.13 CNTA - Canadian Nursery Trades Association.

.14 CPCA - Canadian Painting Contractors Association.

.15 CRCA - Canadian Roofing Contractors Association.

.16 CSA - Canadian Standards Association.

.17 CSC - Construction Specifications Canada.

.18 CSDMA - Canadian Steel Door Manufacturers Association.

.19 CSI - Construction Specifications Institute.

.20 CSSBI - Canadian Sheet Steel Building Institute.

.21 CRCA - Canadian Roofing Contractors Association.

.22 DHI - Door and Hardware Institute.

.23 EEMAC - Electrical and Electronic Manufacturer's Association of Canada.

.24 ESA - Electrical Safety Authority.

.25 FCC - Fire Commissioner of Canada.

.26 FSC - Forest Stewardship Council.

.27 GANA - Glass Association of North America.

.28 HMMA - Hollow Metal Manufacturers Association.

.29 IEEE - Institute of Electrical and Electronics Engineers Inc.

.30 ISO - International Organization for Standardization.

.31 IWFA - International Window Film Association.

.32 LEED - LEED Canada, Leadership in Energy and Environmental Design.

.33 MPI - Master Painters Institute.

.34 NAAMM - National Association of Architectural Metal Manufacturers.

.35 NCPI - National Clay Pipe Institute.

.36 NEMA - National Electrical Manufacturers Association.

.37 NFPA - National Fire Protection Association.
.38 OPSD - Ontario Provincial Standard Drawings.
.39 OPSS - Ontario Provincial Standard Specifications.
.40 PPI - Plastics Pipe Institute.
.41 SDI - Steel Door Institute.
.42 SCAQMD - South Coast Air Quality Management District.
.43 TIA - Telecommunications Industry Association.
.44 TIAC - Thermal Insulation Association of Canada.
.45 TTMAC - Terrazzo Tile and Marble Association of Canada.
.46 UL - Underwriters Laboratories.
.47 ULC - Underwriters Laboratories of Canada.
.48 US EPA - United States Environmental Protection Agency.
.49 WH - Warnock Hersey.

1.4 FEDERAL GOVERNMENT DEPARTMENTS AND AGENGIES

.1 Departments, agencies and crown corporations.

.1 CEAA - Canadian Environmental Assessment Agency.
.2 CSC - Correctional Service Canada.
.3 CRA - Canada Revenue Agency.
.4 DND - Department of National Defence.
.5 EC - Environment Canada.
.6 FHBRO - Federal Heritage Buildings Review Office.
.7 HC - Health Canada.
.8 HCD - Heritage Conservation Directorate.
.9 LC - Labour Canada.
.10 PC - Parks Canada.
.11 PWGSC - Public Works and Government Services Canada.
.12 RCMP - Royal Canadian Mounted Police.
.13 TBS - Treasury Board Secretariat.
.14 TC - Transport Canada.

1.5 PROVINCIAL GOVERNMENT DEPARTMENTS AND AGENGIES

.1 MOEE - Ontario Ministry of Environment and Energy.

.2 MOL - Ontario Ministry of Labour.

.3 MTO and MOT - Ontario Ministry of Transportation.

.4 TSSA - Technical Standards and Safety Authority.

1.6 INTERNATIONAL GOVERNMENT DEPARTMENTS AND AGENCIES

.1 DOHMH - New York City Department of Health and Mental Hygiene, USA.

.2 GSA - Government Services Administration, USA.

1.7 UNITS OF MEASURE METRIC

.1 The following abbreviations of units of measure are commonly found in the Project Manual:

.1 C: Celsius.
.2 cm: centimetre.
.3 kg: kilogram.
.4 kg/m^3: kilogram per cubic metre.
.5 kN: kilonewton.
.6 kPa: kilopascals.
.7 kw: kilowatts.
.8 l/s: litre per second.
.9 m: metre.
.10 m^3: cubic metre.
.11 mg/kg: milligrams per kilogram.
.12 mg/L: milligrams per litre.
.13 mm: millimetres.
.14 MPa: megapascal.
.15 NTU: nephelometric turbidity unit.
.16 ppm: parts per million.
.17 ug/L: micrograms per litre.
.18 ug/m^3: micrograms per cubic metre.

1.8 UNITS OF MEASURE IMPERIAL

.1 The following abbreviations of units of measure are commonly found in the Project Manual:

.1 BTU: British thermal units.
.2 CFM: cubic feet per minute.
.3 F: Fahrenheit.
.4 ft: foot/feet.
.5 FPI: fins per inch.
.6 FPM: feet per minute.
.7 ga: gauge.
.8 gpm: gallons per minute.
.9 in: inches.
.10 lbs: pounds.
.11 NTU: nephelometric turbidity unit.
.12 psi: pounds-force per square inch.
.13 PSIG: PSI gauge.
.14 ppm: parts per million.
.15 RPM: revolutions per minute.

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 SECTION INCLUDES

.1 Inspection and testing, administrative and enforcement requirements.

.2 Tests and mix designs.

.3 Mock-ups.

.4 Mill tests.

.5 Equipment and system adjust and balance.

1.2 INSPECTION

.1 Allow Departmental Representative access to Work. If part of Work is in preparation at locations other than Place of Work, allow access to such Work whenever it is in progress.

.2 Give timely notice requesting inspection if Work is designated for special tests, inspections or approvals by Departmental Representative instructions, or law of Place of Work.

.3 If Contractor covers or permits to be covered Work that has been designated for special tests, inspections or approvals before such is made, uncover such Work, have inspections or tests satisfactorily completed and make good such Work.

.4 Departmental Representative may order any part of Work to be examined if Work is suspected to be not in accordance with Contract Documents. If, upon examination such work is found not in accordance with Contract Documents, correct such Work and pay cost of examination and correction. If such Work is found in accordance with Contract Documents, Departmental Representative shall pay cost of examination and replacement.

1.3 INDEPENDENT INSPECTION AGENCIES

.1 Independent Inspection/Testing Agencies may be engaged by Departmental Representative for purpose of inspecting and/or testing portions of Work, above and beyond those required of the Contractor. Cost of such services will be borne by Departmental Representative.

.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.

1.4 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.

1.5 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 an orderly sequence so as not to cause delay 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.

1.6 REJECTED WORK

.1 Remove defective Work, whether result of poor workmanship, use of defective products or damage and whether incorporated in Work or not, which has been rejected by Departmental Representative as failing to conform to Contract Documents. Replace or re-execute in accordance with Contract Documents.

.2 Make good other Contractor's work damaged by such removals or replacements promptly.

.3 If in opinion of Departmental Representative it is not expedient to correct defective Work or Work not performed in accordance with Contract Documents, Departmental Representative may deduct from Contract Amount difference in value between Work performed and that called for by Contract Documents, amount of which shall be determined by Departmental Representative.

1.7 REPORTS

.1 Submit one (1) electronic copy of inspection and test reports to Departmental Representative and Contractor.

.2 Provide copies to Subcontractor of work being inspected or tested, manufacturer or fabricator of material being inspected or tested and to authorities having jurisdiction as required by authority having jurisdiction.

1.8 TESTS AND MIX DESIGNS

.1 Furnish test results and mix designs as may be requested.

.2 The cost of tests and mix designs beyond those called for in Contract Documents or beyond those required by law of Place of Work shall be appraised by Departmental Representative and may be authorized as recoverable.

1.9 MOCK-UPS

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

.2 Construct in all locations as specified in specific Section.

.3 Prepare mock-ups for Departmental Representative's review with reasonable promptness and in an orderly sequence, so as not to cause any delay in Work.

.4 Failure to prepare mock-ups in ample time is not considered sufficient reason for an extension of Contract Time and no claim for extension by reason of such default will be allowed.

.5 If requested, Departmental Representative will assist in preparing a schedule fixing dates for preparation.

.6 Specification section identifies whether mock-up may remain as part of Work or if it is to be removed and when.

1.10 MILL TESTS

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

1.11 EQUIPMENT AND SYSTEMS

.1 Submit testing, adjusting and balancing reports for mechanical, electrical and building equipment systems.

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 SECTION INCLUDES

.1 Temporary utilities.

1.2 RELATED SECTIONS

.1 Section 01 52 00 - Construction Facilities.

.2 Section 01 56 00 - Temporary Barriers and Enclosures.

1.3 SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00.

1.4 INSTALLATION AND REMOVAL

.1 Provide temporary utilities controls in order to execute work expeditiously.

.2 Remove from site all such work after use.

1.5 WATER SUPPLY

.1 Departmental Representative will provide continuous supply of potable water for construction use.

.2 Departmental Representative will pay for utility charges at prevailing rates.

1.6 TEMPORARY HEATING AND VENTILATION

.1 Heating:

.1 Permanent heating system of building, may be used.

.2 Departmental Representative will pay utility charges.

.2 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.

.3 Maintain strict supervision of operation of temporary 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.

.4 Be responsible for damage to Work due to failure in providing adequate heat and protection during construction.

1.7 TEMPORARY POWER AND LIGHT

.1 Departmental Representative will pay for temporary power during construction for temporary lighting and operating of power tools, to a maximum supply of 230 volts 30 amps.

.2 Temporary power for equipment requiring in excess of above is responsibility of Contractor.

.3 Provide and maintain temporary lighting throughout project to ensure level of illumination on all floors and stairs is not less than 162 lx.

.4 Electrical power and lighting systems installed under this Contract may be used for construction requirements only with prior approval of Departmental Representative provided that guarantees are not affected. Make good damage to electrical system caused by use under this Contract. Replace lamps which have been used for more than 3 months.

1.8 FIRE PROTECTION

.1 Provide and maintain temporary fire protection equipment during performance of Work required by insurance companies having jurisdiction and governing codes, regulations and bylaws.

.2 Burning rubbish and construction waste materials is not permitted on site.

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 SECTION INCLUDES

.1 Construction aids.

.2 Office and sheds.

.3 Parking.

.4 Project identification.

1.2 REFERENCES

.1 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-1.189-2000, Exterior Alkyd Primer for Wood.

.2 CAN/CGSB-1.59-97, Alkyd Exterior Gloss Enamel.

.2 Canadian Standards Association (CSA International)

.1 CSA A23.1-14/A23.2-14, Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete.

.2 CSA 0121-08(R2013), Douglas Fir Plywood.

.3 CAN/CSA-Z321-96(R2006), Signs and Symbols for the Occupational Environment, withdrawn but still available from CSA, CCOHS and Techstreet.

1.3 SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00.

1.4 INSTALLATION AND REMOVAL

.1 Prepare site plan indicating proposed location and dimensions of area to be fenced and used by Contractor, number of trailers to be used, avenues of ingress/egress to fenced area and details of fence installation.

.2 Identify areas which have to be gravelled to prevent tracking of mud.

.3 Indicate use of supplemental or other staging area.

.4 Provide construction facilities in order to execute work expeditiously.

.5 Remove from site all such work after use.

1.5 ELEVATORS

.1 New elevator may be used by construction personnel and transporting of materials once installed. Co-ordinate use with Departmental Representative.

.2 Provide protective coverings for finish surfaces of cars and entrances.

1.6 SITE STORAGE/LOADING

.1 Confine work and operations of employees to areas defined by Contract Documents. Do not unreasonably encumber premises with products.

.2 Do not load or permit to load any part of Work with a weight or force that will endanger the Work.

1.7 CONSTRUCTION PARKING

.1 Contractor may make use of existing parking lot on site. No other parking will be available.

1.8 EQUIPMENT, TOOL AND MATERIALS STORAGE

.1 Provide and maintain, in a clean and orderly condition, lockable weatherproof sheds for storage of tools, equipment and materials.

.2 Locate materials not required to be stored in weatherproof sheds on site in a manner to cause least interference with work activities.

1.9 SANITARY FACILITIES

.1 Designated existing facilities in building may be used on approval of Departmental Representative on a temporary basis. Contractor will not be permitted to use new facilities and must provide temporary sanitary facilities for personnel.

1.10 PROTECTION AND MAINTENANCE OF TRAFFIC

.1 Provide access and temporary relocated roads as necessary to maintain traffic.

.2 Maintain and protect traffic on affected roads during construction period except as otherwise specifically directed by Departmental Representative.

.3 Provide measures for protection and diversion of traffic, including provision of watch-persons and flag-persons, erection of barricades, placing of lights around and in front of equipment and work, and erection and maintenance of adequate warning, danger, and direction signs

.4 Protect travelling public from damage to person and property.

.5 Contractor's traffic on roads selected for hauling material to and from site to interfere as little as possible with public traffic.

.6 Verify adequacy of existing roads and allowable load limit on these roads. Contractor: responsible for repair of damage to roads caused by construction operations.

.7 Provide necessary lighting, signs, barricades, and distinctive markings for safe movement of traffic.

1.11 CLEAN-UP

.1 Remove construction debris, waste materials, packaging material from work site daily.

.2 Clean dirt or mud tracked onto paved or surfaced roadways.

.3 Store materials resulting from demolition activities that are salvageable.

.4 Stack stored new or salvaged material.

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 SECTION INCLUDES

.1 Barriers.

.2 Environmental Controls.

.3 Traffic Controls.

.4 Fire Routes.

1.2 REFERENCES

.1 Canadian General Standards Board (CGSB):

.1 CAN/CGSB-1.189-2000, Exterior Alkyd Primer for Wood.

.2 CAN/CGSB-1.59-97, Alkyd Exterior Gloss Enamel.

.2 Canadian Standards Association (CSA):

.1 CSA O121-08(R2013), Douglas Fir Plywood.

1.3 INSTALLATION AND REMOVAL

.1 Provide temporary controls in order to execute Work expeditiously.

.2 Remove from site all such work after use.

1.4 DUST TIGHT SCREENS

.1 Provide dust tight screens or insulated partitions to localize dust generating activities, and for protection of workers, finished areas of Work and public.

.2 Maintain and relocate protection until such work is complete.

1.5 PUBLIC TRAFFIC FLOW

.1 Provide and maintain competent signal flag operators, traffic signals, barricades and flares, lights, or lanterns as required to perform Work and protect the public.

1.6 FIRE ROUTES

.1 Maintain access to property including overhead clearances for use by emergency response vehicles.

1.7 PROTECTION FOR OFF-SITE AND PUBLIC PROPERTY

.1 Protect surrounding private and public property from damage during performance of Work.

.2 Be responsible for damage incurred.

1.8 PROTECTION OF BUILDING FINISHES

.1 Provide protection for finished and partially finished building finishes and equipment during performance of Work.

.2 Provide necessary screens, covers, and hoardings.

.3 Confirm with Departmental Representative locations and installation schedule 3 days prior to installation.

.4 Be responsible for damage incurred due to lack of or improper protection.

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 SECTION INCLUDES

.1 Product quality, availability, storage, handling, protection, and transportation.

.2 Manufacturer's instructions.

.3 Quality of Work, coordination and fastenings.

.4 Existing facilities.

1.2 RELATED SECTIONS

.1 Section 01 45 00 - Quality Control.

1.3 REFERENCES

.1 Within text of specifications, reference may be made to reference standards.

.2 Conform to these standards, in whole or in part as specifically requested in specifications.

.3 If there is question as to whether any product or system is in conformance with applicable standards, Departmental Representative reserves right to have such products or systems tested to prove or disprove conformance.

.4 The cost for such testing will be born by Departmental Representative in event of conformance with Contract Documents or by Contractor in event of non-conformance.

.5 Conform to latest date of issue of referenced standards in effect on date of submission of Bids, except where specific date or issue is specifically noted.

1.4 QUALITY

.1 Products, materials, equipment and articles (referred to as products throughout specifications) incorporated in Work shall be new, not damaged or defective, and of best quality (compatible with specifications) for purpose intended. If requested, furnish evidence as to type, source and quality of Products provided.

.2 Defective products, whenever identified prior to completion of Work, will be rejected, regardless of previous inspections. Inspection does not relieve responsibility, but is precaution against oversight or error. Remove and replace defective products at own expense and be responsible for delays and expenses caused by rejection.

.3 Should any dispute arise as to quality or fitness of products, decision rests strictly with Departmental Representative based upon requirements of Contract Documents.

.4 Unless otherwise indicated in specifications, maintain uniformity of manufacture for any particular or like item throughout building.

.5 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.

1.5 AVAILABILITY

.1 Immediately upon signing Contract, review product delivery requirements and anticipate foreseeable supply delays for any items. If delays in supply of products are foreseeable, notify Departmental Representative of such, in order that substitutions or other remedial action may be authorized in ample time to prevent delay in performance of Work.

.2 In event of failure to notify Departmental Representative at commencement of Work and should it subsequently appear that Work may be delayed for such reason, Departmental Representative reserves right to substitute more readily available products of similar character, at no increase in Contract Amount or Contract Time.

1.6 METRIC SIZED MATERIALS

.1 SI metric units of measurement are used exclusively on the drawings and in the specifications for this project.

.2 The Contractor is required to provide metric products in the sizes called for in the Contract Documents except where a valid claim can be made that a particular product is not available on the Canadian market.

.3 Claims for exemptions from use of metric sized products shall be in writing and fully substantiated with supportive documentation. Promptly submit application to Departmental Representative for consideration and ruling. Non-metric sized products may not be used unless Contractor's application has been approved in writing by the Departmental Representative.

.4 Difficulties caused by the Contractor's lack of planning and effort to obtain modular metric sized products which are available on the Canadian market will not be considered sufficient reasons for claiming that they cannot be provided.

.5 Claims for additional costs due to provision of specified modular metric sized products will not be considered.

1.7 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 and lumber 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.

1.8 TRANSPORTATION

.1 Pay costs of transportation of products required in performance of Work.

.2 Transportation cost of products supplied by Owner will be paid for by Departmental Representative. Unload, handle and store such products.

1.9 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 may establish course of action.

.3 Improper installation or erection of products, due to failure in complying with these requirements, authorizes Departmental Representative to require removal and re-installation at no increase in Contract Amount or Contract Time.

1.10 QUALITY OF WORK

.1 Ensure Quality of Work is of highest standard, executed by workers experienced and skilled in respective duties for which they are employed. Immediately notify Departmental Representative if required Work is such as to make it impractical to produce required results.

.2 Do not employ anyone unskilled in their required duties. Departmental Representative reserves right to require dismissal from site, workers deemed incompetent or careless.

.3 Decisions as to standard or fitness of Quality of Work in cases of dispute rest solely with Departmental Representative, whose decision is final.

1.11 CO-ORDINATION

.1 Ensure cooperation of workers in laying out Work. Maintain efficient and continuous supervision.

.2 Be responsible for coordination and placement of openings, sleeves and accessories.

1.12 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.

1.13 REMEDIAL WORK

.1 Perform remedial work required to repair or replace parts or portions of Work identified as defective or unacceptable. Coordinate 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.

1.14 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.

1.15 FASTENINGS

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

.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.

1.16 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.

1.17 PROTECTION OF WORK IN PROGRESS

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

1.18 EXISTING UTILITIES

.1 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.

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 SUBMITTALS

.1 Submittals: in accordance with Section 01 33 00.

.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.

1.2 MATERIALS

.1 Required for original installation.

.2 Change in Materials: Submit request for substitution in accordance with Section 01 33 00.

1.3 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.

1.4 EXECUTION

.1 Execute cutting, fitting, and patching to complete Work.

.2 Fit several parts together, to integrate with other Work.

.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 Submit proposed materials, finishes and installation method for patching to Departmental Representative for approval, prior to patching.

.11 Refinish surfaces to match adjacent finishes: Refinish continuous surfaces to nearest intersection. Refinish assemblies by refinishing entire unit.

.12 Fit Work airtight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.

.13 At penetration of fire rated wall, ceiling, or floor construction, completely seal voids with firestopping material in accordance with Section 07 84 00, full thickness of the construction element.

.14 Conceal pipes, ducts and wiring in floor, wall and ceiling construction of finished areas except where indicated otherwise.

1.5 WASTE MANAGEMENT AND DISPOSAL

.1 Separate waste materials for reuse, recycling, composting and anaerobic digestion in accordance with Section 01 74 20.

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 SECTION INCLUDES

.1 Progressive cleaning.

.2 Final cleaning.

1.2 PROJECT CLEANLINESS

.1 Maintain Work in tidy condition, free from accumulation of waste products and debris, other than that caused by Departmental Representative or other Contractors.

.2 Remove waste materials from site at regularly scheduled times or dispose of as directed by Departmental Representative. Do not burn waste materials on site.

.3 Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris.

.4 Provide on-site containers for collection of waste materials and debris.

.5 Provide and use clearly marked separate bins for recycling. Refer to Section 01 74 20.

.6 Remove waste material and debris from site and deposit in waste container at end of each working day.

.7 Dispose of waste materials and debris off site.

.8 Clean interior areas prior to start of finish 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.

1.3 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 or other Contractors.

.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 HEPA 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 Clean equipment and fixtures to a sanitary condition; clean or replace filters of mechanical equipment.

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 CONSTRUCTION & DEMOLITION WASTE

.1 Carefully deconstruct and source separate materials/equipment and divert, from D&C waste destined for landfill to maximum extent possible. Target for this project is 75% diversion from landfill. Reuse, recycle, compost, anaerobic digest or sell material for reuse except where indicated otherwise. On site sales are not permitted.

.2 Source separate waste and maintain waste audits in accordance with the Environmental Protection Act, Ontario Regulation 102/94 and Ontario Regulation 103/94.

.1 Provide facilities for collection, handling and storage of source separated wastes.

.2 Source separate the following waste:

.1 Brick and portland cement concrete.

.2 Corrugated cardboard.

.3 Wood, not including painted or treated wood or laminated wood.

.4 Gypsum board, unpainted.

.5 Steel.

.3 Submit a waste reduction workplan indicating the materials and quantities of material that will be recycled and diverted from landfill.

.1 Indicate how material being removed from the site will be reused, recycled, composted or anaerobically digested.

.4 Submit proof that all waste is being disposed of at a licensed land fill site or waste transfer site. A copy of the disposal/waste transfer site's license and a letter verifying that said landfill site will accept the waste must be supplied to Departmental Representative prior to removal of waste from the demolition site.

1.2 WASTE PROCESSING SITES

.1 Province of: Ontario.

.1 Ministry of Environment and Energy, 135 St. Clair Avenue West, Toronto, ON, M4V 1P5.

.2 Telephone: 800-565-4923 or 416-323-4321.

.3 Fax: 416-323-4682.

.2 Recycling Council of Ontario: 215 Spadina Avenue, #225, Toronto, ON, M5T 2C7.

.1 Telephone: 416-657-2797.

.2 Fax: 416-960-8053.

.3 Email: rco@rco.on.ca.

.4 Internet: http://www.rco.on.ca/.

.5

Part 2 PRODUCTS

2.1 NOT USED

.1 Not Used.

Part 3 EXECUTION

3.1 CANADIAN GOVERNMENTAL DEPARTMENTS CHIEF RESPONSIBILITY FOR THE ENVIRONMENT

.1 Government Chief Responsibility for the Environment.

Province	Address	General	Fax Inquiries	
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

Part 1 GENERAL

1.1 INSPECTION AND DECLARATION

.1 Contractor's Inspection: Contractor and all Subcontractors shall conduct an inspection of Work, identify deficiencies and defects, and repair as required to conform to Contract Documents.

.1 Notify Departmental Representative in writing of satisfactory completion of Contractor's Inspection and that corrections have been made.

.2 Request Departmental Representative's Inspection.

.2 Departmental Representative's Inspection: Departmental Representative and Contractor will perform inspection of Work to identify obvious defects or deficiencies. Contractor to correct Work accordingly.

.3 Completion: submit written certificate that following have been performed:

.1 Work has been completed and inspected for compliance with Contract Documents.

.2 Defects have been corrected and deficiencies have been completed.

.3 Equipment and systems have been tested, adjusted and balanced and are fully operational.

.4 Certificates required by PWGSC Fire Protection Engineer have been submitted.

.5 Operation of systems have been demonstrated to Owner's personnel.

.6 Work is complete and ready for final inspection.

.4 Final Inspection: when items noted above are completed, request final inspection of Work by Departmental Representative and Contractor. If Work is deemed incomplete by Departmental Representative, complete outstanding items and request reinspection.

1.2 CLEANING

.1 In accordance with Section 01 74 11.

.2 Remove waste and surplus materials, rubbish and construction facilities from the site in accordance with Section 01 74 20.

Part 2 PRODUCTS

2.1 NOT USED

Part 3 EXECUTION

3.1 NOT USED

END OF SECTION

Part 1 GENERAL

1.1 SECTION INCLUDES

.1 As-built, samples, and specifications.

.2 Equipment and systems.

.3 Product data, materials and finishes, and related information.

.4 Operation and maintenance data.

.5 Spare parts, special tools and maintenance materials.

.6 Warranties and bonds.

.7 Final site survey.

1.2 SUBMISSION

.1 Prepare instructions and data using personnel experienced in maintenance and operation of described products.

.2 Copy will be returned after final inspection, with Departmental Representative's comments.

.3 Revise content of documents as required prior to final submittal.

.4 Two weeks prior to Substantial Performance of the Work, submit to the Departmental Representative, four final copies of maintenance manuals and commissioning documentation in English.

.5 Ensure spare parts, maintenance materials and special tools provided are new, undamaged or defective, and of same quality and manufacture as products provided in Work.

.6 If requested, furnish evidence as to type, source and quality of products provided.

.7 Defective products will be rejected, regardless of previous inspections. Replace products at own expense.

.8 Pay costs of transportation.

1.3 FORMAT

.1 Organize data in the form of an instructional manual.

.2 Binders: vinyl, hard covered, 3 'D' ring, loose leaf 219 x 279 mm with spine and face pockets.

.3 When multiple binders are used, correlate data into related consistent groupings. Identify contents of each binder on spine.

.4 Cover: Identify each binder with type or printed title 'Project Record Documents'; list title of project and identify subject matter of contents.

.5 Arrange content by systems, under Section numbers and sequence of Table of Contents.

.6 Provide tabbed fly leaf for each separate product and system, with typed description of product and major component parts of equipment.

.7 Text: Manufacturer's printed data, or typewritten data.

.8 Drawings: provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.

.9 Provide 1:1 scaled CAD files in dwg format on CD-ROM or DVD-ROM.

1.4 CONTENTS - EACH VOLUME

.1 Table of Contents: provide title of project;

.1 Date of submission; names,

.2 Addresses, and telephone numbers of 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 clearly identify specific products and component parts, and data applicable to installation; delete inapplicable information.

.4 Drawings: supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams.

.5 Typewritten Text: as required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions specified in Section 01 45 00.

1.5 AS-BUILTS AND SAMPLES

.1 In addition to requirements in General Conditions, maintain at the site for Departmental Representative review and reference throughout the progress of the Work one record copy of:

.1 Contract Drawings.

.2 Specifications.

.3 Amendments and addenda.

.4 Change Orders and other modifications to the Contract.

.5 Reviewed shop drawings, product data, and samples.

.6 Field test records.

.7 Inspection certificates.

.8 Manufacturer's certificates.

.2 Store record documents and samples in field office apart from documents used for construction. Provide files, racks, and secure storage.

.3 Label record documents and file in accordance with Section number listings in List of Contents of this Project Manual. Label each document "PROJECT RECORD" in neat, large, printed letters.

.4 Maintain record documents in clean, dry and legible condition. Do not use record documents for construction purposes.

.5 Keep record documents and samples available for inspection by Departmental Representative.

.6 Turn one set, paper copy and electronic copy, of AS-BUILT drawings and specifications over to Departmental Representative on completion of work. Submit files on USB compatible with PWGSC encryption requirements or through email or alternate electronic file sharing service such as ftp, as directed by Departmental Representative.

.7 If project is completed without significant deviations from Contract drawings and specifications submit to Departmental Representative one set of drawings and specifications marked "AS-BUILT".

1.6 RECORDING ACTUAL SITE CONDITIONS

.1 Record information on set of black line opaque drawings, and in copy of Project Manual, provided by Departmental Representative.

.2 Provide felt tip marking pens, maintaining separate colours for each major system, for recording information.

.3 Record information concurrently with construction progress. Do not conceal Work until required information is recorded.

.4 Contract Drawings and shop drawings: legibly 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 References to related shop drawings and modifications.

.5 Specifications: legibly 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 Amendments and change orders.

.6 Other Documents: maintain manufacturer's certifications, inspection certifications, field test records, required by individual specifications sections.

1.7 EQUIPMENT AND SYSTEMS

.1 Each Item of Equipment and Each System: include description of unit or system, and component parts. Give function, normal operation characteristics, and limiting conditions. Include performance curves, with engineering data and tests, and complete nomenclature and commercial number of replaceable parts.

.2 Panel board circuit directories: provide electrical service characteristics, controls, and communications.

.3 Include installed colour coded wiring diagrams.

.4 Operating Procedures: include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shut-down, and emergency instructions. Include summer, winter, and any special operating instructions.

.5 Maintenance Requirements: include routine procedures and guide for trouble-shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.

.6 Provide servicing and lubrication schedule, and list of lubricants required.

.7 Include manufacturer's printed operation and maintenance instructions.

.8 Include sequence of operation by controls manufacturer.

.9 Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.

.10 Provide installed control diagrams by controls manufacturer.

.11 Provide Contractor's coordination 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.

.15 Additional requirements: As specified in individual specification sections.

1.8 MATERIALS AND FINISHES

.1 Building Products, Applied Materials, and Finishes: include product data, with catalogue number, size, composition, and colour and texture designations. 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.

1.9 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 as directed; place and store.

.4 Receive and catalogue all items. Submit inventory listing to Departmental Representative. Include approved listings in Maintenance Manual.

.5 Obtain receipt for delivered products and submit prior to final payment.

1.10 MAINTENANCE MATERIALS

.1 Provide maintenance and extra materials, in quantities specified in individual specification sections.

.2 Provide items of same manufacture and quality as items in Work.

.3 Deliver to site as directed; place and store.

.4 Receive and catalogue all items. Submit inventory listing to Departmental Representative. Include approved listings in Maintenance Manual.

.5 Obtain receipt for delivered products and submit prior to final payment.

1.11 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 as directed; place and store.

.4 Receive and catalogue all items. Submit inventory listing to Departmental Representative. Include approved listings in Maintenance Manual.

1.12 STORAGE, HANDLING AND PROTECTION

.1 Store spare parts, maintenance materials, and special tools in manner to prevent damage or deterioration.

.2 Store in original and undamaged condition with manufacturer's seal and labels intact.

.3 Store components subject to damage from weather in weatherproof enclosures.

.4 Store paints and freezable materials in a heated and ventilated room.

.5 Remove and replace damaged products at own expense and to satisfaction of Departmental Representative.

1.13 WARRANTIES AND BONDS

.1 Separate each warranty or bond with index tab sheets keyed to Table of Contents listing.

.2 List subcontractor, supplier, and manufacturer, with name, address, and telephone number of responsible principal.

.3 Obtain warranties and bonds, executed in duplicate by subcontractors, suppliers, and manufacturers, within ten days after completion of the applicable item of work.

.4 Except for items put into use with Departmental Representative’s permission, leave date of beginning of time of warranty until the Date of Certificate of Substantial Performance is determined.

.5 Verify that documents are in proper form, contain full information, and are notarized.

.6 Co-execute submittals when required.

.7 Retain warranties and bonds until time specified for submittal.

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 SECTION INCLUDES

.1 Procedures for demonstration and instruction of equipment and systems to Owner's O&M personnel.

.2 O&M personnel includes property facility manager, building operators, maintenance staff, security staff and technical specialists, as applicable.

1.2 DESCRIPTION

.1 Demonstrate scheduled operation and maintenance of equipment and systems to Departmental Representative's personnel two weeks prior to date of final inspection.

.2 Departmental Representative will provide list of personnel to receive instructions, and will coordinate their attendance at agreed-upon times.

1.3 QUALITY CONTROL

.1 When specified in individual Sections, require manufacturer to provide authorized representative to demonstrate operation of equipment and systems, instruct Owner's personnel, and provide written report that demonstration and instructions have been completed.

.2 Submit training schedule of time and date for demonstration and training of each item of equipment and each system in accordance with the training plan four weeks prior to designated dates, for Departmental Representative's approval.

.3 Submit reports within one week after completion of demonstration, that demonstration and instructions have been satisfactorily completed.

.4 Report shall give time and date of each demonstration and training, with list of persons present.

.5 The CxA will witness the Owner’s operating personnel training to verify it was adequate and complete to ensure they fully understand the requirements of operating and maintaining the equipment. Contractors shall ensure training meets the approval of the CxA and provide additional training if requested.

1.4 CONDITIONS FOR DEMONSTRATIONS

.1 Equipment has been inspected and put into operation in accordance with individual specifications Sections.

.2 Testing, adjusting, and balancing has been performed in accordance with Section 23 05 93 - Testing, Adjusting and Balancing for HVAC and equipment and systems are fully operational.

.3 Provide copies of completed operation and maintenance manuals for use in demonstrations and instructions.

1.5 PREPARATION

.1 Verify that conditions for demonstration and instructions comply with requirements.

.2 Verify that designated O&M personnel are present.

1.6 DEMONSTRATION AND INSTRUCTIONS

.1 Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, and maintenance of each item of equipment at scheduled times, at the equipment location.

.2 Instruct personnel in all phases of operation and maintenance using operation and maintenance manuals as the basis of instruction.

.3 Review contents of manual in detail to explain all aspects of operation and maintenance.

.4 Prepare and insert additional data in operations and maintenance manuals when the need for additional data becomes apparent during instructions.

1.7 TIME ALLOCATED FOR INSTRUCTIONS

.1 Ensure amount of time required for instruction of each item of equipment or system as follows:

.1 Sections 23 21 13.02, 23 21 23, 23 36 00, 23 52 00, 23 57 00, 23 73 11: 2 hours of instruction.

.2 Sections 23 21 23, 23 33 15, 23 33 16, 23 34 00, and 23 73 11 - Ventilation System: 2 hours of instruction.

.3 Section 25 01 12 - Control System: as specified in Section 25 01 12.

.4 Section 22 42 00 – Commercial Plumbing System: 1 hours of instruction.

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 SUMMARY

.1 Section Includes:

.1 General requirements relating to commissioning of project's components and systems, specifying general requirements to PV of components, equipment, sub-systems, systems, and integrated systems.

.2 Acronyms:

.1 AFD - Alternate Forms of Delivery, service provider.

.2 BMM - Building Management Manual.

.3 Cx - Commissioning.

.4 EMCS - Energy Monitoring and Control Systems.

.5 O&M - Operation and Maintenance.

.6 PI - Product Information.

.7 PV - Performance Verification.

.8 TAB - Testing, Adjusting and Balancing.

1.2 GENERAL

.1 Cx is a planned program of tests, procedures and checks carried out systematically on systems and integrated systems of the finished Project. Cx is performed after systems and integrated systems are completely installed, functional and Contractor's Performance Verification responsibilities have been completed and approved. Objectives:

.1 Verify installed equipment, systems and integrated systems operate in accordance with contract documents and design criteria and intent.

.2 Ensure appropriate documentation is compiled into the BMM.

.3 Effectively train O&M staff.

.2 Contractor assists in Cx process, operating equipment and systems, troubleshooting and making adjustments as required.

.1 Systems to be operated at full capacity under various modes to determine if they function correctly and consistently at peak efficiency. Systems to be interactively with each other as intended in accordance with Contract Documents and design criteria.

.2 During these checks, adjustments to be made to enhance performance to meet environmental or user requirements.

.3 Design Criteria: as per client's requirements or determined by designer. To meet Project functional and operational requirements.

1.3 COMMISSIONING OVERVIEW

.1 For Cx responsibilities refer to Section 01 91 33.

.2 Cx to be a line item of Contractor's cost breakdown.

.3 Cx activities supplement field quality and testing procedures described in relevant technical sections.

.4 Cx is conducted in concert with activities performed during stage of project delivery. Cx identifies issues in Planning and Design stages which are addressed during Construction and Cx stages to ensure the Work is constructed and proven to operate satisfactorily under weather, environmental and occupancy conditions to meet functional and operational requirements. Cx activities includes transfer of critical knowledge to facility operational personnel.

.5 Departmental Representative will issue Certificate of Substantial Performance when:

.1 Completed Cx documentation has been received, reviewed for suitability and approved by Departmental Representative.

.2 Equipment, components and systems have been commissioned.

.3 O&M training has been completed.

1.4 NON-CONFORMANCE TO PERFORMANCE VERIFICATION REQUIREMENTS

.1 Should equipment, system components, and associated controls be incorrectly installed or malfunction during Cx, correct deficiencies, re-verify equipment and components within the unfunctional system, including related systems as deemed required by Departmental Representative, to ensure effective performance.

.2 Costs for corrective work, additional tests, inspections, to determine acceptability and proper performance of such items to be borne by Contractor. Above costs to be in form of progress payment reductions or hold-back assessments.

1.5 PRE-CX REVIEW

.1 Before Construction:

.1 Review contract documents, confirm by writing to Departmental Representative.

.1 Adequacy of provisions for Cx.

.2 Aspects of design and installation pertinent to success of Cx.

.2 During Construction:

.1 Co-ordinate provision, location and installation of provisions for Cx.

.3 Before start of Cx:

.1 Have completed Cx Plan up-to-date.

.2 Ensure installation of related components, equipment, sub-systems, systems is complete.

.3 Fully understand Cx requirements and procedures.

.4 Have Cx documentation shelf-ready.

.5 Understand completely design criteria and intent and special features.

.6 Submit complete start-up documentation to Departmental Representative.

.7 Have Cx schedules up-to-date.

.8 Ensure systems have been cleaned thoroughly.

.9 Complete TAB procedures on systems, submit TAB reports to Departmental Representative for review and approval.

.10 Ensure "As-Built" system schematics are available.

.4 Inform Departmental Representative in writing of discrepancies and deficiencies on finished works.

1.6 CONFLICTS

.1 Report conflicts between requirements of this section and other sections to Departmental Representative before start-up and obtain clarification.

.2 Failure to report conflict and obtain clarification will result in application of most stringent requirement.

1.7 SUBMITTALS

.1 Submittals: in accordance with Section 01 33 00.

.1 Submit no later than 4 weeks after award of Contract:

.1 Name of Contractor's Cx agent.

.2 Draft Cx documentation.

.3 Preliminary Cx schedule.

.2 Request in writing to Departmental Representative for changes to submittals and obtain written approval at least 8 weeks prior to start of Cx.

.3 Submit proposed Cx procedures to Departmental Representative where not specified and obtain written approval at least 8 weeks prior to start of Cx.

.4 Provide additional documentation relating to Cx process required by Departmental Representative.

1.8 COMMISSIONING DOCUMENTATION

.1 Refer to Section 01 91 33.

.2 Departmental Representative to review and approve Cx documentation.

.3 Provide completed and approved Cx documentation to Departmental Representative.

1.9 COMMISSIONING SCHEDULE

.1 Provide detailed Cx schedule as part of construction schedule in accordance with Section 01 32 16

.2 Provide adequate time for Cx activities prescribed in technical sections and commissioning sections including:

.1 Approval of Cx reports.

.2 Verification of reported results.

.3 Repairs, retesting, re-commissioning, re-verification.

.4 Training.

1.10 COMMISSIONING MEETINGS

.1 Convene Cx meetings following project meetings: Section 01 32 16 and as specified herein.

.2 Purpose: to resolve issues, monitor progress, identify deficiencies, relating to Cx.

.3 Continue Cx meetings on regular basis until commissioning deliverables have been addressed.

.4 At 60% construction completion stage, Departmental Representative to call a separate Cx scope meeting to review progress, discuss schedule of equipment start-up activities and prepare for Cx. Issues at meeting to include:

.1 Review duties and responsibilities of Contractor and subcontractors, addressing delays and potential problems.

.2 Determine the degree of involvement of trades and manufacturer's representatives in the commissioning process.

.5 Thereafter Cx meetings to be held until project completion and as required during equipment start-up and functional testing period.

.6 Meeting will be chaired by Departmental Representative, who will record and distribute minutes.

.7 Ensure subcontractors and relevant manufacturer representatives are present at 60% and subsequent Cx meetings and as required.

1.11 STARTING AND TESTING

.1 Contractor assumes liabilities and costs for inspections. Including disassembly and re-assembly after approval, starting, testing and adjusting, including supply of testing equipment.

1.12 WITNESSING OF STARTING AND TESTING

.1 Provide 14 days notice prior to commencement.

.2 Departmental Representative to witness of start-up and testing.

.3 Contractor's Cx Agent to be present at tests performed and documented by sub-trades, suppliers and equipment manufacturers.

1.13 MANUFACTURER'S INVOLVEMENT

.1 Factory testing: manufacturer to:

.1 Coordinate time and location of testing.

.2 Provide testing documentation for approval by Departmental Representative.

.3 Arrange for Departmental Representative to witness tests.

.4 Obtain written approval of test results and documentation from Departmental Representative before delivery to site.

.2 Obtain manufacturers installation, start-up and operations instructions prior to start-up of components, equipment and systems and review with Departmental Representative.

.1 Compare completed installation with manufacturer's published data, record discrepancies, and review with manufacturer.

.2 Modify procedures detrimental to equipment performance and review same with manufacturer before start-up.

.3 Integrity of warranties:

.1 Use manufacturer's trained start-up personnel where specified elsewhere in other divisions or required to maintain integrity of warranty.

.2 Verify with manufacturer that testing as specified will not void warranties.

.4 Qualifications of manufacturer's personnel:

.1 Experienced in design, installation and operation of equipment and systems.

.2 Ability to interpret test results accurately.

.3 To report results in clear, concise, logical manner.

1.14 PROCEDURES

.1 Verify that equipment and systems are complete, clean, and operating in normal and safe manner prior to conducting start-up, testing and Cx.

.2 Conduct start-up and testing in following distinct phases:

.1 Included in delivery and installation:

.1 Verification of conformity to specification, approved shop drawings and completion of PI report forms.

.2 Visual inspection of quality of installation.

.2 Start-up: follow accepted start-up procedures.

.3 Operational testing: document equipment performance.

.4 System PV: include repetition of tests after correcting deficiencies.

.5 Post-substantial performance verification: to include fine-tuning.

.3 Correct deficiencies and obtain approval from Departmental Representative after distinct phases have been completed and before commencing next phase.

.4 Document require tests on approved PV forms.

.5 Failure to follow accepted start-up procedures will result in re-evaluation of equipment by an independent testing agency selected by Departmental Representative. If results reveal that equipment start-up was not in accordance with requirements, and resulted in damage to equipment, implement following:

.1 Minor equipment/systems: implement corrective measures approved by Departmental Representative.

.2 Major equipment/systems: if evaluation report concludes that damage is minor, implement corrective measures approved by Departmental Representative.

.3 If evaluation report concludes that major damage has occurred, Departmental Representative shall reject equipment.

.1 Rejected equipment to be remove from site and replace with new.

.2 Subject new equipment/systems to specified start-up procedures.

1.15 START-UP DOCUMENTATION

.1 Assemble start-up documentation and submit to Departmental Representative for approval before commencement of commissioning.

.2 Start-up documentation to include:

.1 Factory and on-site test certificates for specified equipment.

.2 Pre-start-up inspection reports.

.3 Signed installation/start-up check lists.

.4 Start-up reports,

.5 Step-by-step description of complete start-up procedures, to permit Departmental Representative to repeat start-up at any time.

1.16 OPERATION AND MAINTENANCE OF EQUIPMENT AND SYSTEMS

.1 After start-up, operate and maintain equipment and systems as directed by equipment/system manufacturer.

.2 With assistance of manufacturer develop written maintenance program and submit Departmental Representative for approval before implementation.

.3 Operate and maintain systems for length of time required for commissioning to be completed.

.4 After completion of commissioning, operate and maintain systems until issuance of certificate of interim acceptance.

1.17 TEST RESULTS

.1 If start-up, testing and/or PV produce unacceptable results, repair, replace or repeat specified starting and/or PV procedures until acceptable results are achieved.

.2 Provide manpower and materials, assume costs for re-commissioning.

1.18 START OF COMMISSIONING

.1 Notify Departmental Representative at least 21 days prior to start of Cx.

.2 Start Cx after elements of building affecting start-up and performance verification of systems have been completed.

1.19 INSTRUMENTS / EQUIPMENT

.1 Submit to Departmental Representative for review and approval:

.1 Complete list of instruments proposed to be used.

.2 Listed data including, serial number, current calibration certificate, calibration date, calibration expiry date and calibration accuracy.

.2 Provide the following equipment as required:

.1 2-way radios.

.2 Ladders.

.3 Equipment as required to complete work.

1.20 COMMISSIONING PERFORMANCE VERIFICATION

.1 Carry out Cx:

.1 Under actual operating conditions, over entire operating range, in all modes.

.2 On independent systems and interacting systems.

.2 Cx procedures to be repeatable and reported results are to be verifiable.

.3 Follow equipment manufacturer's operating instructions.

.4 EMCS trending to be available as supporting documentation for performance verification.

1.21 WITNESSING COMMISSIONING

.1 Departmental Representative to witness activities and verify results.

1.22 AUTHORITIES HAVING JURISDICTION

.1 Where specified start-up, testing or commissioning procedures duplicate verification requirements of authority having jurisdiction, arrange for authority to witness procedures so as to avoid duplication of tests and to facilitate expedient acceptance of facility.

.2 Obtain certificates of approval, acceptance and compliance with rules and regulation of authority having jurisdiction.

.3 Provide copies to Departmental Representative within 5 days of test and with Cx report.

1.23 COMMISSIONING CONSTRAINTS

.1 Since access into secure or sensitive areas will be very difficult after occupancy, it is necessary to complete Cx of occupancy, weather, and seasonal sensitive equipment and systems before issuance of the Certificate of Substantial Performance, using, if necessary, simulated thermal loads.

1.24 EXTRAPOLATION OF RESULTS

.1 Where Cx of weather, occupancy, or seasonal-sensitive equipment or systems cannot be conducted under near-rated or near-design conditions, extrapolate part-load results to design conditions when approved by Departmental Representative in accordance with equipment manufacturer's instructions, using manufacturer's data, with manufacturer's assistance and using approved formulae.

1.25 EXTENT OF VERIFICATION

.1 Laboratory areas:

.1 Provide manpower and instrumentation to verify up to 100% of reported results.

.2 Elsewhere:

.1 Provide manpower and instrumentation to verify up to 30% of reported results, unless specified otherwise in other sections.

.3 Number and location to be at discretion of Departmental Representative.

.4 Conduct tests repeated during verification under same conditions as original tests, using same test equipment, instrumentation.

.5 Review and repeat commissioning of systems if inconsistencies found in more than 20% of reported results.

.6 Perform additional commissioning until results are acceptable to Departmental Representative.

1.26 REPEAT VERIFICATIONS

.1 Assume costs incurred by Departmental Representative for third and subsequent verifications where:

.1 Verification of reported results fail to receive Departmental Representative's approval.

.2 Repetition of second verification again fails to receive approval.

.3 Departmental Representative deems Contractor's request for second verification was premature.

1.27 SUNDRY CHECKS AND ADJUSTMENTS

.1 Make adjustments and changes which become apparent as Cx proceeds.

.2 Perform static and operational checks as applicable and as required.

1.28 DEFICIENCIES, FAULTS, DEFECTS

.1 Correct deficiencies found during start-up and Cx to satisfaction of Departmental Representative.

.2 Report problems, faults or defects affecting Cx to Departmental Representative in writing. Stop Cx until problems are rectified. Proceed with written approval from Departmental Representative.

1.29 COMPLETION OF COMMISSIONING

.1 Upon completion of Cx leave systems in normal operating mode.

.2 Except for warranty and seasonal verification activities specified in Cx specifications, complete Cx prior to issuance of Interim Certificate of Completion.

.3 Cx to be considered complete when contract Cx deliverables have been submitted and accepted by Departmental Representative.

1.30 ACTIVITIES UPON COMPLETION OF COMMISSIONING

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

1.31 TRAINING

.1 In accordance with Section 01 79 00.

1.32 MAINTENANCE MATERIALS, SPARE PARTS, SPECIAL TOOLS

.1 Supply, deliver, and document maintenance materials, spare parts, and special tools as specified in contract.

1.33 OCCUPANCY

.1 Cooperate fully with Departmental Representative during stages of acceptance and occupancy of facility.

1.34 INSTALLED INSTRUMENTATION

.1 Use instruments installed under Contract for TAB and PV if:

.1 Accuracy complies with these specifications.

.2 Calibration certificates have been deposited with Departmental Representative.

.2 Calibrated EMCS sensors may be used to obtain performance data provided that sensor calibration has been completed and accepted.

1.35 PERFORMANCE VERIFICATION TOLERANCES

.1 Application tolerances:

.1 Specified range of acceptable deviations of measured values from specified values or specified design criteria. Except for special areas, to be within +/-10% of specified values.

.2 Instrument accuracy tolerances:

.1 To be of higher order of magnitude than equipment or system being tested.

.3 Measurement tolerances during verification:

.1 Unless otherwise specified actual values to be within +/-2% of recorded values.

1.36 OWNER'S PERFORMANCE TESTING

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

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 SUMMARY

.1 Conform to:

.2 Section 3, SACC Manual-- General Conditions of Contract,

.3 Section 4, SACC Manual—Supplemental General Conditions,

.4 Comply with Section 01 91 13 (General Commissioning Requirements), and

.5 Comply with Division 22, 23 and 25 requirements and documents referred to herein.

.2 Acronyms:

.1 Validate (for tests and demonstrations): to authenticate successful performance of systems and equipment, or record deficiencies; after deficiencies are repaired, to confirm that there has been a successful demonstration of the same systems and equipment; the authentication of those tests become references for the Departmental Representative's certification.

.2 Witness: The Commissioning Authority will observe as required and record summary of systems and equipment test results.

.3 BAS: Building Automation System.

.4 TAB: Testing, Adjusting and Balancing.

.5 Commissioning Authority: An agent in charge of the process of assuring that all systems and components of a building or industrial plant are designed, installed, tested, operated, and maintained according to the operational requirements of the Departmental Representative or Client.

.6 Independent Third Party Agent: An outside person or business specialized in the installation and testing of building systems and equipment who is retained by the Contractor or Departmental Representative.

1.2 REFERENCES

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

.1 ASHRAE Guideline 1.1-2007 Technical Requirements for the Commissioning Process

.2 Canadian Standards Association (CSA):

.1 CSA Z320-11, Building Commissioning Standard & Check Sheets

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

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

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

1.3 DOCUMENTS

.1 Documents will be governed in the order specified in Division 1, in case of discrepancies or conflicts between documents.

1.4 COMMISSIONING OBJECTIVES

.1 To support quality management through monitoring and checking of installation.

.2 To verify system performance through testing and commissioning of completed installation.

.3 To move completed facility from “static completion” state to optimal “dynamic” operating state.

.4 To transfer facility from Contractor to Departmental Representative in such a manner that provision of a quality facility has been assured.

.5 To optimize operating and maintenance through delivery of comprehensive quality training and instruction to Departmental Representative’s operating personnel.

.6 To provide accurate and useful historical records, such as, as-built drawings, test certificates, etc., to Departmental Representative.

.7 To extend commissioning into the operational phase in order to verify performance levels under a range of operating conditions; such as change of seasons.

.8 Monitor operation, performance and maintenance programs; optimize system’s performance under normal operating conditions and occupancy periods, under the direction and review of Commissioning Authority. This phase lasts throughout the warranty period. It may, however, involve activities to ensure completion of:

.9 System debugging and optimization.

.10 All commissioning activities on seasonally-sensitive systems, for varying modes and periodic simulated emergency conditions.

.11 Commissioning shall be considered complete when all of the objectives of commissioning, as specified herein, have been achieved.

1.5 COMMISSIONING MEETINGS, SCHEDULING, AND REPORTING

.1 The Contractor shall include the requirement of commissioning plan in their construction schedule and shall schedule for all tests and equipment start-up in the construction schedule.

.2 The Contractor shall attend all commissioning meetings, as called and chaired by the Commissioning Authority. The meetings shall address commissioning related responsibilities as well as all specified testing, documentation, O&M manuals, training, and post construction requirements. The testing schedules and results of all tests shall be reviewed at the meetings.

.3 The Contractor shall schedule work to include specified Commissioning related tasks, cooperate with the Departmental Representative’s Commissioning Authority, and coordinate sub trades as required, to successfully demonstrate and verify commissioning related tests.

.4 Testing forms and reports associated with the mechanical systems shall be directed to the Departmental Representative and the Commissioning Authority.

1.6 WARRANTY

.1 Involvement of the Commissioning Authority does not void any guaranties or warranties nor does it relieve the Contractor of any contractual responsibilities.

1.7 RESPONSIBILITIES OF CONTRACTOR

.1 Construction Phase:

- .1 To manage and ensure the entire installation complies with the requirements of the Contract Documents.
- .2 Submit shop drawings complete with Contractor's Stamp of Review.
- .3 Complete commissioning data test forms.
- .4 Submit a commissioning schedule. This schedule shall include:
  - .1 Schedule for testing and commissioning of the systems and major equipment.
  - .2 Time schedule for system and equipment commissioning which is in compliance with the timing and sequences of installation schedule stated above. The schedule should allow for additional time for testing and commissioning, such that re-test of the equipment can be performed in a timely manner, if required, without impacting the overall project schedule or causing delay to Project completion.
  - .3 Dates for completion of required factory tests prior to equipment delivery to the site shall be indicated in the schedule.
- .5 Prepare and submit testing and commissioning record or report forms for review and approval.
- .6 Attend commissioning meetings.
- .7 Provide complete equipment and systems start-up including personnel and tools, as required for safe, proper and complete start-up of all mechanical equipment.
- .8 Correct all deficiencies found during installation verification, start-up and TAB to ensure that all equipment and systems are fully functional and ready for functional performance testing.
- .9 Notify CxA a minimum of two weeks in advance of equipment and system start-up and/or installation verification testing.
- .10 Where required by codes and/or specification, retain manufacturers and/or independent third parties to provide service for testing and certification of the systems and training of Departmental Representative's personnel.
- .11 Provide training and instruction to the Departmental Representative's operating personnel.
- .12 Perform testing and commissioning of equipment and systems to the satisfaction of the Departmental Representative and Commissioning Authority. Testing and commissioning will be witnessed by the Commissioning Authority as required. The Contractor or his agents shall also record procedures and findings for approved tests, which shall be submitted to the Departmental Representative and Commissioning Authority with the signature of the tester, for review and approval.

.13 Pay for and be responsible for all inspections required by codes, specification and Authorities having Jurisdiction. Obtain and submit all Certificate of Approvals for such inspections and verifications.

.14 Submit for review as-built drawings including those for location of control devices, and wiring, operating and maintenance manuals for each piece of equipment as per the specification requirements.

.15 Provide Operating and Maintenance Manuals for review by the Departmental Representative and Commissioning Authority with all the testing and commissioning results and reports incorporated.

.16 Obtain issue and assign warranties for equipment and systems to the Departmental Representative.

.17 Provision of all necessary test equipment shall be the responsibility of the contractor. Provide recently validated calibration certificates for all equipment to be used for verification prior to testing and commissioning commencement.

.2 Post-Construction Phase:

.1 Optimize operation according to occupant's needs.

.2 Complete all commissioning procedures and activities and performance verification procedures which were delayed or not concluded during the commissioning phase.

.3 Complete system checks:

.1 Once during the first month of building operation.

.2 Once during the third month of building operation.

.3 Once between the fourth and tenth months in a season opposite to the first or third month visit.

.4 Complete rectification of all deficiencies revealed by these checks. Equipment manufacturers involved in commissioning shall participate in systems checks.

.5 Revise all "as-built" and operating and maintenance documents to reflect all changes, modifications, revisions and adjustment upon completion of commissioning.

1.8 COMMISSIONING INVOLVEMENT

.1 Commissioning Authority shall direct, witness and validate as required.

1.9 SYSTEMS TO BE COMMISSIONED

.1 Mechanical systems shall include but not be limited to the following:

.1 DOAS Air Handling Unit

.2 Air Source Heat Pump Condensing Units

.3 Exhaust Fans

.4 VRF Air Terminal Units

.5 Hydronic Unit Heaters

.6 Radiant Panels

.7 Heat Exchanger

.8 Condensing Boilers

.9 Electric Domestic Hot Water Heaters

.10 Electric Instantaneous Domestic Hot Water Heaters

.11 Pumps

.12 Miscellaneous Ventilation System

.13 Plumbing and Drainage System

.14 Fire Protection system

.15 Building automation system.

.16 Air and water balancing

.17 Natural gas piping system

1.10 TESTING EQUIPMENT

.1 Contractor and manufacturer shall provide all instrumentation and test equipment necessary to conduct the tests specified during the commissioning process. Contractor shall submit a list of equipment to be used and copies of the latest equipment calibration certificates to the Commissioning Authority and Departmental Representative for approval.

1.11 COMMISSIONING PROCESS

.1 Commissioning Authority is to perform and complete all work as specified in this Section and elsewhere in the contract document. Contractor to follow-up during first year of operation for fine tuning and building service monitoring.

.2 Equipment verification is to be performed by the Contractor who shall test and verify proper operation of all equipment and systems prior to start of commissioning and record all results from the test for each piece of equipment. Forms shall be included in the Operating and Maintenance Manual. Equipment data shall include, but is not limited to:

.1 Manufacturer’s name, address and telephone number.

.2 Distributors’ name, address and telephone number.

.3 Make, model number and serial number.

.4 Fans - belt type and size, sheave type and size.

.5 Electrical - volts, amps, fuse size, overload size.

.6 Equipment enclosure type.

.7 Switchboard, panel board - volt, rated current, number of phase and fault rating.

.8 Any other special parameters.

1.12 TESTING FOR MECHANICAL SYSTEMS

.1 Chemical Treatment of Water:

.1 Contractor shall employ a Chemical Treatment Specialist who shall assist the Contractor with selection of the chemical treatment system, inspect the installation and test the system. The Specialist shall submit a water quality test report to the Departmental Representative and Commissioning Authority.

.2 The Specialist shall add chemical immediately after the cleaning process for protection of each system. The specialist shall test water samples and repeat the process until specification requirements are met.

.3 The Specialist shall revisit the site during first year of occupancy and re-test systems as noted in other sections of the specification.

.2 Air and Water Balancing:

.1 TAB Subcontractor shall balance the entire water system to ensure all equipment and systems are operating to design conditions. Adjust the circuits by means of the balancing valves and record the balance positions.

.2 Each pump shall be checked for design, working and shut-off head conditions. Any pump flow that varies by more than ±5% from the design conditions shall be reported to the Contractor with recommendations to resolve the issue.

.3 Flow through all heat exchangers and other such equipment shall be balanced to ensure that the pressure drop through the equipment is within ±5% of manufacturer's design conditions.

.4 Initial balancing of coils shall be used to ensure that the pressure drops are within 10% of manufacturers' design conditions. When both the air and water systems are fully operational, entering air and water and leaving air and water readings shall be taken as close as possible to the peak design conditions to ensure the coil performance meets the design conditions. Coil water working conditions shall only be taken in conjunction with the air flow working conditions for the coil.

.5 TAB Subcontractor shall co-ordinate with Contractor to ensure all necessary devices, dampers and valves for control and balancing are installed in all necessary locations so that system can be balanced to meet the requirements of the specification. Report any deficiencies noted prior to testing and failure to do so resulting in being unable to balance the systems, the cost of any changes required shall be paid for by the Contractor at no cost to Departmental Representative.

.6 TAB Subcontractor shall balance the entire air systems including air volumes and control settings under maximum system pressure drop conditions (filter at replacement condition).

.7 TAB Subcontractor shall take air measurements, make final adjustments and report upon the air volume at each variable volume box, diffuser, register and grille. Measure the static pressure upstream and downstream of the fan, the fan speed and the motor current.

.8 Measure the return and supply air flow when mixing dampers are set for full outside air and minimum outside air position.

.9 Contractor shall provide new filters after final balancing has been completed.

.10 Air volumes measured by TAB Subcontractor shall be within ±5% of those shown on Drawings for diffusers, grilles, registers, variable air volume boxes and fans, at both maximum and minimum volumes shown.

.11 Duct traverse readings shall be taken through access ports. The access ports shall be Duro Dyne IP-1 or IP-2 air tight type. Duct tape is not acceptable.

.12 In all cases where measurements by TAB Subcontractor show failure to comply with the drawings and specifications, Contractor at no cost to Departmental Representative shall change fan sheaves, etc., as required and new balancing measurements shall be taken by TAB Subcontractor.

.13 BAS Subcontractor shall make all necessary adjustments through the control system as requested by TAB Subcontractor and if failure to co-ordinate results in any cost, it should be absorbed by the Contractor with no cost to Departmental Representative.

.14 TAB Subcontractor shall repeat the balancing until required conditions are met.

.15 At time of final inspection, recheck, in presence of Departmental Representative and Commissioning Authority, random selections of data recorded in the certified report. Points or areas of recheck shall be selected by Departmental Representative/ Commissioning Authority and shall be a maximum of 30% of the report data.

.16 In the event the report is rejected, rebalance all systems, submit new certified reports and perform a re-inspection, all at no additional cost to Departmental Representative.

.17 Following final acceptance of the certified reports by Departmental Representative, permanently mark the settings of all valves and other adjustable devices so that balance set position can be restored if distributed at any time. For circuit balancing valves record the valve position by the number of turns registered on the valve and lock the valve into that position. Do not mark such devices until after final acceptance.

.18 Submit copy of air and water balancing report to the Departmental Representative and Commissioning Authority for review.

.19 Include in the Air Balancing Report:

.1 Types, serial numbers and dates of calibration of all instruments used in balancing report;

.2 Fan design and measured data: total volume flow rate, outside air flow, static pressure, motor type, RPM, volts, and full load amps;

.3 A complete system schematic with design and actual flow rates at each outlet or inlet. Show room numbers and floors. Location and number designation;

.4 Manufacturers' catalogue identification and type, of air inlets and outlets application factors, designated area, design and recorded velocities, design and recorded air flow rates.

.3 Duct Leakage Test and Pipe Pressure Test:

.1 Contractor shall test for air leakage of the in accordance with SMACNA Manuals and Standards, as noted in other sections of the specification. Test report to be forwarded to the Commissioning Authority for review and approval.

.4 Start-up and test procedures:

.1 Start-up and test procedures must be consistent with manufacturer's recommendations contained in the Operating and Maintenance Manual.

.2 The start-up report shall record all observations made during the start-up procedures including problems and their resolutions.

.3 Contractor shall retain the services of the manufacturer's technicians to test the equipment and associated systems. Technician shall record the results of the tests on the testing forms. A copy of the test forms, signed by the manufacturers' technician, shall be forwarded to the Commissioning Authority and Departmental Representative for review and comments, if any. The original copy of the test form shall be inserted into the Operating Manual.

.5 Re-Testing:

.1 Should equipment or systems fail a test, the test shall be repeated after repairs or adjustments have been made. The additional tests shall be witnessed by the Departmental Representative and the Commissioning Authority.

.2 Tests which have not been witnessed may not be accepted and could be repeated unless directed otherwise.

.6 Air Handling Systems:

.1 Air handling units shall be inspected and tested by manufacturer's technician. Technician shall enter the test results on forms provided by manufacturer. The Departmental Representative shall witness the final operational test.

.2 Technician shall verify that the units have been installed according to manufacturer's recommendations, shop drawings and specification.

.3 Tests shall include verification of electrical power, electrical interlocks, safeties, control, heating and cooling system, fans and dampers.

.4 Technician shall start-up the air handling unit and monitor the operation for a minimum of 4 hours of running time after all tests have been completed. Technician shall issue a report to Departmental Representative and Commissioning Authority after each visit.

.5 Air handling unit manufacturer shall co-ordinate with BAS Subcontractor to provide the necessary interface to the BAS.

.6 Contractor shall rectify any deficiencies identified by TAB Subcontractor related to low/high air flow, high amperage, etc.

.7 1.23 Building Automation and Controls Systems:

.1 The Building Automation and Controls Systems shall be fully tested and commissioned by manufacturer's technician to operate in the manner defined by the specifications.

.2 BAS Subcontractor shall provide a print-out of general and critical alarm lists and all points connected to the BAS. The point-to-point verification report for all control and monitoring points shall be submitted to the Commissioning Authority prior to the acceptance test.

.3 BAS Subcontractor shall provide an operating terminal and sufficient training and instruction to TAB Contractor which will allow them to set-up and balance the water and air systems.

.4 All sensors to be calibrated to ensure the recorded data are accurate.

.5 Ensure all required interfaces are properly installed such as interface with life safety monitoring system.

.6 BAS Subcontractor in conjunction with the mechanical contractor shall create simulated design load conditions for control verification tests.

.7 Testing procedures should include but not limited to:

.8 Check and verify that each input point is reporting to the Building Automation and Controls Systems panels and workstations in the normal state and change or state.

.9 Create false alarms at each point and provide a print-out of the test.

.10 Command each output point, via workstation and verify action at the device.

.11 Verify that each time of day and optimum start program is operational in software and at the device.

.12 Verify that each program is operational in software and at the device(s).

.13 Verify that each system graphic is dynamically updating.

.14 Test each DDC loop and verify that it is controlling in a stable manner. Create set point changes on output points. False loads shall be introduced to observe the control loops response.

.15 Verify that each report type is functional.

.16 Verify that each global program that controls more than 1 system is operating.

.17 Verify that all safeties are operating (i.e. fire stat).

.18 Verify valve and damper actuation.

.19 Verify the calibration of each analog input point.

.20 Any sensor disconnected from the input terminal after completion of the performance test shall be retested.

.21 BAS Subcontractor shall provide a “signed-off” copy of the results of all tests to the Commissioning Authority/Departmental Representative. Acceptance test will not begin until the tests have been reviewed and accepted.

.22 When all tests have been completed by BAS Subcontractor, the acceptance test procedure shall begin as noted in other sections of this specification.

.23 During the acceptance test Contractor shall log all-points in each day. The logs shall be issued to Commissioning Authority for review.

.24 System shall not be accepted or considered substantially complete until all tests are completed and approved.

.25 BAS Subcontractor shall provide a minimum of 2 weeks’ notice to the Commissioning Authority prior to testing date.

.26 BAS Subcontractor shall revisit the site during the first year of operation to review the performance of the Building Automation and Controls Systems. The review shall include DDC loop tuning, sensor calibration, programs, communication, DDC panels, workstations and the operational logs.. The visits shall be:

.1 Beginning of cooling season

.2 During the cooling season

.3 Beginning of heating season

.4 During the heating season

1.13 OPERATING AND MAINTENANCE MANUAL

.1 Contractor shall prepare and submit the Operating and Maintenance Manual in accordance with Section 01 78 00 – Closeout Submittals to Departmental Representative/ Commissioning Authority prior to beginning of training.

.2 The final copy of the O&M manual shall be submitted to the Departmental Representative after all comments provided by the Commissioning Authority and Departmental Representative are addressed by the Contractor.

1.14 OPERATOR TRAINING AND INSTRUCTIONS

.1 Contractor and equipment manufacturers shall provide operator training for each mechanical system and equipment. The training shall meet all requirements as noted in other sections of this specification.

.2 Each session shall be structured to cover:

.1 The Operating and Maintenance Manual.

.2 Operating procedures.

.3 Maintenance procedures.

.4 Trouble-shooting procedures.

.5 Manufacturer's or service representative's name, address and phone number.

.3 Contractor shall prepare a detailed training and instruction plan. This plan shall include the outline of all sessions and identification of the training presenters.

.4 Training and instruction requirement for the mechanical system shall include a walk-through of building by Contractor.

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 SUMMARY

.1 Section Includes:

.1 Commissioning forms to be completed for equipment, system and integrated system.

1.2 INSTALLATION/START- UP CHECK LISTS

.1 Include the following data:

.1 Product manufacturer's installation instructions and recommended checks.

.2 Special procedures as specified in relevant technical sections.

.3 Items considered good installation and engineering industry practices deemed appropriate for proper and efficient operation.

.2 Equipment manufacturer's installation/start-up check lists are acceptable for use. As deemed necessary by Departmental Representative supplemental additional data lists will be required for specific project conditions.

.3 Use check lists for equipment installation. Document check list verifying checks have been made, indicate deficiencies and corrective action taken.

.4 Installer to sign check lists upon completion, certifying stated checks and inspections have been performed. Return completed check lists to Departmental Representative. Check lists will be required during Commissioning and will be included in Building Maintenance Manual (BMM) at completion of project.

.5 Use of check lists will not be considered part of commissioning process but will be stringently used for equipment pre-start and start-up procedures.

1.3 PRODUCT INFORMATION (PI) REPORT FORMS

.1 Product Information (PI) forms compiles gathered data on items of equipment produced by equipment manufacturer, includes nameplate information, parts list, operating instructions, maintenance guidelines and pertinent technical data and recommended checks that is necessary to prepare for start-up and functional testing and used during operation and maintenance of equipment. This documentation is included in the BMM at completion of work.

.2 Prior to Performance Verification (PV) of systems complete items on PI forms related to systems and obtain Departmental Representative's approval.

1.4 PERFORMANCE VERIFICATION (PV) FORMS

.1 PV forms to be used for checks, running dynamic tests and adjustments carried out on equipment and systems to ensure correct operation, efficiently and function independently and interactively with other systems as intended with project requirements.

.2 PV report forms include those developed by Contractor records measured data and readings taken during functional testing and Performance Verification procedures.

.3 Prior to PV of integrated system, complete PV forms of related systems and obtain Departmental Representative's approval.

1.5 CHANGES AND DEVELOPMENT OF NEW REPORT FORMS

.1 When additional forms are required, but are not available from Departmental Representative develop appropriate verification forms and submit to Departmental Representative for approval prior to use.

.1 Additional commissioning forms to be in same format as provided by Departmental Representative.

1.6 COMMISSIONING FORMS

.1 Use Commissioning forms to verify installation and record performance when starting equipment and systems.

.2 Strategy for Use:

.1 Departmental Representative provides Contractor project-specific Commissioning forms with Specification data included.

.2 Contractor will provide required shop drawings information and verify correct installation and operation of items indicated on these forms.

.3 Confirm operation as per design criteria and intent.

.4 Identify variances between design and operation and reasons for variances.

.5 Verify operation in specified normal and emergency modes and under specified load conditions.

.6 Record analytical and substantiating data.

.7 Verify reported results.

.8 Form to bear signatures of recording technician and reviewed and signed off by Departmental Representative.

.9 Submit immediately after tests are performed.

.10 Reported results in true measured SI unit values.

.11 Provide Departmental Representative with originals of completed forms.

.12 Maintain copy on site during start-up, testing and commissioning period.

1.7 LANGUAGE

.1 To suit the language profile of the awarded contract.

Part 2 PRODUCTS

2.1 NOT USED

.1 Not Used.

Part 3 EXECUTION

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 GENERAL

1.1 SUMMARY

.1 Section Includes:

.1 This Section is limited to portions of the Building Management Manual (BMM) provided to Departmental Representative by Contractor.

.2 Acronyms:

.1 BMM - Building Management Manual.

.2 Cx - Commissioning.

.3 HVAC - Heating, Ventilation and Air Conditioning.

.4 PI - Product Information.

.5 PV - Performance Verification.

.6 TAB - Testing, Adjusting and Balancing.

.7 WHMIS - Workplace Hazardous Materials Information System.

1.2 GENERAL REQUIREMENTS

.1 Standard letter size paper 216 mm x 279 mm.

.2 Methodology used to facilitate updating.

.3 Drawings, diagrams and schematics to be professionally developed.

.4 Electronic copy of data to be in a format accepted and approved by Departmental Representative.

1.3 APPROVALS

.1 Prior to commencement, co-ordinate requirements for preparation, submission and approval with Departmental Representative.

1.4 GENERAL INFORMATION

.1 Provide Departmental Representative the following for insertion into appropriate Part and Section of BMM:

.1 Complete list of names, addresses, telephone and fax numbers of Contractor, sub-contractors that participated in delivery of project - as indicated in Section 1.2 of BMM.

.2 Summary of architectural, structural, fire protection, mechanical and electrical systems installed and commissioned - as indicated in Section 1.4 of BMM.

.1 Including sequence of operation as finalized after commissioning is complete as indicated in Section 2.0 of BMM.

.3 Description of building operation under conditions of heightened security and emergencies as indicated in Section 2.0 of BMM.

.4 System, equipment and components Maintenance Management System (MMS) identification - Section 2.1 of BMM.

.5 Information on operation and maintenance of architectural systems and equipment installed and commissioned - Section 2.0 of BMM.

.6 Information on operation and maintenance of fire protection and life safety systems and equipment installed and commissioned - Section 2.0 of BMM.

.7 Information on operation and maintenance of mechanical systems and equipment installed and commissioned - Section 2.0 of BMM.

.8 Operating and maintenance manual - Section 3.2 of BMM.

.9 Final commissioning plan as actually implemented.

.10 Completed commissioning checklists.

.11 Commissioning test procedures employed.

.12 Completed Product Information (PI) and Performance Verification (PV) report forms, approved and accepted by Departmental Representative.

.13 Commissioning reports.

1.5 CONTENTS OF OPERATING AND MAINTENANCE MANUAL

.1 For detailed requirements refer to Section 01 78 00 – Closeout Submittals.

.2 Departmental Representative to review and approve format and organization within twelve (12) weeks of award of contract.

.3 Include original manufactures brochures and written information on products and equipment installed on this project.

.4 Record and organize for easy access and retrieval of information contained in BMM.

.5 Include completed PI report forms, data and information from other sources as required.

.6 Inventory directory relating to information on installed systems, equipment and components.

.7 Approved project shop-drawings, product and maintenance data.

.8 Manufacturer's data and recommendations relating: manufacturing process, installation, commissioning, start-up, O&M, shutdown and training materials.

.9 Inventory and location of spare parts, special tools and maintenance materials.

.10 Warranty information.

.11 Inspection certificates with expiration dates, which require on-going re-certification inspections.

.12 Maintenance program supporting information including:

.1 Recommended maintenance procedures and schedule.

.2 Information to removal and replacement of equipment including, required equipment, points of lift and means of entry and egress.

1.6 LIFE SAFETY COMPLIANCE (LSC) MANUAL

.1 Samples of LSC Manual will be available from Departmental Representative.

.2 Content of Manual:

.1 All possible Emergency situations modes including: presence of fire and smoke, power failure, lose of water or pressure, chemical spills and refrigerant release.

.2 Failure of elevators and escalators.

.3 HVAC emergencies and fuel supply failures.

.4 Intrusion and security breach.

.5 Emergency provisions for natural disasters, bomb threats and other disruptive situations.

.6 Dedicated emergency generators for high security projects, medical facilities and computer systems.

.7 Emergency control procedures for fire, power and major equipment failure.

.8 Emergency contacts and numbers.

.9 Manual to be readily available and comprehensible to non-technical readers.

1.7 SUPPORTING DOCUMENTATION FOR INSERTION INTO SUPPORTING APPENDICES

.1 Provide Departmental Representative supporting documentation relating to installed equipment and system, including:

.1 General:

.2 Finalized commissioning plan.

.3 WHMIS information manual.

.4 Approved "as-built" drawings and specifications.

.5 Procedures used during commissioning.

.6 Cross-Reference to specification sections.

.2 Architectural and structural:

.1 Inspection certificates, construction permits.

.2 Roof anchor log books.

.3 PV reports.

.3 Fire prevention, suppression and protection:

.1 Test reports.

.2 Smoke test reports.

.3 PV reports.

.4 Mechanical:

.1 Installation permits, inspection certificates.

.2 Piping pressure test certificates.

.3 Ducting leakage test reports.

.4 TAB and PV reports.

.5 Charts of valves and steam traps.

.6 Copies of posted instructions.

.5 Electrical:

.1 Installation permits, inspection certificates.

.2 TAB and PV reports.

.3 Electrical work log book.

.4 Charts and schedules.

.5 Locations of cables and components.

.6 Copies of posted instructions.

.6 Assist Departmental Representative with preparation of BMM.

1.8 LANGUAGE

.1 English and French Language to be in separate binders.

1.9 USE OF CURRENT TECHNOLOGY

.1 Use current technology for production of documentation. Emphasis on ease of accessibility at all times, maintain in up-to-date state, compatibility with user's requirements.

.2 Obtain Departmental Representative's approval before starting Work.

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 SECTION INCLUDES

.1 Methods and procedures for deconstruction of structures and parts of structures.

1.2 RELATED REQUIREMENTS

.1 Section 04 01 52 – Unit Masonry Repair and Replacement: Brick removal and salvage.

1.3 REFERENCES

.1 CSA International

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

.2 Canada Green Building Council (CaGBC)

.1 LEED Canada-NC 2009, LEED (Leadership in Energy and Environmental Design): Green Building Rating System Reference Package For New Construction and Major Renovations (including Addenda).

.3 U.S. Environmental Protection Agency (EPA)/Office of Water

.1 EPA 832/R-92-005, Storm Water Management for Construction Activities: Developing Pollution Prevention Plans and Best Management Practices.

.4 Federal Legislation.

.1 Canadian Environmental Assessment Act (CEAA), 1992, c. 37.

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

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

1.4 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00.

.2 Submit demolition drawings:

.1 Submit for review and approval by Departmental Representative shoring and underpinning drawings stamped and signed by professional engineer registered or licensed in the Province of Ontario Canada, showing proposed method.

.3 If material resembling spray or trowel-applied asbestos or other designated substance listed be encountered, stop work, take preventative measures, and notify Departmental Representative immediately.

.1 Proceed only after receipt of written instructions have been received from Departmental Representative.

.4 Notify Departmental Representative before disrupting building access or services.

1.5 DEFINITIONS

.1 Alternate Disposal: reuse and recycling of materials by designated facility, user or receiving organization which has valid Certificate of Approval to operate. Alternative to landfill disposal.

.2 Deconstruction: systematic dismantling of structure in a manner that achieves safe removal/disposal of hazardous materials and maximum salvage/recycling of materials.

.1 Ultimate objective is to recover potentially valuable resources while diverting from landfill what has traditionally been significant portion of waste system.

.3 Demolition: rapid destruction of structure with or without prior removal of hazardous materials.

.4 Hazardous Materials: dangerous substances, dangerous goods, hazardous commodities and hazardous products, including but not limited to: corrosive agents, flammable substances, ammunition, explosives, radioactive substances, or other material that can endanger human health, well being or environment if handled improperly.

.5 Recycle: process by which waste and recyclable materials are transformed or collected for purpose of being transferred into new products.

.6 Recycling: process of sorting, cleansing, treating and reconstituting solid waste and other discarded materials for purpose of using in altered form.

.1 Recycling does not include burning, incinerating, or thermally destroying waste.

.7 Reuse: repeated use of product in same form but not necessarily for same purpose. Reuse includes:

.1 Salvaging reusable materials from remodelling 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.

.8 Salvage: removal of structural and non-structural materials from deconstruction/disassembly projects for purpose of reuse or recycling.

.9 Source Separation: acts of keeping different types of waste materials separate, beginning from first time they became waste.

.10 Waste Management Coordinator (WMC): contractor representative responsible for supervising waste management activities as well as coordinating related, required submittal and reporting requirements.

1.6 SUBMITTALS

.1 Submittals in accordance with Section 01 33 00.

.2 Submit copies of certified weigh bills from authorized disposal sites and reuse and recycling facilities for material removed from site to Departmental Representative at specified project milestones or upon request.

.1 Written authorization from Departmental Representative is required to deviate from receiving organizations listed in Waste Reduction Workplan.

.3 Include following information:

.1 Time and date of removal.

.2 Description of materials.

.3 Weight of material.

.4 Breakdown of reuse, recycling and landfill percentages.

.5 End destination of materials.

.4 Workers, haulers and subcontractors must possess current, applicable Certificates of Approval to remove, handle and dispose of wastes categorized as hazardous.

.1 Provide proof of compliance within 24 hours upon written request of Departmental Representative.

1.7 QUALITY ASSURANCE

.1 Ensure Work is performed in compliance with CEPA, CEAA, TDGA, and applicable provincial regulations.

1.8 STORAGE, HANDLING AND PROTECTION

.1 Do in accordance with Section 01 74 20.

1.9 ENVIRONMENTAL REQUIREMENTS

.1 Do Work in accordance with Section 01 35 43.

1.10 SITE CONDITIONS

.1 Existing Conditions.

.1 Should materials resembling spray or trowel applied asbestos or other designated substance 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.

.2 Protection.

.1 Prevent movement, settlement or damage of adjacent structures, services, walks, paving, trees, landscaping, adjacent grades. Provide bracing or shoring 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 appears to be endangered, take preventative measures. Cease operations and immediately notify Departmental Representative.

.3 Prevent debris from blocking surface drainage system, elevators, mechanical and electrical systems.

Part 2 PRODUCTS

2.1 EQUIPMENT

.1 Leave equipment and machinery running only while in use, except where extreme temperatures prohibit shutting down.

.2 Where possible use water efficient wetting equipment/trucks/attachments when minimizing dust.

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

Part 3 EXECUTION

3.1 EXAMINATION

.1 Inspect building with Departmental Representative and verify extent and location of items designated for removal, disposal, alternative disposal, recycling, salvage and items to remain.

.2 Locate and protect utilities. Preserve active utilities traversing site in operating condition.

.3 Notify and obtain approval of utility companies before starting demolition.

.4 Disconnect, cap, plug or divert, as required, existing public utilities within the property where they interfere with the execution of the work, in conformity with the requirements of the authorities having jurisdiction. Mark the location of these and previously capped or plugged services on the site and indicate location (horizontal and vertical) on the record drawings. Support, shore up and maintain pipes and conduits encountered.

.1 Immediately notify Departmental Representative and utility company concerned in case of damage to any utility or service, designated to remain in place.

.2 Immediately notify the Departmental Representative should uncharted utility or service be encountered, and await instruction in writing regarding remedial action.

3.2 PREPARATION

.1 Do Work in accordance with Section 01 35 29.

.2 Post warning signs on electrical lines and equipment which must remain energized to serve other products during period of demolition.

.3 Locate and protect utility lines. Do not disrupt active or energized utilities traversing premises.

.4 Disconnect and cap designated mechanical services.

.5 Demolition/Removal:

.1 Remove items as indicated.

.2 Remove parts of existing building to permit new construction.

.3 Trim edges of partially demolished building elements to tolerances as defined by Departmental Representative to suit future use.

3.3 DISASSEMBLY

.1 Materials removed from structure are property of Contractor unless indicated otherwise.

.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 briefed 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.

.6 Workers must utilize adequate fall protection where Departmental Representative considers it necessary.

.7 Maintain structural integrity of structure.

.8 Systematically remove finishes, furnishings, and mechanical and electrical equipment as indicated.

.9 Carefully remove windows and doors from structure.

.10 Disassemble non-loadbearing interior partitions and remove materials from structure.

.11 Disassemble in sequence: roof, interior loadbearing partitions, exterior walls, floors, and foundation.

.12 Wherever possible, transfer material assemblies from heights to ground level for easier disassembly. Take appropriate measures to ensure safety.

.13 Separate from waste stream, material in condition suitable for reuse and/or recycling.

.14 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.

.15 Source separate for recycling materials that cannot be salvaged for reuse including wood, metal, concrete and asphalt.

.16 Remove materials that cannot be salvaged for reuse or recycling and dispose of in accordance with applicable codes at licensed facilities.

.17 Where existing materials are to be re-used in Work, use special care in removal, handling, storage and re-installation to assure proper function in completed work.

3.4 PROCESSING

.1 Designate location for processing of materials which eliminates double handling and provides adequate space to maintain efficient material flow.

.2 Separate and handle materials to ensure best possible condition of salvaged materials.

.3 Keep processing area clean and free of excess debris.

.4 Supply separate, marked disposal bins for categories of waste material. Notify Departmental Representative prior to removal of bins from site.

.5 Separate processed materials into organized piles for stockpiling. Provide collection area for materials processed. Pile materials on pallets to facilitate transport to storage areas.

3.5 REMOVAL FROM SITE

.1 Transport material designated for alternate disposal to approved receiving organizations listed in waste reduction workplan and in accordance with applicable regulations. Do not deviate from receiving organizations listed in waste reduction workplan without prior written authorization from Departmental Representative.

.2 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.

3.6 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11.

.3 Refer to demolition drawings and specifications for items to be salvaged for reuse.

.4 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 20.

.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 Definitions:

.1 Dangerous Goods: product, substance, or organism specifically listed or meets hazard criteria established in Transportation of Dangerous Goods Regulations.

.2 Hazardous Material: product, substance, or organism used for its original purpose; and is either dangerous goods or material that will cause adverse impact to environment or adversely affect health of persons, animals, or plant life when released into the environment.

.3 Hazardous Waste: hazardous material no longer used for its original purpose and that is intended for recycling, treatment or disposal.

1.2 REFERENCE STANDARDS:

.1 Canada Green Building Council (CaGBC)

.1 LEED Canada-NC 2009, LEED (Leadership in Energy and Environmental Design): Green Building Rating System Reference Package for New Construction and Major Renovations.

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

.1 Export and Import of Hazardous Waste and Hazardous Recyclable Material Regulations (SOR/2005-149).

.3 Department of Justice Canada (Jus)

.1 Transportation of Dangerous Goods Act, 1992 (TDG Act) 1992, (c. 34).

.2 Transportation of Dangerous Goods Regulations (T-19.01-SOR/2001-286).

.4 Green Seal Environmental Standards (GS)

.1 GS-11-2008, 2nd Edition, Paints and Coatings.

.2 GS-36-00, Commercial Adhesives.

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

.1 Material Safety Data Sheets (MSDS).

.6 National Research Council Canada Institute for Research in Construction (NRC-IRC)

.1 National Fire Code of Canada-2010.

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

.2 SCAQMD Rule 1113-A2007, Architectural Coatings.

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

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for hazardous materials and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Submit two copies of WHMIS MSDS to Departmental Representative for each hazardous material required prior to bringing hazardous material on site.

.3 Submit hazardous materials management plan to Departmental Representative that identifies hazardous materials, usage, location, personal protective equipment requirements, and disposal arrangements.

.2 Sustainable Design Submittals:

.1 Construction Waste Management:

.1 Submit project Waste Management Plan and/or Waste Reduction Workplan, as required, highlighting recycling and salvage requirements.

.2 Submit calculations on end-of-project recycling rates, salvage rates, and landfill rates demonstrating that construction wastes were recycled or salvaged

.3 Low-Emitting Materials: submit listing of adhesives, sealants and paints and coatings used in building, comply with VOC and chemical component limits or restrictions requirements.

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 Transport hazardous materials and wastes in accordance with Transportation of Dangerous Goods Act, Transportation of Dangerous Goods Regulations, and applicable provincial regulations.

.1 When exporting hazardous waste to another country, ensure compliance with Export and Import of Hazardous Waste and Hazardous Recyclable Materials Regulations.

.4 Storage and Handling Requirements:

.1 Co-ordinate storage of hazardous materials with Departmental Representative and abide by internal requirements for labelling and storage of materials and wastes.

.2 Store and handle hazardous materials and wastes in accordance with applicable federal and provincial laws, regulations, codes, and guidelines.

.3 Store and handle flammable and combustible materials in accordance with National Fire Code of Canada requirements.

.4 Keep no more than 45 litres of flammable and combustible liquids such as gasoline, kerosene and naphtha for ready use.

.1 Store flammable and combustible liquids in approved safety cans bearing the Underwriters' Laboratory of Canada or Factory Mutual seal of approval.

.2 Storage of quantities of flammable and combustible liquids exceeding 45 litres for work purposes requires the written approval of the Departmental Representative.

.5 Transfer of flammable and combustible liquids is prohibited within buildings.

.6 Transfer flammable and combustible liquids away from open flames or heat-producing devices.

.7 Solvents or cleaning agents must be non-flammable or have flash point above 38 degrees C.

.8 Store flammable and combustible waste liquids for disposal in approved containers located in safe, ventilated area. Keep quantities to minimum.

.9 Observe smoking regulations, smoking is prohibited in areas where hazardous materials are stored, used, or handled.

.10 Storage requirements for quantities of hazardous materials and wastes in excess of 5 kg for solids, and 5 litres for liquids:

.1 Store hazardous materials and wastes in closed and sealed containers.

.2 Label containers of hazardous materials and wastes in accordance with WHMIS.

.3 Store hazardous materials and wastes in containers compatible with that material or waste.

.4 Segregate incompatible materials and wastes.

.5 Ensure that different hazardous materials or hazardous wastes are stored in separate containers.

.6 Store hazardous materials and wastes in secure storage area with controlled access.

.7 Maintain clear egress from storage area.

.8 Store hazardous materials and wastes in location that will prevent them from spilling into environment.

.9 Have appropriate emergency spill response equipment available near storage area, including personal protective equipment.

.10 Maintain inventory of hazardous materials and wastes, including product name, quantity, and date when storage began.

.11 When hazardous waste is generated on site:

.12 Ensure personnel have been trained in accordance with Workplace Hazardous Materials Information System (WHMIS) requirements.

.13 Report spills or accidents immediately to Departmental Representative. Submit a written spill report to Departmental Representative within 24 hours of incident.

Part 2 PRODUCTS

2.1 MATERIALS

.1 Description:

.1 Bring on site only quantities hazardous material required to perform Work.

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

Part 3 EXECUTION

3.1 CLEANING

.1 Progress 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 Dispose of hazardous waste materials in accordance with applicable federal and provincial acts, regulations, and guidelines.

.2 Recycle hazardous wastes for which there is approved, cost effective recycling process available.

.3 Send hazardous wastes to authorized hazardous waste disposal or treatment facilities.

.4 Burning, diluting, or mixing hazardous wastes for purpose of disposal is prohibited.

.5 Disposal of hazardous materials in waterways, storm or sanitary sewers, or in municipal solid waste landfills is prohibited.

.6 Dispose of hazardous wastes in timely fashion in accordance with applicable provincial regulations.

.7 Minimize generation of hazardous waste to maximum extent practicable. Take necessary precautions to avoid mixing clean and contaminated wastes.

.8 Identify and evaluate recycling and reclamation options as alternatives to land disposal, such as:

.1 Hazardous wastes recycled in manner constituting disposal.

.2 Hazardous waste burned for energy recovery.

.3 Lead-acid battery recycling.

.4 Hazardous wastes with economically recoverable precious metals.

END OF SECTION

Part 1 GENERAL

1.1 SUMMARY

.1 Comply with requirements of this Section when performing following work:

.1 Removal of any asbestos-containing exterior caulking associated with windows, doors, etc., if the material is removed without being broken, cut, drilled, abraded, ground, sanded or vibrated.

.2 Removal of any asbestos-containing 30 cm x 30 cm vinyl floor tiles and associated mastics, if the material is removed without being broken, cut, drilled, abraded, ground, sanded or vibrated.

.3 Removing less than one square metre of drywall in which joint-filling compounds that are asbestos-containing material have been used.

.4 Breaking, cutting, drilling, abrading, grinding, sanding or vibrating above noted and other non-friable asbestos-containing material if,

.1 the material is wetted to control the spread of dust or fibres, and

.2 the work is done only by means of non-powered hand-held tools.

.5 Refer to the following document for details on asbestos-containing materials:

.1 Designated Substance Survey, 441 University Avenue, Windsor, Ontario. Prepared by DST Consulting Engineers, Inc. Dated January 21, 2017.

1.2 SECTION INCLUDES

.1 Requirements and procedures for asbestos abatement of non-friable asbestos-containing materials, and less than one square metre of drywall with asbestos containing joint compound.

1.3 REFERENCES

.1 Department of Justice Canada (JUS)

.1 Canadian Environmental Protection Act, 1999 (CEPA).

.2 Transport Canada (TC)

.1 Transportation of Dangerous Goods Act, 1992 (TDGA).

.3 O. Reg. 278/05, Designated Substance - Asbestos on Construction Projects and in Buildings and Repair Operations.

.4 O. Reg. 490/09, Designated Substances.

.5 A Guide to the Regulations respecting Asbestos on Construction Projects and in Buildings and Repair Operations released in November 2007, http://www.labour.gov.on.ca/english/hs/ asbestos/index.html.

1.4 DEFINITIONS

.1 HEPA vacuum: High Efficiency Particulate Air filtered vacuum equipment with filter system capable of collecting and retaining fibres greater than 0.3 microns in any direction at 99.97% efficiency.

.2 Amended Water: water with nonionic surfactant wetting agent added to reduce water tension to allow thorough wetting of fibres.

.3 Asbestos-Containing Materials (ACMs): materials that contain 0.5 per cent or more asbestos by dry weight and are identified under Existing Conditions including fallen materials and settled dust.

.4 Asbestos Work Area: area where work takes place which will, or may, disturb ACMs.

.5 Authorized Visitors: Engineers, Consultants or designated representatives, and representatives of regulatory agencies.

.6 Competent worker person: in relation to specific work, means a worker who:

.1 Is qualified because of knowledge, training and experience to perform the work.

.2 Is familiar with the provincial and federal laws and with the provisions of the regulations that apply to the work.

.3 Has knowledge of all potential or actual danger to health or safety in the work.

.6 Friable material: means material that:

.1 When dry, can be crumbled, pulverized or powdered by hand pressure, or

.2 is crumbled, pulverized or powdered.

.7 Non-Friable Material: material that when dry cannot be crumbled, pulverized or powdered by hand pressure.

.8 Occupied Area: any area of the building or work site that is outside Asbestos Work Area.

.9 Polyethylene: polyethylene sheeting or rip-proof polyethylene sheeting with tape along edges, around penetrating objects, over cuts and tears, and elsewhere as required to provide protection and isolation.

.10 Sprayer: garden reservoir type sprayer or airless spray equipment capable of producing mist or fine spray. Must have appropriate capacity for work.

1.5 SUBMITTALS

.1 Submit proof satisfactory to Departmental Representative that suitable arrangements have been made to dispose of asbestos-containing waste in accordance with requirements of authority having jurisdiction.

.2 Submit Provincial/Territorial and/or local requirements for Notice of Project Form.

.3 Submit proof of Contractor's Asbestos Liability Insurance.

.4 Submit to Departmental Representative necessary permits for transportation and disposal of asbestos-containing waste and proof that asbestos-containing waste has been received and properly disposed.

.5 Submit proof that all asbestos workers and/or supervisor have received appropriate training and education by a competent person in the hazards of asbestos exposure, good personal hygiene and work practices while working in Asbestos Work Areas, and the use, cleaning and disposal of respirators and protective clothing.

.6 Submit proof satisfactory to Departmental Representative that employees have respirator fitting and testing. Workers must be fit tested (irritant smoke test) with respirator that is personally issued.

1.6 QUALITY ASSURANCE

.1 Regulatory Requirements: comply with Federal, Provincial/Territorial, and local requirements pertaining to asbestos, provided that in case of conflict among these requirements or with these specifications, more stringent requirement applies. Comply with regulations in effect at time Work is performed.

.2 Health and Safety:

.3 Safety Requirements: worker protection.

.1 Protective equipment and clothing to be worn by workers while in Asbestos Work Area include:

.1 Air purifying half-mask respirator with N-100, R-100 or P-100 particulate filter, personally issued to worker and marked as to efficiency and purpose, suitable for protection against asbestos and acceptable to Provincial Authority having jurisdiction. The respirator to be fitted so that there is an effective seal between the respirator and the worker's face, unless the respirator is equipped with a hood or helmet. The respirator to be cleaned, disinfected and inspected after use on each shift, or more often if necessary, when issued for the exclusive use of one worker, or after each use when used by more than one worker. The respirator to have damaged or deteriorated parts replaced prior to being used by a worker; and, when not in use, to be stored in a convenient, clean and sanitary location. The employer to establish written procedures regarding the selection, use and care of respirators, and a copy of the procedures to be provided to and reviewed with each worker who is required to wear a respirator. A worker not to be assigned to an operation requiring the use of a respirator unless he or she is physically able to perform the operation while using the respirator.

.2 Disposable-type protective clothing that does not readily retain or permit penetration of asbestos fibres. Protective clothing to be provided by the employer and worn by every worker who enters the work area, and the protective clothing shall consist of a head covering and full body covering that fits snugly at the ankles, wrists and neck, in order to prevent asbestos fibres from reaching the garments and skin under the protective clothing to include suitable footwear, and to be repaired or replaced if torn.

.2 Eating, drinking, chewing, and smoking are not permitted in Asbestos Work Area.

.3 Before leaving Asbestos Work Area, the worker can decontaminate his or her protective clothing by using a vacuum equipped with a HEPA filter, or by damp wiping, before removing the protective clothing, or, if the protective clothing will not be reused, place it in a container for dust and waste. The container to be dust tight, suitable for asbestos waste, impervious to asbestos, identified as asbestos waste, cleaned with a damp cloth or a vacuum equipped with a HEPA filter immediately before removal from the work area, and removed from the work area frequently and at regular intervals.

.4 Facilities for washing hands and face shall be provided within or close to the Asbestos Work Area.

.5 Ensure workers wash hands and face when leaving Asbestos Work Area.

.6 Ensure that no person required to enter an Asbestos Work Area has facial hair that affects seal between respirator and face.

1.7 WASTE MANAGEMENT AND DISPOSAL

.1 Separate waste materials for reuse and recycling.

.2 Remove from site and dispose of packaging materials at appropriate recycling facilities.

.3 Collect and separate for disposal paper, plastic, polystyrene, corrugated cardboard, packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.

.4 Separate for reuse and recycling and place in designated containers waste in accordance with Waste Management Plan, as applicable.

.5 Place materials defined as hazardous or toxic in designated containers.

.6 Handle and dispose of hazardous materials in accordance with the CEPA, TDGA, Regional and Municipal regulations.

.7 Fold up metal banding, flatten and place in designated area for recycling.

.8 Disposal of asbestos waste generated by removal activities must comply with Federal, Provincial, Territorial and Municipal regulations. Dispose of asbestos waste in sealed double thickness 0.15 mm thick (6 mil) bags or leak proof drums. Label containers with appropriate warning labels. All waste bags or drums containing asbestos-containing materials shall be kept inside the containment or in the staging area until pick-up for transportation to licensed landfill.

.9 Provide manifests describing and listing waste created. Transport containers by approved means to licensed landfill for burial.

1.8 EXISTING CONDITIONS

.1 Materials in the project area have been confirmed to contain asbestos that may result in health risk during removal, disturbance, and/or repair activities.

.2 Refer to the following documentation for details on asbestos-containing materials:

.1 Designated Substance Survey, 441 University Avenue, Windsor, Ontario. Prepared by DST Consulting Engineers, Inc. Dated January 21, 2017.

.3 Notify Departmental Representative of friable material discovered during Work and not apparent from drawings, specifications, or report pertaining to Work. Do not disturb such material pending instructions from Departmental Representative.

1.9 SCHEDULING – NOT USED

1.10 OWNER'S INSTRUCTIONS

.1 Before beginning Work, provide Departmental Representative satisfactory proof that every worker has had instruction and training in hazards of asbestos exposure, in personal hygiene and work practices, and in use, cleaning, and disposal of respirators and protective clothing.

.2 Instruction and training related to respirators includes, following minimum requirements:

.1 Fitting of equipment.

.2 Inspection and maintenance of equipment.

.3 Disinfecting of equipment.

.4 Limitations of equipment.

.3 Instruction and training must be provided by a competent, qualified person.

Part 2 PRODUCTS

2.1 MATERIALS

.1 Drop Sheets:

.1 Polyethylene: 0.15 mm thick.

.2 FR polyethylene: 0.15 mm thick woven fibre reinforced fabric bonded both sides with polyethylene.

.2 Wetting Agent: 50% polyoxyethylene ester and 50% polyoxyethylene ether mixed with water in a concentration to provide thorough wetting of asbestos-containing material.

.3 Waste Containers: contain waste in two separate containers.

.1 Inner container: 0.15 mm thick sealable polyethylene waste bag.

.2 Outer container: sealable metal or fibre type where there are sharp objects included in waste material; otherwise outer container may be sealable metal or fibre type or second 0.15 mm thick sealable polyethylene bag.

.3 Labelling requirements: affix pre-printed cautionary asbestos warning in both official languages that is visible when ready for removal to disposal site.

.4 Slow - drying sealer: non-staining, clear, water - dispersible type that remains tacky on surface for at least 8 hours and designed for purpose of trapping residual asbestos fibres.

.5 Tape: fibreglass - reinforced duct tape suitable for sealing polyethylene under both dry conditions and wet conditions using amended water.

Part 3 EXECUTION

3.1 PROCEDURES

.1 Before beginning Work, isolate Asbestos Work Area using, minimum, preprinted cautionary asbestos warning signs in both official languages that are visible at access routes to Asbestos Work Area.

.1 Remove visible dust from surfaces in the work area where dust is likely to be disturbed during course of work.

.2 Use HEPA vacuum or damp cloths where damp cleaning does not create a hazard and is otherwise appropriate.

.3 Do not use compressed air to clean up or remove dust from any surface.

.2 Prevent spread of dust from Asbestos Work Area using measures appropriate to work to be done.

.1 Use FR polyethylene drop sheets over flooring such as carpeting that absorbs dust and over flooring in Asbestos Work Area where dust and contamination cannot otherwise be safely contained. Drop sheets are not to be reused.

.3 Wet materials containing asbestos to be cut, ground, abraded, scraped, drilled, or otherwise disturbed unless wetting creates hazard or causes damage.

.1 Use garden reservoir type low - velocity fine - mist sprayer.

.2 Perform Work to reduce dust creation to lowest levels practicable.

.3 Work will be subject to visual inspection and air monitoring.

.4 Contamination of surrounding areas indicated by visual inspection or air monitoring will require complete enclosure and clean-up of affected areas.

.4 Frequently and at regular intervals during Work and immediately on completion of work:

.1 Dust and waste to be cleaned up and removed using a vacuum equipped with a HEPA filter, or by damp mopping or wet sweeping, and placed in a waste container, and

.2 Drop sheets to be wetted and placed in a waste container as soon as practicable.

.5 Cleanup:

.1 Place dust and asbestos containing waste in sealed dust-tight waste bags. Treat drop sheets and disposable protective clothing as asbestos waste; wet and fold these items to contain dust, and then place in plastic bags.

.2 Clean exterior of each waste-filled bag using damp cloths or HEPA vacuum and place in second clean waste bag immediately prior to removal from Asbestos Work Area.

.3 Seal waste bags and remove from site. Dispose of in accordance with requirements of Provincial/Territorial and Federal Authority having jurisdiction. Supervise dumping and ensure that dump operator is fully aware of hazardous nature of material to be dumped and that the appropriate guidelines and regulations for asbestos disposal are followed.

.4 Perform final thorough clean-up of Work areas and adjacent areas affected by Work using HEPA vacuum.

END OF SECTION

Part 1 GENERAL

1.1 SUMMARY

.1 Comply with requirements of this Section when performing following Work:

.1 Removal of asbestos-containing grey cement compound/thermal insulation/remnants from pipe fittings, including but not necessarily limited to elbows, valves, tees, hangers, etc., in the basement with the use of Glove Bags.

.2 The removal or disturbance of one square metre or less of friable asbestos-containing plaster during the repair, alteration, maintenance or demolition of all or part of machinery or equipment, or of a building.

.3 Removing more than one square metre of drywall in which joint-filling compounds that are asbestos containing materials have been used.

.4 Removing non-friable asbestos containing materials by breaking, cutting, drilling, abrading, grounding, sanding or vibrating at locations indicated in the report if the work is done by means of power tools that are attached to dust-collecting devices equipped with HEPA filters.

.5 The removal or disturbance of one square metre or less of friable asbestos-containing material.

.6 Refer to the following document for details on asbestos-containing materials:

.1 Designated Substance Survey, 441 University Avenue, Windsor, Ontario. Prepared by DST Consulting Engineers, Inc. Dated January 27, 2017.

1.2 SECTION INCLUDES

.1 Requirements and procedures for asbestos abatement of asbestos-containing materials of the type described within.

1.3 REFERENCES

.1 O.Reg. 278/05, Designated Substance - Asbestos on Construction Projects and in Buildings and Repair Operations.

.2 A Guide to the Regulations respecting Asbestos on Construction Projects and in Buildings and Repair Operations released in November 2007, http://www.labour.gov.on.ca/english/hs/ asbestos/index.html.

.3 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-1.205-[94], Sealer for Application of Asbestos Fibre Releasing Materials.

.4 Department of Justice Canada (Jus)

.1 Canadian Environmental Protection Act, 1999 (CEPA).

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

.1 Material Safety Data Sheets (MSDS).

.6 Transport Canada (TC)

.1 Transportation of Dangerous Goods Act, 1992 (TDGA).

.7 Underwriters' Laboratories of Canada (ULC).

1.4 DEFINITIONS

.1 Amended Water: water with non-ionic surfactant wetting agent added to reduce water tension to allow wetting of fibres.

.2 Asbestos Containing Materials (ACMs): materials that contain 0.5 per cent or more asbestos by dry weight and are identified under Existing Conditions including fallen materials and settled dust.

.3 Asbestos Work Area: area where work takes place which will, or may disturb ACMs.

.4 Authorized Visitors: Engineers, or designated representatives, and representatives of regulatory agencies.

.5 Competent worker person: in relation to specific work, means a worker who:

.1 Is qualified because of knowledge, training and experience to perform the work.

.2 Is familiar with the provincial and federal laws and with the provisions of the regulations that apply to the work.

.3 Has knowledge of all potential or actual danger to health or safety in the work.

.6 Friable Materials: material that when dry can be crumbled, pulverized or powdered by hand pressure and includes such material that is crumbled, pulverized or powdered.

.7 Glove Bag: prefabricated glove bag as follows:

.1 Minimum thickness 0.25 mm (10 mil) polyvinyl-chloride bag.

.2 Integral 0.25 mm (10 mil) thick polyvinyl-chloride gloves and elastic ports.

.3 Equipped with reversible double pull double throw zipper on top and at approximately mid-section of the bag.

.4 Straps for sealing ends around pipe.

.8 HEPA vacuum: High Efficiency Particulate Air filtered vacuum equipment with filter system capable of collecting and retaining fibres greater than 0.3 microns in any dimension at 99.97% efficiency.

.9 Non-Friable Material: material that when dry cannot be crumbled, pulverized or powdered by hand pressure.

.10 Occupied Area: any area of building or work site that is outside Asbestos Work Area.

.11 Polyethylene: polyethylene sheeting or rip-proof polyethylene sheeting with tape along edges, around penetrating objects, over cuts and tears, and elsewhere as required to provide protection and isolation.

.12 Sprayer: garden reservoir type sprayer or airless spray equipment capable of producing mist or fine spray. Must have appropriate capacity for scope of work.

1.5 SUBMITTALS

.1 Submit proof satisfactory to Departmental Representative that suitable arrangements have been made to dispose of asbestos containing waste in accordance with requirements of authority having jurisdiction.

.2 Submit Provincial/Territorial and/or local requirements for Notice of Project Form.

.3 Submit proof of Contractor's Asbestos Liability Insurance.

.4 Submit to Departmental Representative necessary permits for transportation and disposal of asbestos containing waste and proof that asbestos containing waste has been received and properly disposed.

.5 Submit proof satisfactory to Departmental Representative that all asbestos workers have received appropriate training and education by a competent person in the hazards of asbestos exposure, good personal hygiene, entry and exit from Asbestos Work Area, aspects of work procedures and protective measures while working in Asbestos Work Areas, and the use, cleaning and disposal of respirators and protective clothing.

.6 Submit proof that supervisory personnel have attended asbestos abatement course, of not less than two days duration, approved by Departmental Representative. Minimum of one supervisor for every ten workers.

.7 Submit Worker's Compensation Board status and transcription of insurance.

.8 Submit documentation including test results, fire and flammability data, and Material Safety Data Sheets (MSDS) for chemicals or materials including:

.1 Encapsulants;
.2 Amended water;
.3 Slow drying sealer.

.9 Submit proof satisfactory to Departmental Representative that employees have respirator fitting and testing. Workers must be fit tested (irritant smoke test) with respirator that is personally issued.

1.6 QUALITY ASSURANCE

.1 Regulatory Requirements: comply with Federal, Provincial/Territorial and local requirements pertaining to asbestos, provided that in case of conflict among these requirements or with these specifications more stringent requirement applies. Comply with regulations in effect at the time work is performed.

.2 Health and Safety:

.1 Safety Requirements: worker and visitor protection.

.1 Protective equipment and clothing to be worn by workers while in Asbestos Work Area include:

.1 Air purifying half-mask respirator with N-100, R-100 or P-100 particulate filter, personally issued to worker and marked as to efficiency and purpose, suitable for protection against asbestos and acceptable to Provincial Authority having jurisdiction. The respirator to be fitted so that there is an effective seal between the respirator and the worker's face, unless the respirator is equipped with a hood or helmet. The respirator to be cleaned, disinfected and inspected after use on each shift, or more often if necessary, when issued for the exclusive use of one worker, or after each use when used by more than one worker. The respirator to have damaged or deteriorated parts replaced prior to being used by a worker; and, when not in use, to be stored in a convenient, clean and sanitary location. The employer to establish written procedures regarding the selection, use and care of respirators, and a copy of the procedures to be provided to and reviewed with each worker who is required to wear a respirator. A worker not to be assigned to an operation requiring the use of a respirator unless he or she is physically able to perform the operation while using the respirator.

.2 Disposable type protective clothing that does not readily retain or permit penetration of asbestos fibres. Protective clothing to be provided by the employer and worn by every worker who enters the work area, and the protective clothing to consist of a head covering and full body covering that fits snugly at the ankles, wrists and neck, in order to prevent asbestos fibres from reaching the garments and skin under the protective clothing. It includes suitable footwear, and it to be repaired or replaced if torn.

.2 Eating, drinking, chewing, and smoking are not permitted in Asbestos Work Area.

.3 Before leaving Asbestos Work Area, the worker can decontaminate his or her protective clothing by using a vacuum equipped with a HEPA filter, or by damp wiping, before removing the protective clothing, or, if the protective clothing will not be reused, place it in a container for dust and waste. The container to be dust tight, suitable for asbestos waste, impervious to asbestos, identified as asbestos waste, cleaned with a damp cloth or a vacuum equipped with a HEPA filter immediately before removal from the work area, and removed from the work area frequently and at regular intervals.

.4 Ensure workers wash hands and face when leaving Asbestos Work Area. Facilities for washing shall be provided within or close to the Asbestos Work Area.

.5 Ensure that no person required to enter an Asbestos Work Area has facial hair that affects seal between respirator and face.

.6 Visitor Protection:

.1 Provide protective clothing and approved respirators to Authorized Visitors to work areas.

.2 Instruct Authorized Visitors in the use of protective clothing, respirators and procedures.

.3 Instruct Authorized Visitors in proper procedures to be followed in entering into and exiting from Asbestos Work Area.

1.7 WASTE MANAGEMENT AND DISPOSAL

.1 Separate waste materials for reuse and recycling.

.2 Remove from site and dispose of packaging materials at appropriate recycling facilities.

.3 Collect and separate for disposal paper, plastic, polystyrene, corrugated cardboard, packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.

.4 Separate for reuse and recycling and place in designated containers in accordance with Waste Management Plan.

.5 Place materials defined as hazardous or toxic in designated containers.

.6 Handle and dispose of hazardous materials in accordance with the CEPA, TDGA, Regional and Municipal regulations.

.7 Fold up metal banding, flatten and place in designated area for recycling.

.8 Disposal of asbestos waste generated by removal activities must comply with Federal, Provincial/Territorial and Municipal regulations. Dispose of asbestos waste in sealed double thickness 0.15 mm thick (6 mil) bags or leak proof drums. Label containers with appropriate warning labels.

.9 Provide manifests describing and listing waste created. Transport containers by approved means to licensed landfill for burial.

1.8 EXISTING CONDITIONS

.1 Information pertaining to asbestos-containing material to be handled, removed, or otherwise disturbed and disposed of during this Project are located in the following documentation:

.1 Designated Substance Survey, 441 University Avenue, Windsor, Ontario. Prepared by DST Consulting Engineers Inc. Dated January 27, 2017.

.2 Notify Departmental Representative of friable material discovered during Work and not apparent from drawings, specifications, or report pertaining to Work. Do not disturb such material until instructed by Departmental Representative.

1.9 SCHEDULING – NOT USED

1.10 OWNER'S INSTRUCTIONS

.1 Before beginning Work, provide Departmental Representative satisfactory proof that every worker has had instruction and training in hazards of asbestos exposure, in personal hygiene and work practices, in use of glove bag procedures, and in use, cleaning, and disposal of respirators and protective clothing.

.2 Instruction and training related to respirators includes, at minimum:

.1 Fitting of equipment.

.2 Inspection and maintenance of equipment.

.3 Disinfecting of equipment.

.4 Limitations of equipment.

.3 Instruction and training must be provided by competent, qualified person.

Part 2 PRODUCTS

2.1 MATERIALS

.1 Drop and Enclosure Sheets:

.1 Polyethylene: 0.15 mm thick.

.2 FR polyethylene: 0.15 mm thick woven fibre reinforced fabric bonded both sides with polyethylene.

.2 Wetting Agent: 50% polyoxyethylene ester and 50% polyoxyethylene ether mixed with water in concentration to provide thorough wetting of asbestos containing material.

.3 Waste Containers: contain waste in two separate containers.

.1 Inner container: 0.15 mm thick sealable polyethylene bag or where glove bag method is used, glove bag itself.

.2 Outer container: sealable metal or fibre type where there are sharp objects included in waste material; otherwise outer container may be sealable metal or fibre type or second 0.15 mm thick sealable polyethylene bag.

.3 Labelling requirements: affix preprinted cautionary asbestos warning, in both official languages, that is visible when ready for removal to disposal site.

.4 Glove bag:

.1 Acceptable materials: safe-T-Strip products in configuration suitable for Work, or Alternative material approved by addendum during bid period in accordance with Instructions to Bidders.

.2 The glove bag to be equipped with:

.1 Sleeves and gloves that are permanently sealed to the body of the bag to allow the worker to access and deal with the insulation and maintain a sealed enclosure throughout the work period.

.2 Valves or openings to allow insertion of a vacuum hose and the nozzle of a water sprayer while maintaining the seal to the pipe, duct or similar structure.

.3 A tool pouch with a drain.

.4 A seamless bottom and a means of sealing off the lower portion of the bag.

.5 A high strength double throw zipper and removable straps, if the bag is to be moved during the removal operation.

.5 Tape: tape suitable for sealing polyethylene to surfaces under both dry and wet conditions using amended water.

.6 Slow - drying sealer: non-staining, clear, water - dispersible type that remains tacky on surface for at least 8 hours and designed for purpose of trapping residual asbestos fibres.

.1 Sealer: flame spread and smoke developed rating less than 50 and be compatible with new fireproofing.

.7 Encapsulant: Penetrating type conforming to CAN/CGSB-1.205.

Part 3 EXECUTION

3.1 SUPERVISION

.1 Minimum of one Supervisor for every ten workers is required.

.2 Approved Supervisor must remain within Asbestos Work Area during disturbance, removal, or other handling of asbestos-containing materials.

3.2 PROCEDURES

.1 Before beginning Work, at each access to Asbestos Work Area, install warning signs in both official languages in upper case 'Helvetica Medium' letters reading as follows, where number in parentheses indicates font size to be used: 'CAUTION ASBESTOS HAZARD AREA (25 mm) / NO UNAUTHORIZED ENTRY (19 mm) / WEAR ASSIGNED PROTECTIVE EQUIPMENT (19 mm) / BREATHING ASBESTOS DUST MAY CAUSE SERIOUS BODILY HARM (7 mm)'.

.2 Before beginning Work remove visible dust from surfaces in work area where dust is likely to be disturbed during course of work.

.1 Use HEPA vacuum or damp cloths where damp cleaning does not create hazard and is otherwise appropriate.

.2 Do not use compressed air to clean up or remove dust from any surface.

.3 Prevent spread of dust from Asbestos Work Area using measures appropriate to work to be done.

.1 Use FR polyethylene drop sheets over flooring such as carpeting that absorbs dust and over flooring in work areas where dust or contamination cannot otherwise be safely contained.

.2 When removing asbestos containing material from piping or equipment and "glove bag" method is not used erect enclosure of polyethylene sheeting around work area, shut off mechanical ventilation system serving work area and seal ventilation ducts to and from work area.

.4 Remove loose material by HEPA vacuum; thoroughly wet friable material containing asbestos to be removed or disturbed before and during Work unless wetting creates hazard or causes damage.

.1 Use garden reservoir type low - velocity sprayer or airless spray equipment capable of producing mist or fine spray.

.2 Perform Work in a manner to reduce dust creation to lowest levels practicable.

.5 Pipe Insulation Removal Using Glove Bag:

.1 A glove bag not to be used to remove insulation from a pipe, duct or similar structure if:

.1 It may not be possible to maintain a proper seal for any reason including, without limitation:

.1 The condition of the insulation.

.2 The temperature of the pipe, duct or similar structure.

.2 The bag could become damaged for any reason including, without limitation.

.1 The type of jacketing.

.2 The temperature of the pipe, duct or similar structure.

.2 Upon installation of the glove bag, inspect bag for any damage or defects. If any damage or defects are found, the glove bag is to be repaired or replaced. The glove bag to be inspected at regular intervals for damage and defects, and repair or replaced, as appropriately. The asbestos containing contents of the damaged or defective glove bag found during removal are to be wetted and the glove bag and its contents are to be removed and disposed of in an appropriate waste disposal container. Any damaged or defective glove bags are not be reused.

.3 Place tools necessary to remove insulation in tool pouch. Wrap bag around pipe and close zippers. Seal bag to pipe with cloth straps.

.4 Place hands in gloves and use necessary tools to remove insulation. Arrange insulation in bag to obtain full capacity of bag.

.5 Insert nozzle of garden reservoir type sprayer into bag through valve and wash down pipe and interior of bag thoroughly. Wet surface of insulation in lower section of bag.

.6 To remove bag after completion of stripping, wash top section and tools thoroughly. Remove air from top section through elasticized valve using a HEPA vacuum. Pull polyethylene waste container over glove bag before removing from pipe. Release one strap and remove freshly washed tools. Place tools in water. Remove second strap and zipper. Fold over into waste container and seal.

.7 After removal of bag ensure that pipe is free of residue. Remove residue using HEPA vacuum or wet cloths. Ensure that surfaces are free of sludge which after drying could release asbestos dust into atmosphere. Seal exposed surfaces of pipe and ends of insulation with slow drying sealer to seal in any residual fibres.

.8 Upon completion of Work shift, cover exposed ends of remaining pipe insulation with polyethylene taped in place.

.6 Work is subject to visual inspection and air monitoring. Contamination of surrounding areas indicated by visual inspection or air monitoring will require complete enclosure and clean-up of affected areas.

.7 Cleanup:

.1 Frequently during Work and immediately after completion of work, clean up dust and asbestos containing waste using HEPA vacuum or by damp mopping.

.2 Place dust and asbestos containing waste in sealed dust tight waste bags. Treat drop sheets and disposable protective clothing as asbestos waste and wet and fold to contain dust and then place in waste bags.

.3 Immediately before their removal from Asbestos Work Area and disposal, clean each filled waste bag using damp cloths or HEPA vacuum and place in second clean waste bag.

.4 Seal and remove double bagged waste from site. Dispose of in accordance with requirements of Provincial/Territorial and Federal authority having jurisdiction. Supervise dumping and ensure that dump operator is fully aware of hazardous nature of material to be dumped and that guidelines and regulations for asbestos disposal are followed.

.5 Perform final thorough clean-up of Asbestos Work Areas and adjacent areas affected by Work using HEPA vacuum.

3.3 AIR MONITORING

.1 From beginning of Work until completion of cleaning operations, Departmental Representative may take air samples on daily basis outside of Asbestos Work Area enclosures in accordance with PWGSC requirements.

.1 Contractor will be responsible for monitoring inside enclosure in accordance with applicable Provincial/Territorial Occupational Health and Safety Regulations.

.2 If air monitoring shows that areas outside Asbestos Work Area enclosures are contaminated, enclose, maintain and clean these areas in same manner as that applicable to Asbestos Work Area.

.3 Ensure that respiratory safety factors are not exceeded.

.4 The Departmental Representative may collect clearance/post-abatement air samples following a final visual inspection of the Asbestos Work Area by the Departmental Representative. Samples will be analyzed and compared to applicable regulations.

.1 Final air monitoring results must show fibre levels of less than 0.05 fibres per cubic centimetre (f/cc).

.1 If air monitoring shows that areas inside the Asbestos Work Area enclosures are contaminated; enclose, maintain and clean these areas in same manner as that applicable to Asbestos Work Area at no additional cost to the Departmental Representative.

.2 Repeat as necessary until fibre levels are less than 0.05 f/cc

.3 No additional costs will be allowed by Contractor for additional labour or materials required to provide specified performance level.

END OF SECTION

Part 1 GENERAL

1.1 SUMMARY

.1 Comply with requirements of this Section when performing following Work:

.1 Removal or disturbance as specified of more than one square metre of friable asbestos containing material during the repair, alteration, maintenance or demolition of a building or any machinery or equipment located in the basement.

.2 Removal or disturbance of more than one square metre of asbestos-containing plaster, located both in the exterior soffit and interior columns.

.3 Breaking, cutting, drilling, abrading, grinding, sanding or vibrating non-friable asbestos containing material, if the work is done by means of power tools that are not attached to dust-collecting devices equipped with HEPA filters.

1.2 SECTION INCLUDES

.1 Requirements and procedures for asbestos abatement of asbestos-containing materials of the type described within.

1.3 REFERENCES

.1 O.Reg. 278/05, Designated Substance - Asbestos on Construction Projects and in Buildings and Repair Operations.

.2 A Guide to the Regulations respecting Asbestos on Construction Projects and in Buildings and Repair Operations released in November 2007, http://www.labour.gov.on.ca/english/hs/ asbestos/index.html.

.3 Public Works and Governement Services Canada.

.1 Annex C - Appendix 6 - Work Procedures of PWGSC DM Directive 057 Asbestos Management.

.4 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-1.205-[94], Sealer for Application to Asbestos-Fibre-Releasing Materials.

.5 Canadian Standards Association (CSA International).

.6 Department of Justice Canada

.1 Canadian Environmental Protection Act (CEPA), 1999.

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

.1 Material Safety Data Sheets (MSDS).

.8 Transport Canada (TC)

.1 Transportation of Dangerous Goods Act, 1992 (TDGA).

.9 Underwriters' Laboratories of Canada (ULC).

1.4 DEFINITIONS

.1 Airlock: system for permitting ingress or egress without permitting air movement between contaminated area and uncontaminated area, typically consisting of two curtained doorways at least 2 m apart.

.2 Amended Water: water with a non-ionic surfactant wetting agent added to reduce water tension to allow wetting of fibres.

.3 Asbestos Containing Materials (ACMs): materials that contain 0.5 per cent or more asbestos by dry weight and are identified under Existing Conditions including fallen materials and settled dust.

.4 Asbestos Work Areas: area where work takes place which will, or may disturb ACMs.

.5 Authorized Visitors: Departmental Representatives or designated representatives, and representatives of regulatory agencies.

.6 Competent worker person: in relation to specific work, means a worker who:

.1 Is qualified because of knowledge, training and experience to perform the work.

.2 Is familiar with the provincial and federal laws and with the provisions of the regulations that apply to the work.

.3 Has knowledge of all potential or actual danger to health or safety in the work.

.7 Curtained doorway: arrangement of closures to allow ingress and egress from one room to another while permitting minimal air movement between rooms, typically constructed as follows:

.1 Place two overlapping sheets of polyethylene over existing or temporarily framed doorway, secure each along top of doorway, secure vertical edge of one sheet along one vertical side of doorway, and secure vertical edge of other sheet along opposite vertical side of doorway.

.2 Reinforce free edges of polyethylene with duct tape and weight bottom edge to ensure proper closing.

.3 Overlap each polyethylene sheet at openings not less than 1.5 m on each side.

.8 DOP Test: testing method used to determine integrity of Negative Pressure unit using Dispersed Oil Particulate (DOP) HEPA-filter leak test.

.9 Friable Materials: material that when dry can be crumbled, pulverized or powdered by hand pressure and includes such material that is crumbled, pulverized or powdered.

.10 Glove Bag: prefabricated glove bag as follows:

.1 Minimum thickness 0.25 mm (10 mil) polyvinyl-chloride bag.

.2 Integral 0.25 mm (10 mil) thick polyvinyl-chloride gloves and elastic ports.

.3 Equipped with reversible double pull double throw zipper on top and at approximately mid-section of the bag.

.4 Straps for sealing ends around pipe.

.11 HEPA vacuum: High Efficiency Particulate Air filtered vacuum equipment with a filter system capable of collecting and retaining fibres greater than 0.3 microns in any direction at 99.97% efficiency.

.12 Negative pressure: system that extracts air directly from work area, filters such extracted air through High Efficiency Particulate Air filtering system, and discharges this air directly outside work area to exterior of building.

.1 System to maintain minimum pressure differential of 5 Pa relative to adjacent areas outside of work areas, be equipped with alarm to warn of system breakdown, and be equipped with instrument to continuously monitor and automatically record pressure differences.

.13 Non-Friable Materials: material that when dry cannot be crumbled, pulverized or powdered by hand pressure.

.14 Occupied Areas: any area of building or work site that is outside Asbestos Work Area.

.15 Polyethylene sheeting sealed with tape: polyethylene sheeting of type and thickness specified sealed with tape along edges, around penetrating objects, over cuts and tears, and elsewhere as required to provide continuous polyethylene membrane to protect underlying surfaces from water damage or damage by sealants, and to prevent escape of asbestos fibres through sheeting into clean area.

.16 Sprayer: garden reservoir type sprayer or airless spray equipment capable of producing mist or fine spray. Must be appropriate capacity for scope of work.

1.5 SUBMITTALS

.1 Before beginning work:

.1 Obtain from appropriate agency and submit to Departmental Representative necessary permits for transportation and disposal of asbestos waste. Ensure that dump operator is fully aware of hazardous nature of material being dumped, and proper methods of disposal. Submit proof satisfactory to Departmental Representative that suitable arrangements have been made to receive and properly dispose of asbestos waste.

.2 Submit proof satisfactory to Departmental Representative that all asbestos workers have received appropriate training and education by a competent person on hazards of asbestos exposure, good personal hygiene, entry and exit from Asbestos Work Area, aspects of work procedures and protective measures while working in Asbestos Work Areas, and the use, cleaning and disposal of respirators and protective clothing. Submit proof of attendance in form of certificate.

.3 Ensure supervisory personnel have attended asbestos abatement course, of not less than two days duration, approved by Departmental Representative. Submit proof of attendance in form of certificate. Minimum of one Supervisor for every ten workers.

.4 Submit layout of proposed enclosures and decontamination facilities to Departmental Representative for review.

.5 Submit documentation including test results for sealer proposed for use.

.6 Submit Provincial/Territorial and/or local requirements for Notice of Project form.

.7 Submit proof of Contractor's Asbestos Liability Insurance.

.8 Submit proof satisfactory to Departmental Representative that employees have respirator fitting and testing. Workers must be fit tested (irritant smoke test) with respirator that is personally issued.

.9 Submit Workplace Safety and Insurance Board status and transcription of insurance.

.10 Submit documentation including test results, fire and flammability data, and Material Safety Data Sheets (MSDS) for chemicals or materials including but not limited to following:

.1 Encapsulants.

.2 Amended water.

.3 Slow drying sealer.

1.6 QUALITY ASSURANCE

.1 Regulatory Requirements: comply with Federal, Provincial/Territorial and local requirements pertaining to asbestos, provided that in case of conflict among those requirements or with these specifications more stringent requirement applies. Comply with regulations in effect at time work is performed.

.2 Health and Safety:

.1 Safety Requirements: worker and visitor protection.

.1 Protective equipment and clothing to be worn by workers while in Asbestos Work Area includes:

.1 Air purifying full face-mask respirator with N-100, R-100 or P-100 particulate filter, personally issued to worker and marked as to efficiency and purpose, suitable for protection against asbestos and acceptable to Provincial Authority having jurisdiction. The respirator to be fitted so that there is an effective seal between the respirator and the worker's face, unless the respirator is equipped with a hood or helmet. The respirator to be cleaned, disinfected and inspected after use on each shift, or more often if necessary, when issued for the exclusive use of one worker, or after each use when used by more than one worker. The respirator to have damaged or deteriorated parts replaced prior to being used by a worker; and, when not in use, to be stored in a convenient, clean and sanitary location. The employer to establish written procedures regarding the selection, use and care of respirators, and a copy of the procedures to be provided to and reviewed with each worker who is required to wear a respirator. A worker not to be assigned to an operation requiring the use of a respirator unless he or she is physically able to perform the operation while using the respirator.

.2 Disposable type protective clothing that does not readily retain or permit penetration of asbestos fibres. Protective clothing to be provided by the employer and worn by every worker who enters the work area, and the protective clothing to consist of a head covering and full body covering that fits snugly at the ankles, wrists and neck, in order to prevent asbestos fibres from reaching the garments and skin under the protective clothing. It includes suitable footwear, and it to be repaired or replaced if torn. Requirements for each worker:

.1 Remove street clothes in clean change room and put on respirator with new filters or reusable filters that have been tested as satisfactory, clean coveralls and head covers before entering Equipment and Access Rooms or Asbestos Work Area. Store street clothes, uncontaminated footwear, towels, and similar uncontaminated articles in clean change room.

.2 Remove gross contamination from clothing before leaving work area then proceed to Equipment and Access Room and remove clothing except respirators. Place contaminated work suits in receptacles for disposal with other asbestos - contaminated materials. Leave reusable items except respirator in Equipment and Access Room. Still wearing the respirator proceed naked to showers. Using soap and water wash body and hair thoroughly. Clean outside of respirator with soap and water while showering; remove respirator; remove filters and wet them and dispose of filters in container provided for purpose; and wash and rinse inside of respirator. When not in use in work area, store work footwear in Equipment and Access Room. Upon completion of asbestos abatement, dispose of footwear as contaminated waste or clean thoroughly inside and out using soap and water before removing from work area or from Equipment and Access Room.

.3 After showering and drying off, proceed to clean change room and dress in street clothes at end of each day's work, or in clean coveralls before eating, smoking, or drinking. If re-entering work area, follow procedures outlined in paragraphs above.

.4 Enter unloading room from outside dressed in clean coveralls to remove waste containers and equipment from Holding Room of Container and Equipment Decontamination Enclosure system. Workers must not use this system as means to leave or enter work area.

.2 Eating, drinking, chewing, and smoking are not permitted in Asbestos Work Area.

.3 Ensure workers are fully protected with respirators and protective clothing during preparation of system of enclosures prior to commencing actual asbestos abatement.

.4 Provide and post in Clean Change Room and in Equipment and Access Room the procedures described in this Section, in both official languages.

.5 Ensure that no person required to enter an Asbestos Work Area has facial hair that affects seal between respirator and face.

.6 Visitor Protection:

.1 Provide protective clothing and approved respirators to Authorized Visitors to work areas.

.2 Instruct Authorized Visitors in the use of protective clothing, respirators and procedures.

.3 Instruct Authorized Visitors in proper procedures to be followed in entering into and exiting from Asbestos Work Area.

1.7 WASTE MANAGEMENT AND DISPOSAL

.1 Separate waste materials for reuse and recycling.

.2 Remove from site and dispose of packaging materials at appropriate recycling facilities.

.3 Collect and separate for disposal paper, plastic, polystyrene, corrugated cardboard, packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.

.4 Separate for reuse and recycling and place in designated containers in accordance with Waste Management Plan.

.5 Place materials defined as hazardous or toxic in designated containers.

.6 Handle and dispose of hazardous materials in accordance with the CEPA, TDGA, Regional and Municipal regulations.

.7 Fold up metal banding, flatten and place in designated area for recycling.

.8 Disposal of asbestos waste generated by removal activities must comply with Federal, Provincial, Territorial and Municipal regulations. Dispose of asbestos waste in sealed double thickness 0.152 mm thick (6 mil) bags or leak proof drums. Label containers with appropriate warning labels.

.9 Provide manifests describing and listing waste created. Transport containers by approved means to licensed landfill for burial.

1.8 EXISTING CONDITIONS

.1 Information pertaining to asbestos containing materials to be handled, removed, or otherwise disturbed and disposed of during this Project are located in the following documentation:

.1 Designated Substance Survey, 441 University Avenue, Windsor, Ontario. Prepared by DST Consulting Engineers Inc. Dated January 27, 2017.

.2 Notify Departmental Representative of suspect asbestos containing material discovered during Work and not apparent from drawings, specifications, or report pertaining to Work. Do not disturb such material until instructed by Departmental Representative.

1.9 SCHEDULING

.1 Not later than ten (10) days before beginning Work on this Project notify following in writing:

.1 Appropriate Regional or Zone Director of Medical Services Branch, Health Canada.

.2 Regional Office of Labour Canada.

.3 Provincial/Territorial, Department of Labour.

.4 Disposal Authority.

.2 Inform sub-trades of presence of asbestos containing materials identified in Existing Conditions.

.3 Submit to Departmental Representative copy of notifications prior to start of Work.

1.10 OWNER'S INSTRUCTIONS

.1 Before beginning Work, provide to Departmental Representative satisfactory proof that every worker has had instruction and training in hazards of asbestos exposure, in personal hygiene including dress and showers, in entry and exit from Asbestos Work Area, in aspects of work procedures including glove bag procedures, and in use, cleaning, and disposal of respirators and protective clothing.

.2 Instruction and training related to respirators includes, at minimum:

.1 Proper fitting of equipment.

.2 Inspection and maintenance of equipment.

.3 Disinfecting of equipment.

.4 Limitations of equipment.

.3 Instruction and training must be provided by competent, qualified person.

.4 Supervisory personnel to complete required training.

Part 2 PRODUCTS

2.1 MATERIALS

.1 Polyethylene: minimum 0.15 mm thick unless otherwise specified; in sheet size to minimize joints.

.2 FR polyethylene: minimum 0.15 mm thick, woven fibre reinforced fabric bonded both sides with polyethylene.

.3 Tape: fibreglass - reinforced duct tape suitable for sealing polyethylene under both dry conditions and wet conditions using amended water.

.4 Wetting agent: 50% polyoxyethylene ester and 50% polyoxyethylene ether, or other material approved by Departmental Representative, mixed with water in concentration to provide adequate penetration and wetting of asbestos containing material.

.5 Waste Containers: contain waste in two separate containers.

.1 Inner container: 0.15 mm thick sealable polyethylene bag.

.2 Outer container: sealable metal or fibre type where there are sharp objects included in waste material; otherwise outer container may be sealable metal or fibre type or second 0.15 mm thick sealable polyethylene bag.

.3 Labelling requirements: affix preprinted cautionary asbestos warning, in both official languages, that is visible when ready for removal to disposal site. Label containers in accordance with Asbestos Regulations [29 CFR 1910.1001]. Label in both official languages.

.6 Tape: tape suitable for sealing polyethylene to surfaces under both dry and wet conditions using amended water.

.7 Slow - drying sealer: non-staining, clear, water - dispersible type that remains tacky on surface for at least 8 hours and designed for purpose of trapping residual asbestos fibres.

.8 Sealer: flame spread and smoke developed rating less than 50 and be compatible with new fireproofing.

.9 Encapsulant: Penetrating type conforming to CAN/CGSB-1.205.

Part 3 EXECUTION

3.1 PREPARATION

.1 Work Areas:

.1 Shut off and isolate air handling and ventilation systems to prevent fibre dispersal to other building areas during work phase. Conduct smoke tests to ensure that duct work is airtight. Seal and caulk joints and seams of active return air ducts within Asbestos Work Area.

.2 Preclean potentially moveable furniture and carpeting within proposed work areas using HEPA vacuum and remove from work areas to temporary location.

.3 Preclean fixed casework, plant, and equipment within proposed work areas, using HEPA vacuum and cover with polyethylene sheeting sealed with tape.

.4 Clean proposed work areas using, where practicable, HEPA vacuum cleaning equipment. If not practicable, use wet cleaning method. Do not use methods that raise dust, such as dry sweeping, or vacuuming using other than HEPA vacuum equipment.

.5 The spread of dust from the work area to be prevented by:

.1 Using enclosures of polyethylene or other suitable material that is impervious to asbestos (including, if the enclosure material is opaque, one or more transparent window areas to allow observation of the entire work area from outside the enclosure), if the work area is not enclosed by walls.

.2 Using curtains of polyethylene sheeting or other suitable material that is impervious to asbestos, fitted on each side of each entrance or exit from the work area.

.6 Put negative pressure system in operation and operate continuously from time first polyethylene is installed to seal openings until final completion of work including final cleanup. Provide continuous monitoring of pressure difference using automatic recording instrument. The system to maintain a negative air pressure of 5 Pa (0.02 inches) of water, relative to the area outside the enclosed area. The system to be inspected and maintained by a competent person prior each use to ensure that there is no air leakage, and if the filter is found to be damaged or defective, it to be replaced before the ventilation system is used.

.7 Seal off openings such as corridors, doorways, windows, skylights, ducts, grilles, and diffusers, with polyethylene sheeting sealed with tape.

.8 Cover floor and wall surfaces with polyethylene sheeting sealed with tape. Cover floors first so that polyethylene extends at least 300 mm up walls then cover walls to overlap floor sheeting.

.9 Build airlocks at entrances to and exits from work areas so that work areas are always closed off by one curtained doorway when workers enter or exit.

.10 At each access to work areas install warning signs in both official languages in upper case "Helvetica Medium" letters reading as follows where number in parentheses indicates font size to be used: "CAUTION ASBESTOS HAZARD AREA (25 mm) NO UNAUTHORIZED ENTRY (19 mm) WEAR ASSIGNED PROTECTIVE EQUIPMENT (19 mm) BREATHING ASBESTOS DUST MAY CAUSE SERIOUS BODILY HARM (7 mm)".

.11 After work area isolation, remove heating, ventilating, and air conditioning filters, pack in sealed plastic bags 0.15 mm minimum thick and treat as contaminated asbestos waste. Remove ceiling - mounted objects such as lights, partitions, other fixtures not previously sealed off, and other objects that interfere with asbestos removal, as directed by Departmental Representative. Use localized water spraying during fixture removal to reduce fibre dispersal.

.12 Maintain emergency and fire exits from work areas, or establish alternative exits satisfactory to Fire Commissioner of Canada and Provincial/Territorial Fire Marshall Authority having jurisdiction.

.13 Where application of water is required for wetting asbestos containing materials, shut off electrical power, provide 24 volt safety lighting and ground fault interrupter circuits on power source for electrical tools, in accordance with applicable CSA Standard. Ensure safe installation of electrical lines and equipment.

.2 Worker Decontamination Enclosure System:

.1 Worker Decontamination Enclosure System includes Equipment and Access Room, Shower Room, and Clean Room, as follows:

.1 Equipment and Access Room: build Equipment and Access Room between Shower Room and work areas, with two curtained doorways, one to Shower Room and one to work areas. Install portable toilet, waste receptor, and storage facilities for workers' shoes and protective clothing to be reworn in work areas. Build Equipment and Access Room large enough to accommodate specified facilities, other equipment needed, and at least one worker allowing him /her sufficient space to undress comfortably.

.2 Shower Room: build Shower Room between Clean Room and Equipment and Access Room, with two curtained doorways, one to Clean Room and one to Equipment and Access Room. Provide one shower for every five workers. Provide constant supply of hot and cold or warm water. Water source will be designated by Departmental Representative. Drains to common sewers will be designated by the Departmental Representative. Provide piping and connect to water sources and drains. Pump waste water through 5 micrometre filter system acceptable to Departmental Representative before directing into drains. Provide soap, clean towels, and appropriate containers for disposal of used respirator filters.

.3 Clean Room: build Clean Room between Shower Room and clean areas outside of enclosures, with two curtained doorways, one to outside of enclosures and one to Shower Room. Provide lockers or hangers and hooks for workers' street clothes and personal belongings. Provide storage for clean protective clothing and respiratory equipment. Install mirror to permit workers to fit respiratory equipment properly.

.3 Container and Equipment Decontamination Enclosure System:

.1 Container and Equipment Decontamination Enclosure System consists of Staging Area within work area, Washroom, Holding Room, and Unloading Room. Purpose of system is to provide means to decontaminate waste containers, scaffolding, waste and material containers, vacuum and spray equipment, and other tools and equipment for which Worker Decontamination Enclosure System is not suitable.

.1 Staging Area: designate Staging Area in work area for gross removal of dust and debris from waste containers and equipment, labelling and sealing of waste containers, and temporary storage pending removal to Washroom. Equip Staging Area with curtained doorway to Washroom.

.2 Washroom: build Washroom between Staging Area and Holding Room with two curtained doorways, one to Staging Area and one to Holding Room. Provide high - pressure low - volume sprays for washing of waste containers and equipment. Pump waste water through 5 micrometre filter system before directing into drains. Provide piping and connect to water sources and drains.

.3 Holding Room: build Holding Room between Washroom and Unloading Room, with two curtained doorways, one to Washroom and one to Unloading Room. Build Holding Room sized to accommodate at least two waste containers and largest item of equipment used.

.4 Unloading Room: build Unloading Room between Holding Room and outside, with two curtained doorways, one to Holding Room and one to outside.

.4 Construction of Decontamination Enclosures:

.1 Build suitable framing for enclosures or use existing rooms where convenient, and line with polyethylene sheeting sealed with tape. Use two layers of FR polyethylene on floors

.2 Build curtained doorways between enclosures so that when people move through or when waste containers and equipment are moved through doorway, one of two closures comprising doorway always remains closed.

.5 Separation of Work Areas from Occupied Areas:

.1 Separate parts of building required to remain in use as specified by the Departmental Representative from parts of building used for asbestos abatement by means of airtight barrier system constructed as follows:

.1 Build suitable floor to ceiling lumber or metal stud framing, cover with polyethylene sheeting sealed with tape, and apply 9 mm minimum thick plywood. Seal joints between plywood sheets and between plywood and adjacent materials with surface film forming type sealer, to create airtight barrier.

.2 Cover plywood barrier with polyethylene sealed with tape, as specified for work areas.

.6 Maintenance of Enclosures:

.1 Maintain enclosures in tidy condition.

.2 Ensure that barriers and polyethylene linings are effectively sealed and taped. Repair damaged barriers and remedy defects immediately upon discovery.

.3 Visually inspect enclosures at beginning of each working period.

.4 Use smoke methods to test effectiveness of barriers when directed by Departmental Representative.

.7 Do not begin Asbestos Abatement work until:

.1 Arrangements have been made for disposal of waste.

.2 For wet stripping techniques, arrangements have been made for containing, filtering, and disposal of waste water.

.3 Work areas and decontamination enclosures and parts of building required to remain in use are effectively segregated.

.4 Tools, equipment, and materials waste containers are on hand.

.5 Arrangements have been made for building security.

.6 Warning signs are displayed where access to contaminated areas is possible.

.7 Notifications have been completed and other preparatory steps have been taken.

3.2 SUPERVISION

.1 Minimum of one Supervisor for every ten workers is required.

.2 Approved Supervisor must remain within Asbestos Work Area during disturbance, removal, or other handling of asbestos containing materials.

3.3 ASBESTOS REMOVAL

.1 Before removing asbestos:

.2 Prepare site.

.3 Spray asbestos material with water containing specified wetting agent, using airless spray equipment capable of providing "mist" application to prevent release of fibres. Saturate asbestos material sufficiently to wet it to substrate without causing excess dripping. Spray asbestos material repeatedly during work process to maintain saturation and to minimize asbestos fibre dispersion.

.2 Remove saturated asbestos material in small sections. Do not allow saturated asbestos to dry out. As it is being removed pack material in sealable plastic bags 0.15 mm minimum thick and place in labelled containers for transport.

.3 Seal filled containers. Clean external surfaces thoroughly by wet sponging. Remove from immediate working area to Staging Area. Clean external surfaces thoroughly again by wet sponging before moving containers to decontamination Washroom. Wash containers thoroughly in decontamination Washroom, and store in Holding Room pending removal to Unloading Room and outside. Ensure that containers are removed from Holding Room by workers who have entered from uncontaminated areas dressed in clean coveralls.

.4 After completion of stripping work, wire brushed and wet sponged surfaces from which asbestos has been removed to remove visible material. During this work keep surfaces wet.

.5 Where Departmental Representative decides complete removal of asbestos containing material is impossible due to obstructions such as structural members or major service elements, or because asbestos containing material was originally applied to asphaltic coating, and provides written direction, encapsulate material as follows:

.1 Apply surface film forming type sealer to provide 0.635 mm minimum dry film thickness over sprayed asbestos surfaces. Apply using airless spray equipment to avoid blowing off fibres. Use different colour for each coat. Apply penetrating type sealer to penetrate existing sprayed asbestos surfaces to uniform depth of 25 mm minimum.

.6 After wire brushing and wet sponging to remove visible asbestos, and after encapsulating asbestos containing material impossible to remove, wet clean entire work area including Equipment and Access Room, and equipment used in process. After 24 hour period to allow for dust settling, wet clean these areas and objects again. During this settling period no entry, activity, or ventilation will be permitted. After second 24 hour period under same conditions, clean these areas and objects again using HEPA vacuum followed by wet cleaning. After inspection by Departmental Representative apply continuous coat of slow drying sealer to surfaces of work area. Allow at least 16 hours with no entry, activity, ventilation, or disturbance other than operation of negative pressure units during this period.

.7 Work is subject to visual inspection and air monitoring. Contamination of surrounding areas indicated by visual inspection or air monitoring will require complete enclosure and clean-up of affected areas.

.8 Cleanup:

.1 Frequently during Work and immediately after completion of work, clean up dust and asbestos containing waste using HEPA vacuum or by damp mopping.

.2 Place dust and asbestos containing waste in sealed dust tight waste bags. Treat drop sheets and disposable protective clothing as asbestos waste and wet and fold to contain dust and then place in waste bags.

.3 Immediately before their removal from Asbestos Work Area and disposal, clean each filled waste bag using damp cloths or HEPA vacuum and place in second clean waste bag.

.4 Seal and remove double bagged waste from site. Dispose of in accordance with requirements of Provincial/Territorial and Federal authority having jurisdiction. Supervise dumping and ensure that dump operator is fully aware of hazardous nature of material to be dumped and that guidelines and regulations for asbestos disposal are followed.

.5 Perform final thorough clean-up of Asbestos Work Areas and adjacent areas affected by Work using HEPA vacuum.

3.4 FINAL CLEANUP

.1 Following cleaning specified in 3.3.8 above, and when air sampling by Departmental Representative shows that asbestos levels on both sides of seals do not exceed 0.01 fibres/cc as determined by phase contrast microscopy, as described in NIOSH Method 7400 or equivalent, proceed with final cleanup.

.2 Remove polyethylene sheet by rolling it away from walls to centre of work area. Vacuum visible asbestos containing particles observed during cleanup, immediately, using HEPA vacuum equipment.

.3 Place polyethylene seals, tape, cleaning material, clothing, and other contaminated waste in plastic bags and sealed labelled waste containers for transport.

.4 Include in clean-up Work areas, Equipment and Access Room, Washroom, Shower Room, and other contaminated enclosures.

.5 Include in clean-up sealed waste containers and equipment used in Work and remove from work areas, via Container and Equipment Decontamination Enclosure System, at appropriate time in cleaning sequence.

.6 Conduct final check to ensure that no dust or debris remains on surfaces as result of dismantling operations and carry out air monitoring again to ensure that asbestos levels in building do not exceed 0.01 fibres/cc. Repeat cleaning using HEPA vacuum equipment, or wet cleaning methods where feasible, in conjunction with sampling until levels meet this criteria.

.7 As work progresses, and to prevent exceeding available storage capacity on site, remove sealed and labelled containers containing asbestos waste and dispose of to authorized disposal area in accordance with requirements of disposal authority. Ensure that each shipment of containers transported to dump is accompanied by Contractor's representative to ensure that dumping is done in accordance with governing regulations.

3.5 RE-ESTABLISH- MENT OF OBJECTS AND SYSTEMS

.1 When cleanup is complete:

.1 Re-establish objects and furniture moved to temporary locations in course of Work, in their proper positions.

.2 Re-secure mounted objects removed in course of Work in their former positions.

.3 Re-establish mechanical and electrical systems in proper working order. Install new filters.

.4 Repair or replace objects damaged in the course of Work, as directed by Departmental Representative.

3.6 AIR MONITORING

.1 From beginning of Work until completion of cleaning operations, Departmental Representative may take air samples on daily basis outside of work area enclosure in accordance with Health Canada recommendations.

.1 Contractor will be responsible for monitoring inside enclosure in accordance with applicable Provincial/Territorial Occupational Health and Safety Regulations.

.2 Use results of air monitoring inside work area to establish type of respirators to be used. Workers may be required to wear sample pumps for up to full-shift periods.

.1 If fibre levels are above safety factor of respirators in use, stop abatement, apply means of dust suppression, and use higher safety factor in respiratory protection for persons inside enclosure.

.2 If air monitoring shows that areas outside work area enclosures are contaminated, enclose, maintain and clean these areas, in same manner as that applicable to work areas.

.3 Final air monitoring to be conducted by Departmental Representative as follows: After Asbestos Work Area has passed visual inspection and acceptable coat of lock-down agent has been applied to surfaces within enclosure, and appropriate setting period has passed, Departmental Representative will perform air monitoring within Asbestos Work Area.

.1 Final air monitoring results must show fibre levels of less than 0.01 f/cc.

.2 If air monitoring results show fibre levels in excess of 0.01 f/cc, re-clean work area and apply another acceptable coat of lock-down agent to surfaces.

.3 Repeat as necessary until fibre levels are less than 0.01 f/cc.

3.7 INSPECTION

.1 Perform inspection of Asbestos Work Area to confirm compliance with specification and governing authority requirements. Deviations from these requirements that have not been approved in writing by Departmental Representative may result in Work stoppage, at no cost to Owner.

.2 Departmental Representative will inspect Work for:

.1 Adherence to specific procedures and materials.

.2 Final cleanliness and completion.

.3 No additional costs will be allowed by Contractor for additional labour or materials required to provide specified performance level.

.3 When asbestos leakage from Asbestos Work Area has occurred or is likely to occur Departmental Representative may order Work shutdown.

.1 No additional costs will be allowed by Contractor for additional labour or materials required to provide specified performance level.

END OF SECTION

Part 1 GENERAL

1.1 SUMMARY

.1 Comply with requirements of this Section when performing following Work: Type 1 Operation.

.1 Removal of lead-containing coatings with a chemical gel or paste and fibrous laminated cloth wrap on walls.

.2 Removal of lead-containing coatings or materials using a power tool with an effective dust collection system equipped with a HEPA filter on walls.

.3 Removal of lead-containing coatings or materials with non-powered hand tool, other than manual scraping and sanding on walls.

1.2 REFERENCES

.1 Ontario Ministry of Labour

.1 Occupational Health and Safety Branch, Guideline Lead On Construction Projects, September 2004, and O. Reg. 490/09 respecting Designated Substances - Lead made under the Occupational Health and Safety Act as amended by O. Reg. 148/12 and O. Reg. 149/12.

.2 Department of Justice Canada

.1 Canadian Environmental Protection Act, 1999 (CEPA).

.3 Health Canada

.1 Workplace Hazardous Materials Information System (WHMIS), Material Safety Data Sheets (MSDS).

.4 Human Resources and Social Development Canada (HRSDC)

.1 Canada Labour Code Part II, - SOR 86-304 - Occupational Health and Safety Regulations.

.5 Transport Canada (TC)

.1 Transportation of Dangerous Goods Act, 1992 (TDGA).

1.3 DEFINITIONS

.1 HEPA vacuum: High Efficiency Particulate Air filtered vacuum equipment with a filter system capable of collecting and retaining fibres greater than 0.3 microns in any direction at 99.97% efficiency.

.2 Authorized Visitors: Departmental Representative or designated representative[s].

.3 Polyethylene: polyethylene sheeting or rip-proof polyethylene sheeting with tape along edges, around penetrating objects over cuts and tears, and elsewhere as required to provide protection and isolation. For protection of underlying surfaces from damage and to prevent lead dust entering in clean area.

.4 Sprayer: garden reservoir type sprayer or airless spray equipment capable of producing mist or fine spray. Must be appropriate capacity for scope of work.

.5 Action level: employee exposure, without regard to use of respirators, to airborne concentration of lead of 50 micrograms per cubic meter of air (50 ug/m3) calculated as 8-hour time-weighted average (TWA). Minimum precautions for lead abatement are based on airborne lead concentrations less than 0.05 milligrams per cubic meter of air for removal of lead based paint by methods noted in paragraph 1.1.

.6 Competent person: Departmental Representative capable of identifying existing lead hazards in workplace taking corrective measures to eliminate them.

.7 Lead dust: wipe sampling on vertical surfaces and/or horizontal surfaces, dust and debris is considered to be lead contaminated if it contains more than 40 micrograms of lead in dust per square foot.

1.4 SUBMITTALS

.1 Provide proof satisfactory to Departmental Representative that suitable arrangements have been made to dispose of lead based paint waste in accordance with requirements of authority having jurisdiction.

.2 Provide proof of Contractor's General and Environmental Liability Insurance.

.3 Quality Control:

.1 Provide Departmental Representative necessary permits for transportation and disposal of lead based paint waste and proof that lead based paint waste has been received and properly disposed.

.2 Provide proof satisfactory to Departmental Representative that employees have had instruction on hazards of lead exposure, respirator use, dress, and aspects of work procedures and protective measures.

1.5 QUALITY ASSURANCE

.1 Regulatory Requirements: comply with Federal, Provincial/Territorial and local requirements pertaining to lead paint, provided that in case of conflict among those requirements or with these specifications more stringent requirement applies. Comply with regulations in effect at time work is performed.

.2 Health and Safety:

.1 Safety Requirements: worker and visitor protection.

.1 Protective equipment and clothing to be worn by workers and visitors in work Area include:

.1 Respirator NIOSH approved and equipped with replaceable HEPA filter cartridges with an assigned protection factor of 10, acceptable to Authority having jurisdiction. Suitable for type of lead and level of lead dust exposure. Provide sufficient amount of filters.

.2 Half mask respirator: half-mask particulate respirator with N - series filter, and 95% efficiency could be provided.

.2 Eating, drinking, chewing, and smoking are not permitted in work area.

.3 Ensure workers wash hands and face when leaving work area. Facilities for washing are determined by the Departmental Representative.

.4 Visitor Protection:

.1 Provide approved respirators to Authorized Visitors to work areas.

.2 Instruct Authorized Visitors procedures to be followed in entering and exiting work area.

1.6 WASTE MANAGEMENT AND DISPOSAL

.1 Separate waste materials for reuse and recycling.

.2 Handle and dispose of hazardous materials in accordance with CEPA, TDGA, Regional and Municipal regulations.

.3 Disposal of lead waste generated by removal activities must comply with Federal, Provincial, Territorial and Municipal regulations. Dispose of lead waste in sealed double thickness 0.152 mm thick bags or leak proof drums. Label containers with appropriate warning labels.

.4 Provide manifests describing and listing waste created. Transport containers by approved means to licensed landfill for burial.

1.7 EXISTING CONDITIONS

.1 Information pertaining to lead based paint to be handled, removed, or otherwise disturbed and disposed of during this Project are located in the following documentation:

.1 Designated Substance Survey, 441 University Avenue, Windsor, Ontario. Prepared by DST Consulting Engineers Inc. Dated January 27, 2017.

.2 Notify Departmental Representative of lead based paint discovered during Work and not apparent from drawings, specifications, or report pertaining to Work. Do not disturb such material until instructed by Departmental Representative.

1.8 SCHEDULING

.1 Not later than two days before beginning Work on this Project notify following in writing:

.1 Appropriate Regional or Zone Director of Medical Services Branch, Health Canada.

.2 Provincial Ministry of Labour.

.3 Disposal Authority.

.2 Inform sub trades of presence of lead- containing materials identified in Existing Conditions.

.3 Provide Departmental Representative copy of notifications prior to start of Work.

.4 Hours of Work: perform work involving lead abatement located at the Building at hours specified by the Departmental Representative. Include in Contract Sum additional costs due to this requirement.

1.9 OWNER'S INSTRUCTIONS

.1 Provide Departmental Representative satisfactory proof that every worker has had instruction and training in hazards of lead exposure, in personal hygiene, in aspects of work procedures, and in use, cleaning, and disposal of respirators.

.2 Instruction and training related to respirators includes, at minimum:

.1 Proper fitting of equipment.

.2 Inspection and maintenance of equipment.

.3 Disinfecting of equipment.

.4 Limitations of equipment.

.3 Instruction and training must be provided by competent, qualified person.

.4 Supervisory personnel to complete required training.

Part 2 PRODUCTS

2.1 MATERIALS

.1 Polyethylene 0.15 mm thick unless otherwise specified; in sheet size to minimize joints.

.2 Tape: fibreglass - reinforced duct tape suitable for sealing polyethylene under dry conditions and wet conditions using amended water.

.3 Slow - drying sealer: non-staining, clear, water - dispersible type that remains tacky on surface for at least 8 hours and designed for purpose of trapping residual lead paint residue.

.4 Lead waste containers: metal type acceptable to dump operator with tightly fitting covers and 0.15 mm thickness sealable polyethylene liners.

.1 Label containers with pre-printed bilingual cautionary Warning Lead clearly visible when ready for removal to disposal site.

Part 3 EXECUTION

3.1 SUPERVISION

.1 One Supervisor for every ten workers is required.

.2 Supervisor must remain within work area during disturbance, removal, or handling of lead based paints.

3.2 PREPARATION

.1 Remove and store items to be salvaged or reused.

.1 Protect and wrap items and transport and store in area specified by Departmental Representative.

.2 Work Area:

.1 Shut off and isolate HVAC system to prevent dust dispersal into other building areas. Conduct smoke tests to ensure duct work is airtight.

.2 Pre-clean fixed casework and equipment within work area, using HEPA vacuum and cover and seal with polyethylene sheeting and tape.

.3 Clean work area using HEPA vacuum. If not practicable, use wet cleaning method. Do not raise dust.

.4 Seal off openings with polyethylene sheeting and seal with tape.

.5 Protect floor surfaces covered from wall to wall with polyethylene sheets.

.6 Maintain emergency fire exits or establish alternatives satisfactory to Authority having jurisdiction.

.7 Where water application is required for wetting lead containing materials, provide temporary water supply appropriately sized for application of water as required.

.8 Provide electrical power and shut off for operation of powered tools and equipment. Provide 24 volt safety lighting and ground fault interrupter circuits on power source for electrical tools, in accordance with applicable CSA Standard. Ensure safe installation of electrical cables and equipment.

.3 Do not start work until:

.1 Arrangements have been made for disposal of waste.

.2 Tools, equipment, and materials waste containers are on site.

.3 Arrangements have been made for building security.

.4 Notifications have been completed and preparatory steps have been taken.

3.3 LEAD ABATEMENT

.1 Removal of lead-containing coatings with a chemical gel or paste and fibrous laminated cloth wrap; or removal equipped with HEPA filters; or removal with using power tools, non-powered hand tool, other than manual scraping and sanding.

.2 Remove lead based paint in small sections and pack as it is being removed in sealable 0.15 mm plastic bags and place in labelled containers for transport.

.3 Seal filled containers. Clean external surfaces thoroughly by wet sponging. Remove from immediate working area to staging area. Clean external surfaces thoroughly again by wet sponging. Wash containers thoroughly pending removal to outside. Ensure containers are removed by workers who have entered from uncontaminated areas dressed in clean coveralls.

.4 After completion of stripping work, wire brush and wet sponge surface from which lead based paint has been removed to remove visible material. During this work keep surfaces wet.

.5 After wire brushing and wet sponging to remove visible lead based paint, and after encapsulating lead containing material impossible to remove, wet clean entire work area, and equipment used in process. After inspection by Departmental Representative apply continuous coat of slow drying sealer to surfaces of work area. Do not disturb work area for 8 hours no entry, activity, ventilation, or disturbance during this period.

3.4 INSPECTION

.1 Perform inspection to confirm compliance with specification and governing authority requirements. Deviations from these requirements not approved in writing by Departmental Representative will result in work stoppage, at no cost to Owner.

.2 Departmental Representative will inspect work for:

.1 Adherence to specific procedures and materials.

.2 Final cleanliness and completion.

.3 No additional costs will be allowed by Contractor for additional labour or materials required to provide specified performance level.

3.5 LEAD SURFACE SAMPLING - WORK AREAS

.1 Final lead surface sampling to be conducted as follows:

.1 After work area has passed a visual inspection for cleanliness approved and accepted by Departmental Representative. Apply coat of lock-down agent to surfaces within enclosure, and appropriate setting period of 8 hours has passed, Departmental Representative will perform lead wipe sampling.

.1 Final lead wipe sampling results from horizontal and vertical surfaces must show lead levels of less than 40 micrograms of lead in dust per square foot. Samples collected and analyzed in accordance with EPA 747-R-95-007.

.2 If wipe sampling results show levels of lead in excess of 40 micrograms per square foot, re-clean work area at contractor's expense and apply another acceptable coat of lock-down agent to surfaces.

.3 Repeat as necessary until fibre levels are less than 40 micrograms per square foot.

3.6 FINAL CLEANUP

.1 Following cleaning and when lead wipe surfaces sampling are below acceptable concentrations, proceed with final cleanup.

.2 Remove polyethylene sheet by rolling it away from walls to centre of work area. Vacuum visible lead containing particles observed during cleanup, immediately, using HEPA vacuum.

.3 Place polyethylene sheets, tape, cleaning material, clothing, and contaminated waste in plastic bags and sealed labelled waste containers for transport.

.4 Conduct final check to ensure no dust or debris remains on surfaces as result of dismantling operations.

3.7 RE-ESTABLISH- MENT OF OBJECTS AND SYSTEMS

.1 Repair or replace objects damaged in course of work to their original state or better, as directed by Departmental Representative.

END OF SECTION

Part 1 GENERAL

1.1 SUMMARY

.1 Comply with requirements of this Section when performing following Work: Type 2 Operation.

.1 Removal of lead based paint from walls, and ceilings by scraping or sanding using non-powered hand tools.

.2 Manual demolition of lead-painted plaster walls or building components by striking wall with sledgehammer or similar tool.

1.2 SECTION INCLUDES

.1 Requirements and procedures for abatement of lead based paints.

1.3 REFERENCES

.1 Ontario Ministry of Labour

.1 Occupational Health and Safety Branch, Guideline Lead On Construction Projects, September 2004, O. Reg. 490/09 respecting Designated Substances - Lead made under the Occupational Health and Safety Act as amended by O. Reg. 148/12 and O. Reg. 149/12.

.2 Department of Justice Canada

.1 Canadian Environmental Protection Act, 1999 (CEPA).

.3 Health Canada

.1 Workplace Hazardous Materials Information System (WHMIS), Material Safety Data Sheets (MSDS).

.4 Human Resources and Social Development Canada (HRSDC)

.1 Canada Labour Code Part II, - SOR 86-304 - Occupational Health and Safety Regulations.

.5 Transport Canada (TC)

.1 Transportation of Dangerous Goods Act, 1992 (TDGA).

1.4 DEFINITIONS

.1 HEPA vacuum: High Efficiency Particulate Air filtered vacuum equipment with filter system capable of collecting and retaining fibres greater than 0.3 microns in any direction at 99.97% efficiency.

.2 Authorized Visitors: Departmental Representative or designated representatives and representatives of regulatory agencies.

.3 Occupied Area: areas of building or work site that is outside Work Area.

.4 Sprayer: garden reservoir type sprayer or airless spray equipment capable of producing mist or fine spray. Must be appropriate capacity for scope of work.

.5 Airlock: ingress or egress system, without permitting air movement between contaminated area and uncontaminated area. Consisting of two curtained doorways at least 2 m apart.

.6 Curtained doorway: arrangement of closures to allow ingress and egress from one room to another. Typically constructed as follows:

.1 Place two overlapping polyethylene sheets over existing or temporarily framed doorway, securing each along top of doorway, securing vertical edge of one sheet along one vertical side of doorway, and secure other sheet along opposite vertical side of doorway.

.2 Reinforce free edges of polyethylene with duct tape and add weight to bottom edge to ensure proper closing.

.3 Overlap each polyethylene sheet at openings 1.5 m on each side.

.7 Action level: employee exposure, without regard to usage of respirators, to an airborne concentration of lead of 50 micrograms per cubic meter of air calculated as 8 hour time-weighted average (TWA). Intermediate precautions for lead abatement are based on airborne lead concentrations greater than 0.05 milligrams per cubic meter of air within Work Area.

.8 Competent person: Departmental Representative capable of identifying existing lead hazards in workplace and taking corrective measures to eliminate them.

.9 Lead in Dust: wipe sampling on vertical and/or horizontal surfaces, dust and debris is considered to be lead contaminated if it contains more than 40 micrograms of lead in dust per square foot.

1.5 SUBMITTALS

.1 Provide proof satisfactory to Departmental Representative that suitable arrangements have been made to dispose of lead based paint waste in accordance with requirements of authority having jurisdiction.

.2 Provide: Provincial and local requirements for Notice of Project Form.

.3 Provide proof of Contractor's General and Environmental Liability Insurance.

.4 Quality Control:

.1 Provide Departmental Representative necessary permits for transportation and disposal of lead based paint waste and proof that it has been received and properly disposed.

.2 Provide proof satisfactory to Departmental Representative that employees have had instruction on hazards of lead exposure, respirator use, dress, entry and exit from Work Area, and aspects of work procedures and protective measures.

.3 Provide proof that supervisory personnel have attended lead abatement course, of not less than two days duration, approved by Departmental Representative. Minimum of one supervisor for every ten workers.

.5 Product data:

.1 Provide documentation including test results, fire and flammability data, and Material Safety Data Sheets (MSDS) for chemicals or materials including:

.1 Encapsulants.

.2 Amended water.

.3 Slow drying sealer.

1.6 QUALITY ASSURANCE

.1 Regulatory Requirements: comply with Federal, Provincial/Territorial and local requirements pertaining to lead paint, in case of conflict among those requirements or with these specifications more stringent requirement applies. Comply with regulations in effect at time work is performed.

.2 Health and Safety:

.1 Safety Requirements: worker and visitor protection.

.1 Protective equipment and clothing to be worn by workers and visitors in Work Area includes:

.1 Respirator NIOSH approved and equipped with filter cartridges with assigned protection factor of 50, acceptable to Authority having jurisdiction. Suitable for type of lead and level of lead dust exposure in Lead Work Area. Provide sufficient filters so workers can install new filters following disposal of used filters and before re-entering contaminated areas.

.2 Disposable type protective clothing that does not readily retain or permit skin contamination, consisting of full body covering including head covering with snug fitting cuffs at wrists, ankles, and neck.

.2 Requirements for workers:

.1 Remove street clothes in clean change room and put on respirator with new filters or reusable filters, clean coveralls and head covers before entering Equipment and Access Rooms or Work Area. Store street clothes, uncontaminated footwear, towels, and similar uncontaminated articles in clean change room.

.2 Remove gross contamination from clothing before leaving work area. Place contaminated work suits in receptacles for disposal with other lead - contaminated materials. Leave reusable items except respirator in Equipment and Access Room. When not in use in Work Area, store work footwear in Equipment and Access Room. Upon completion of lead abatement, dispose of footwear as contaminated waste or clean thoroughly inside and out using soap and water before removing from Work Area or from Equipment and Access Room.

.3 Enter unloading room from outside dressed in clean coveralls to remove waste containers and equipment from Holding Room of Container and Equipment Decontamination Enclosure system. Workers not to use this system as means to leave or enter work area.

.3 Eating, drinking, chewing, and smoking are not permitted in Work Area.

.4 Ensure workers are fully protected with respirators and protective clothing during preparation of system of enclosures prior to commencing actual lead abatement.

.5 Ensure workers wash hands and face when leaving Work Area. Facilities for washing are located as indicated by the Departmental Representative.

.6 Provide and post in Clean Change Room and in Equipment and Access Room the procedures described in this Section, in both official languages.

.7 Ensure no person required to enter Work Area has facial hair that affects seal between respirator and face.

.8 Visitor Protection:

.1 Provide protective clothing and approved respirators to Authorized Visitors to Work Areas.

.2 Instruct Authorized Visitors in use of protective clothing, respirators and procedures.

.3 Instruct Authorized Visitors in proper procedures to be followed in entering into and exiting from Work Area.

1.7 WASTE MANAGEMENT AND DISPOSAL

.1 Handle and dispose of hazardous materials in accordance with CEPA, TDGA, Regional and Municipal regulations.

.2 Disposal of lead waste generated by removal activities must comply with Federal, Provincial, and Municipal regulations. Dispose of lead waste in sealed double thickness 0.152 mm thick bags or leak proof drums. Label containers with appropriate warning labels.

.3 Provide manifests describing and listing waste created. Transport containers by approved means to licensed landfill for burial.

1.8 EXISTING CONDITIONS

.1 Information pertaining to lead based paint to be handled, removed, or otherwise disturbed and disposed of during this Project are located in the following documentation:

.1 Designated Substance Survey, 441 University Avenue, Windsor, Ontario. Prepared by DST Consulting Engineers Inc. Dated January 27, 2017.

.2 Notify Departmental Representative of lead based paint discovered during Work and not apparent from drawings, specifications, or report pertaining to Work. Do not disturb such material until instructed by Departmental Representative.

1.9 SCHEDULING

.1 Not later than two days before beginning Work on this Project notify the following in writing, where appropriate:

.1 Appropriate Regional or Zone Director of Medical Services Branch, Health Canada.

.2 Provincial Ministry of Labour.

.3 Disposal Authority.

.2 Inform sub trades of presence of lead-containing materials identified in Existing Conditions.

.3 Provide Departmental Representative copy of notifications prior to start of Work.

Part 2 PRODUCTS

2.1 MATERIALS

.1 Polyethylene: 0.15 mm unless otherwise specified; in sheet size to minimize joints.

.2 FR polyethylene: 0.15 mm woven fibre reinforced fabric bonded both sides with polyethylene.

.3 Tape: fibreglass - reinforced duct tape suitable for sealing polyethylene under dry conditions and wet conditions using amended water.

.4 Slow - drying sealer: non-staining, clear, water - dispersible type that remains tacky on surface for at least 8 hours and designed for trapping residual lead paint residue.

.5 Lead waste containers: metal or fibre type acceptable to dump operator with tightly fitting covers and 0.15 mm sealable polyethylene liners.

.1 Label containers with pre-printed bilingual cautionary Warning Lead clearly visible when ready for removal to disposal site.

Part 3 EXECUTION

3.1 SUPERVISION

.1 Approved Supervisor must remain within Lead Work Area during disturbance, removal, or other handling of lead based paints.

3.2 PREPARATION

.1 Remove and wrap items to be salvaged or reused, and transport and store in area specified by Departmental Representative.

.2 Work Area:

.1 Shut off and isolate HVAC system to prevent dust dispersal into other building areas. Conduct smoke tests to ensure duct work is airtight.

.2 Pre-clean fixed casework, and equipment within work areas, using HEPA vacuum and cover with polyethylene sheeting sealed with tape.

.3 Clean work areas using HEPA vacuum. If not practicable, use wet cleaning method. Do not use methods that raise dust, such as dry sweeping, or vacuuming using other than HEPA vacuum.

.4 Seal off openings, corridors, doorways, windows, skylights, ducts, grilles, and diffusers, with polyethylene sheeting sealed with tape.

.5 Cover floor surfaces in work area from wall to wall with FR polyethylene drop sheets to protect existing floor during removal.

.6 Build airlocks at entrances and exits from work areas to ensure work areas are always closed off by one curtained doorway when workers enter or exit.

.7 At point of access to work areas install warning signs in both official languages in upper case "Helvetica Medium" letters reading as follows where number in parentheses indicates font size to be used:

.1 CAUTION LEAD HAZARD AREA (25 mm).

.2 NO UNAUTHORIZED ENTRY (19 mm).

.3 WEAR ASSIGNED PROTECTIVE EQUIPMENT AND RESPIRATOR (19 mm).

.4 BREATHING LEAD CONTAMINATED DUST CAUSES SERIOUS BODILY HARM (7 mm).

.8 Maintain emergency and fire exits from work areas, or establish alternative exits satisfactory to Authority having jurisdiction.

.9 Where water application is required for wetting lead containing materials, provide temporary water supply by use of appropriately sized hoses for application of water as required.

.10 Provide electrical power and shut off for operation of powered tools and equipment. Provide 24 volt safety lighting and ground fault interrupter circuits on power source for electrical tools, in accordance with applicable CSA Standard. Ensure safe installation of electrical lines and equipment.

.3 Worker Decontamination Enclosure System:

.1 Worker Decontamination Enclosure System includes Equipment and Access Room and Clean Room, as follows:

.1 Equipment and Access Room: construct between exit and work areas, with two curtained doorways, one to the rest of suite, and one to work area. Install waste receptor and storage facilities for workers' shoes and protective clothing to be re-worn in work areas. Build large enough to accommodate specified facilities, equipment needed, and at least one worker allowing sufficient space to change comfortably.

.2 Clean Room: construct with curtained doorway to outside of enclosures. Provide lockers or hangers and hooks for workers' street clothes and personal belongings. Provide storage for clean protective clothing and respiratory equipment. Install mirror to permit workers to fit respiratory equipment properly.

.4 Construction of Decontamination Enclosures:

.1 Construct framing for enclosures or use existing rooms. Line enclosure with polyethylene sheeting and seal with tape, apply two layers of FR polyethylene on floor.

.2 Construct curtain doorways between enclosures so when people move through or waste containers and equipment are moved through doorway, one of two closures comprising doorway always remains closed.

.5 Separation of Work Areas from Occupied Areas

.1 Barriers between Work Area and occupied area to be constructed as follows:

.1 Construct floor to ceiling lumber stud framing, cover with polyethylene sheeting and seal with duct tape. Apply plywood over polyethylene sheeting. Seal plywood joints and between adjacent materials with surface film forming sealer, to create airtight barrier.

.2 Cover plywood with polyethylene sheeting and sealed with duct tape.

.6 Maintenance of Enclosures:

.1 Maintain enclosures in clean condition.

.2 Ensure barriers and polyethylene linings are effectively sealed and taped. Repair damaged barriers and remedy defects immediately.

.3 Visually inspect enclosures at beginning of each work day.

.4 Use smoke test method to test effectiveness of barriers as directed by Departmental Representative.

3.3 LEAD - BASE PAINT ABATEMENT

.1 Removal of lead based paint to be performed by scraping or sanding using non-powered hand tools, or manual demolition of lead-painted plaster walls or building components by striking a wall with sledgehammer or similar tool.

.2 Remove lead based paint in small sections and pack as it is being removed in sealable 0.15 mm plastic bags and place in labelled containers for transport.

.3 Seal filled containers. Clean external surfaces thoroughly by wet sponging. Remove from immediate working area to Staging Area. Clean external surfaces thoroughly again by wet sponging before moving containers to decontamination Washroom. Wash containers thoroughly in decontamination Washroom, and store in Holding Room pending removal to Unloading Room and outside. Ensure containers are removed from Holding Room by workers who have entered from uncontaminated areas dressed in clean coveralls.

.4 After completion of stripping work, wire brush and wet sponge surface from which lead based paint has been removed to remove visible material. During this work keep surfaces wet.

.5 After wire brushing and wet sponging to remove visible lead based paint, and after encapsulating lead containing material impossible to remove, wet clean work area including equipment and access room, and equipment used in process. After inspection by Departmental Representative, apply continuous coat of slow drying sealer to surfaces. Do not disturb work for 8 hours with no entry, activity, ventilation or disturbance during this period.

.6 After enclosing lead painted surfaces, wet clean work area and equipment and access room. During settling period no entry, activity, or ventilation will be permitted.

3.4 INSPECTION

.1 Perform inspection to confirm compliance with specification and governing authority requirements. Deviations from these requirements not approved in writing by Departmental Representative will result in work stoppage, at no cost to Departmental Representative.

.2 Departmental Representative will inspect work for:

.1 Adherence to specific procedures and materials.

.2 Final cleanliness and completion.

.3 No additional costs will be allowed by Contractor for additional labour or materials required to provide specified performance level.

.3 When lead dust leakage from Work Area occurs Departmental Representative may order Work shutdown.

.1 No additional costs will be allowed by Contractor for additional labour or materials required to provide specified performance level.

3.5 LEAD SURFACE SAMPLING - WORK AREAS

.1 Final lead surface sampling may be conducted by Departmental Representative as follows:

.1 After Work Area has passed a visual inspection for cleanliness approved by Departmental Representative and acceptable coat of lock-down agent has been applied to surfaces within enclosure, and appropriate setting period of 8 hours has passed. Departmental Representative will perform lead wipe sampling in Work Area.

.1 Final lead wipe sampling results from horizontal and vertical surfaces where lead based paints have been removed must show lead levels of less than 40 micrograms of lead in dust per square foot. Samples must be collected and analyzed in accordance with EPA 747-R-95-007.

.2 If wipe sampling results show levels of lead in excess of 40 micrograms per square foot, re-clean work area at contractor's expense and apply another acceptable coat of lock-down agent to surfaces.

.3 Repeat as necessary until fibre levels are less than 40 micrograms per square foot.

3.6 FINAL CLEANUP

.1 Following specified cleaning procedures, and when lead wipe sampling is below acceptable concentrations proceed with final cleanup.

.2 Remove polyethylene sheet by rolling it away from walls to centre of work area. Vacuum visible lead containing particles observed during cleanup, immediately, using HEPA vacuum equipment.

.3 Place polyethylene seals, tape, cleaning material, clothing, and other contaminated waste in plastic bags and sealed labelled waste containers for transport.

.4 Clean-up Work Areas, Equipment and Access Room, and other contaminated enclosures.

.5 Clean-up sealed waste containers and equipment used in Work and remove from work areas, via Container and Equipment Decontamination Enclosure System, at appropriate time in cleaning sequence.

.6 Conduct final check to ensure no dust or debris remains on surfaces as result of dismantling operations.

3.7 RE-ESTABLISHMENT OF OBJECTS AND SYSTEMS

.1 Repair or replace objects damaged in course of work to their original state or better, as directed by Departmental Representative.

END OF SECTION

Part 1 GENERAL

1.1 SUMMARY

.1 Comply with requirements of this Section when performing following Work:

.1 Removal of lead based paint from walls and ceilings as indicated using power tools with an effective dust collection system equipped with HEPA filter.

.2 Abrasive blasting of lead based paint on walls and ceilings as indicated.

.3 Removal of lead-containing dust using air mist extraction system.

1.2 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CAN/CSA-Z180.1-[00(R2005)], Compressed Breathing Air and Systems.

.2 Department of Justice Canada

.1 Canadian Environmental Protection Act, 1999 (CEPA).

.3 Health Canada

.1 Workplace Hazardous Materials Information System (WHMIS), Material Safety Data Sheets (MSDS).

.4 Human Resources and Social Development Canada (HRSDC)

.1 Canada Labour Code Part II, - SOR 86-304 - Occupational Health and Safety Regulations.

.5 Ontario Ministry of Labour

.1 O. Reg 490/09, Designated Substances as amended by O. Reg. 148/12 and O. Reg. 149/12.

.6 Transport Canada (TC)

.1 Transportation of Dangerous Goods Act, 1992 (TDGA).

1.3 DEFINITIONS

.1 HEPA vacuum: High Efficiency Particulate Air filtered vacuum equipment with a filter system capable of collecting and retaining fibres greater than 0.3 microns in any direction at 99.97% efficiency.

.2 Authorized Visitors: Departmental Representative or designated representatives of regulatory agencies.

.3 Occupied Area: area of building or work site outside Work Area.

.4 Dioctyl Phthalate (DOP) Test: testing method used to evaluate particle penetration and air flow resistance properties of filtration materials - HEPA filter leak test.

.5 Sprayer: garden reservoir type sprayer or airless spray equipment capable of producing mist or fine spray. Appropriate capacity for scope of work.

.6 Airlock: ingress or egress system without permitting air movement between contaminated area and uncontaminated area. Consisting of two curtained doorways at least 2 m apart.

.7 Curtained doorway: arrangement of closures to allow ingress and egress from one room to another while permitting minimal air movement between rooms, typically constructed as follows:

.1 Place two overlapping sheets of polyethylene over existing or temporarily framed doorway, secure each along top of doorway, secure vertical edge of one sheet along one vertical side of doorway, and secure vertical edge of other sheet along opposite vertical side of doorway.

.2 Reinforce free edges of polyethylene with duct tape and add weight to bottom edge to ensure proper closing.

.3 Overlap each polyethylene sheet at openings 1.5 m on each side.

.8 Action level: employee exposure, without regard to usage of respirators, to an airborne concentration of lead of 50 micrograms per cubic metre of air calculated as an 8-hour time-weighted average (TWA). Maximum precautions for lead abatement are based on airborne lead concentrations greater than 1.25 milligrams per cubic meter of air within Work Area.

.9 Competent person: Individuals capable of identifying existing lead hazards in workplace and taking corrective measures to eliminate them.

.10 Lead in Dust: wipe sampling on the vertical and/or horizontal surfaces, dust and debris is considered to be lead contaminated if it contains more than 40 micrograms of lead in dust per square foot.

.11 Negative Air Pressure Machine: extracts air directly from work area and filters extracted air through a HEPA filter, discharge air to exterior of building.

.1 Maintain pressure differential of 5 to 7 Pa relative to adjacent areas outside of work areas. Machine to be equipped with alarm to warn of system breakdown, and equipped with instrument to continuously monitor and automatically record pressure differences.

1.4 SUBMITTALS

.1 Provide proof satisfactory to Departmental Representative that suitable arrangements have been made to dispose of lead based paint waste in accordance with requirements of authority having jurisdiction.

.2 Provide: Provincial and local requirements for Notice of Project Form.

.3 Provide proof of Contractor's General and Environmental Liability Insurance.

.4 Quality Control:

.1 Provide Departmental Representative necessary permits for transportation and disposal of lead based paint waste and proof it has been received and properly disposed.

.2 Provide proof satisfactory to Departmental Representative that employees had instruction on hazards of lead exposure, respirator use, dress, entry and exit from Work Area, and aspects of work procedures and protective measures.

.3 Provide proof that supervisory personnel have attended lead abatement course, of not less than two days duration, approved by Departmental Representative. Minimum of one supervisor for every ten workers.

.5 Product data:

.1 Provide documentation including test results, fire and flammability data, and Material Safety Data Sheets (MSDS) for chemicals or materials including:

.1 Encapsulants.

.2 Amended water.

.3 Slow drying sealer.

1.5 QUALITY ASSURANCE

.1 Regulatory Requirements: comply with Federal, Provincial/Territorial and local requirements pertaining to lead, in case of conflict among those requirements or with these specifications the more stringent requirement applies. Comply with regulations in effect at time work is performed.

.2 Health and Safety:

.1 Safety Requirements: worker and visitor protection.

.1 Protective equipment and clothing to be worn by workers while in Lead Work Area includes:

.1 Leads removal using power tool: respirator NIOSH approved and equipped with filter cartridges with assigned protection factor of 50, acceptable to Authority having jurisdiction. Suitable for type of lead and level of lead dust exposure in Lead Work Area. Provide sufficient filters so workers can install new filters following disposal of used filters and before re-entering contaminated areas.

.2 Abrasive blasting of lead paint: NIOSH approved and equipped with filter cartridges with assigned protection factor of 1000, acceptable to Authority having jurisdiction. Suitable for type of lead and level of lead dust exposure in Lead Work Area. Respirator to be equivalent Type CE abrasive blast supplied air respirator operated in a pressure demand or positive pressure mode with a tight-fitting half-mask. Compressed air used to supply supplied air respirators to meet breathing air purity requirements of CAN/CSA-Z180.1. Where an oil-lubricated compressor is used to supply breathing air, a continuous carbon monoxide monitor/alarm to be provided.

.3 Disposable protective clothing that does not readily retain or permit skin contamination, consisting of full body covering including head covering with snug fitting cuffs at wrists, ankles, and neck.

.2 Requirements for workers:

.1 Remove street clothes in clean change room and put on respirator with new filters or reusable filters, clean coveralls and head covers before entering Equipment and Access Rooms or Work Area. Store street clothes, uncontaminated footwear, towels, and similar uncontaminated articles in clean change room.

.2 Remove gross contamination from clothing before leaving work area. Place contaminated work suits in receptacles for disposal with other lead contaminated materials. Leave reusable items except respirator in Equipment and Access Room. When not in use in work area, store work footwear in Equipment and Access Room. Upon completion of lead abatement, dispose of footwear as contaminated waste or clean thoroughly inside and out using soap and water before removing from work area or from Equipment and Access Room.

.3 Enter unloading room from outside dressed in clean coveralls to remove waste containers and equipment from Holding Room of Container and Equipment Decontamination Enclosure system. Workers not use this system as means to leave or enter Work Area.

.3 Eating, drinking, chewing, and smoking are not permitted in Work Area.

.4 Ensure workers are fully protected with respirators and protective clothing during preparation of system of enclosures prior to commencing actual lead abatement.

.5 Ensure workers wash hands and face when leaving Lead Work Area. Facilities for washing are located as indicated by the Departmental Representative

.6 Provide and post in Clean Change Room and in Equipment and Access Room the procedures described in this Section, in both official languages.

.7 Ensure no person required to enter Work Area has facial hair that affects seal between respirator and face.

.8 Visitor Protection:

.1 Provide protective clothing and approved respirators to Authorized Visitors to work areas.

.2 Instruct Authorized Visitors in use of protective clothing, respirators and procedures.

.3 Instruct Authorized Visitors in proper procedures to be followed in entering into and exiting from Work Area.

1.6 WASTE MANAGEMENT AND DISPOSAL

.1 Separate waste materials for reuse and recycling.

.2 Handle and dispose of hazardous materials in accordance with CEPA, TDGA, Regional and Municipal regulations.

.3 Disposal of lead waste generated by removal activities must comply with Federal, Provincial, and Municipal regulations. Dispose of lead waste in sealed double thickness 0.15 mm thick bags or leak proof drums. Label containers with appropriate warning labels.

.4 Provide manifests describing and listing waste created. Transport containers by approved means to licensed landfill for burial.

1.7 EXISTING CONDITIONS

.1 Information pertaining to lead based paint to be handled, removed, or otherwise disturbed and disposed of during this Project are located in the following documentation:

.1 Designated Substance Survey, 441 University Avenue, Windsor, Ontario. Prepared by DST Consulting Engineers Inc. Dated January 27, 2017.

.2 Notify Departmental Representative of lead based paint discovered during Work and not apparent from drawings, specifications, or report pertaining to Work. Do not disturb such material until instructed by Departmental Representative.

1.8 SCHEDULING

.1 Not later than two days before beginning Work on this Project notify the following in writing; where appropriate.

.1 Appropriate Regional or Zone Director of Medical Services Branch, Health Canada.

.2 Provincial Ministry of Labour.

.3 Disposal Authority.

.2 Inform sub trades of presence of lead-containing materials identified in Existing Conditions.

.3 Provide Departmental Representative copy of notifications prior to start of Work.

.4 Hours of Work: perform work involving lead abatement located the Building at hours specified by the Departmental Representative. Include in Contract Sum additional costs due to this requirement.

Part 2 PRODUCTS

2.1 MATERIALS

.1 Polyethylene 0.15 mm unless otherwise specified; in sheet size minimize joints.

.2 FR polyethylene: 0.15 mm woven fibre reinforced fabric bonded both sides with polyethylene.

.3 Tape: fibreglass - reinforced duct tape suitable for sealing polyethylene under dry conditions and wet conditions using amended water.

.4 Slow - drying sealer: non-staining, clear, water - dispersible type that remains tacky on surface for at least 8 hours and designed for trapping residual lead paint residue.

.5 Lead waste containers: metal type acceptable to dump operator with tightly fitting covers and 0.15 mm sealable polyethylene liners.

.1 Label containers with pre-printed bilingual cautionary Warning Lead clearly visible when ready for removal to disposal site.

Part 3 EXECUTION

3.1 SUPERVISION

.1 Approved Supervisor must remain within Work Area during disturbance, removal, or handling of lead based paints.

3.2 PREPARATION

.1 Remove and wrap items to be salvaged or reused, and transport and store in area specified by Departmental Representative.

.2 Work Area:

.1 Shut off and isolate HVAC system to prevent lead dust and particulate dispersal into other building areas. Conduct smoke tests to ensure duct work is airtight.

.2 Pre-clean fixed casework, and equipment within work areas, using HEPA vacuum and cover with polyethylene sheeting sealed with tape.

.3 Clean work areas using HEPA vacuum. If not practicable, use wet cleaning method. Do not use methods that raise dust, such as dry sweeping, or vacuuming using other than HEPA vacuum.

.4 Install negative pressure machine system and operate continuously from installation of polyethylene sheeting until completion of final cleanup. Provide automatic continuous monitoring and recording instrument of pressure difference.

.5 Seal off openings, corridors, doorways, windows, skylights, ducts, grilles, and diffusers, with polyethylene sheeting sealed with tape.

.6 Cover floor surfaces in work area from wall to wall with FR polyethylene drop sheets to protect existing floor during removal.

.7 Build airlocks at entrances and exits from work areas to ensure work areas are always closed off by one curtained doorway when workers enter or exit.

.8 At point of access to work areas install warning signs in both official languages in upper case "Helvetica Medium" letters reading as follows where number in parentheses indicates font size to be used:

.1 CAUTION LEAD HAZARD AREA (25 mm).

.2 NO UNAUTHORIZED ENTRY (19 mm)

.3 WEAR ASSIGNED PROTECTIVE EQUIPMENT AND RESPIRATOR (19 mm).

.4 BREATHING LEAD CONTAMINATED DUST CAUSES SERIOUS BODILY HARM (7 mm).

.9 .9 Maintain emergency and fire exits from work areas, or establish alternative exits satisfactory to Authority having jurisdiction.

.10 Where water application is required for wetting lead containing materials, provide temporary water supply by use of appropriately sized hoses for application of water as required.

.11 Provide electrical power and shut off for operation of powered tools and equipment. Provide 24 volt safety lighting and ground fault interrupter circuits on power source for electrical tools, in accordance with applicable CSA Standard. Ensure safe installation of electrical lines and equipment.

.3 Worker Decontamination Enclosure System:

.1 Worker Decontamination Enclosure System includes Equipment and Access Room and Clean Room, as follows:

.1 Equipment and Access Room: construct between exit and work areas, with two curtained doorways, one to the rest of the suite, and one to work area. Install waste receptor and storage facilities for workers' shoes and protective clothing to be re-worn in work areas. Build large enough to accommodate specified facilities, equipment needed, and at least one worker allowing sufficient space to change comfortably.

.2 Clean Room: construct with curtained doorway to outside of enclosures. Provide lockers or hangers and hooks for workers' street clothes and personal belongings. Provide storage for clean protective clothing and respiratory equipment. Install mirror to permit workers to fit respiratory equipment properly.

.4 Construction of Decontamination Enclosures:

.1 Construct framing for enclosures or use existing rooms. Line enclosure with polyethylene sheeting and seal with tape, apply two layers of FR polyethylene on floor.

.2 Construct curtain doorways between enclosures so when people move through or waste containers and equipment are moved through doorway, one of two closure comprising doorway always remains closed.

.3 Shower room in decontamination facility to be provided with the following:

.1 Hot and cold water or water of constant temperature not less than 40 degrees Celsius or more than 50 degrees Celsius.

.2 Individual controls inside to regulate water flow and temperature.

.4 Prior to each shift in which a decontamination facility is being used, a competent person should inspect the facility to ensure that there are no defects that would allow lead-containing dust to escape. Defects should be repaired before the facility is used. The decontamination facility should be maintained in a clean and sanitary condition.

.5 Separation of Work Areas from Occupied Areas:

.1 Barriers between Work Area and occupied area to be constructed as follows:

.1 Construct floor to ceiling lumber stud framing, cover with polyethylene sheeting and seal with duct tape. Apply plywood over polyethylene sheeting. Seal plywood joints and between adjacent materials with surface film forming sealer, to create airtight barrier.

.2 Cover plywood with polyethylene sheeting and sealed with duct tape.

.6 Maintenance of Enclosures:

.1 Maintain enclosures in tidy condition.

.2 Ensure barriers and polyethylene linings are effectively sealed and taped. Repair damaged barriers and remedy defects immediately.

.3 Visually inspect enclosures at beginning of each working day.

.4 Use smoke test method to test effectiveness of barriers as directed by Departmental Representative.

3.3 LEAD - BASE PAINT ABATEMENT

.1 Removal of lead based paint to be performed using power tools that are attached to dust-collecting vacuums with HEPA filters.

.2 Remove lead based paint in small sections and pack as it is being removed in sealable 0.15 mm plastic bags and place in labelled containers for transport.

.3 Wet method to be used to reduce dust generation. Examples of wet methods include wetting surfaces, wet scraping, and wet shovelling. Wet method not be used if it creates a hazard or cause damage to equipment or to project. Power tools to be equipped with a shroud, and to be kept flush with surface.

.4 Seal filled containers. Clean external surfaces thoroughly by wet sponging. Remove immediate from working area to staging area. Clean external surfaces thoroughly again by wet sponging before moving containers to decontamination Washroom. Wash containers thoroughly in decontamination Washroom, and store in Holding Room pending removal to Unloading Room and outside. Ensure containers are removed from Holding Room by workers who have entered from uncontaminated areas dressed in clean coveralls.

.5 After completion of stripping work, wire brush and wet sponge surface to remove visible material. During this work keep surfaces wet. After wire brushing and wet sponging, wet clean and HEPA vacuum entire work area including Equipment and Access Room. Compressed air or dry sweeping not be used to clean up lead-containing dust or waste. After inspection and approval by Departmental Representative apply continuous coat of slow drying sealer to surfaces. Do not disturb work area for [8] hours, no entry, activity, or ventilation other than operation negative air machine during this period.

.6 After enclosing lead painted surfaces, wet clean work area and equipment and access room. During settling period no entry, activity, or ventilation will be permitted.

3.4 INSPECTION

.1 Perform inspection to confirm compliance with specification and governing authority requirements. Deviations from requirements not been approved in writing by Departmental Representative will result in Work shutdown, at no cost to Owner.

.2 Departmental Representative will inspect work for:

.1 Adherence to specific procedures and materials.

.2 Final cleanliness and completion.

.3 No additional costs will be allowed for additional labour or materials required to provide specified performance level.

.3 When lead dust leakage from Work Area occurs Departmental Representative will order Work shutdown.

.1 No additional costs will be allowed by Contractor for additional labour or materials required to provide specified performance level.

3.5 LEAD SURFACE SAMPLING - WORK AREAS

.1 Final lead surface sampling may be conducted by Departmental Representative as follows:

.1 After Work Area has passed a visual inspection for cleanliness approved by Departmental Representative and acceptable coat of lock-down agent has been applied to surfaces within enclosure, and appropriate setting period of 8 hours has passed, Departmental Representative will perform lead wipe sampling in Work Area.

.1 Final lead wipe sampling results from horizontal and vertical surfaces must show lead levels of less than 40 micrograms of lead in dust per square foot. Samples collected and analyzed in accordance with EPA 747-R-95-007.

.2 If wipe sampling results show levels of lead dust in excess of 40 micrograms per square foot, re-clean work area at contractor's expense and apply another acceptable coat of lock-down agent to surfaces.

.3 Repeat as necessary until lead dust levels are less than 40 micrograms per square foot.

3.6 FINAL CLEANUP

.1 Following specified cleaning procedures, and when lead wipe sampling is below acceptable concentrations proceed with final cleanup.

.2 Remove polyethylene sheet by rolling it away from walls to centre of work area. Vacuum visible lead containing particles observed during cleanup, immediately, using HEPA vacuum.

.3 Place polyethylene sheets, tape, cleaning material, clothing, and contaminated waste in plastic bags and sealed labelled waste containers for transport.

.4 Clean up Work areas, Equipment and Access Room, and other contaminated enclosures.

.5 Remove sealed waste containers and equipment used in Work and remove from work areas at appropriate time in cleaning sequence.

.6 Conduct final check to ensure no dust or debris remain on surfaces as result of dismantling operations.

3.7 RE-ESTABLISHMENT OF OBJECTS AND SYSTEMS

.1 Repair or replace objects damaged in course of work to their original state or better, as directed by Departmental Representative.

END OF SECTION

Part 1 GENERAL

1.1 MEASUREMENT PROCEDURES – NOT USED

1.2 REFERENCES

.1 American Conference of Governmental Industrial Hygienists (ACGIH), Bioaerosols Assessment and Control 1999.

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

.1 Material Safety Data Sheets (MSDS).

.3 New York City Department of Health - Bureau of Environmental and Occupational Disease Epidemiology's Guidelines on the Assessment and Remediation of Fungi in Indoor Environment 2008.

.4 United States Department of Labor Occupational Safety and Health Administration (OSHA)

.1 29 CFR 1910.134 - Respiratory Protection.

.2 29 CFR 1910.1200 - Hazard Communication.

.5 United States Environmental Protection Agency (EPA), Mould Remediation in Schools and Commercial Buildings, 2001.

.6 Canadian Standards Association (CSA)

.1 CSA Z94.4-02(R2007), Selection, Use and Care of Respirators.

.7 Canadian Construction Association’s Mould Guidelines for the Canadian Construction Industry – CCA 82-2004.

1.3 DEFINITIONS

.1 Authorized Visitors: Departmental Representative, Engineers, Consultants or designated representatives, and representatives of regulatory agencies.

.2 Cleaning solution: detergent solution.

.3 Competent person: individuals, Engineer, Consultant, who can demonstrate that mould remediation training has been obtained, is capable of identifying existing microbial hazards in workplace and selecting appropriate control strategy for microbial exposure.

.4 Contractor: remediation contractor providing demolition and removal services as defined in specification.

.5 Fibre Reinforced Polyethylene Sheet: rip-proof fibre reinforced polyethylene sheeting with added fibre reinforced adhesive tape along edges.

.6 HEPA vacuum: High Efficiency Particulate Air filtered vacuum equipment with filter system capable of collecting and retaining fibres greater than 0.3 microns in any direction at 99.97% efficiency.

.7 HVAC: heating ventilating and air-conditioning system[s] which serve occupied areas. Includes but is not limited to air handling units, duct work, terminal boxes and vents.

.8 Mould contaminated work area: specific area or location where actual work is being performed or other areas of facility where it has been determined that it may be hazardous to public health as result of mould remediation.

.9 Occupied Area: areas of building or work site that is outside mould contaminated work area.

.10 PPE: Personnel Protection Equipment.

.11 Sprayer: garden reservoir type sprayer or airless spray equipment capable of producing mist or fine spray. Must have a minimum of six litres capacity for work.

1.4 REGULATORY REQUIREMENTS

.1 Comply with regulations in effect at time work is performed. In case of conflict among these requirements or with these specifications the more stringent requirement applies. If no regulations exist, follow guidelines most widely accepted by recognized professional organizations such as occupational hygienists, health professionals or environmental engineers as listed in paragraph 1.2 References.

1.5 SUBMITTALS

.1 Submit Provincial and/or local requirements for Notice of Project form.

.2 Submit proof of Contractors Liability Insurance for dealing with hazardous materials.

.3 Submit Workers Compensation Board status and transcription of insurance.

.4 Submit proof of attendance in form of certificate that supervisory personnel have trained in asbestos or mould remediation course, approved by Departmental Representative. Minimum of one supervisor for every ten trained workers.

1.6 CLOSEOUT SUBMITTALS

.1 Maintain general log to provide permanent record of project. Maintain logs and other required documentation as part of permanent project file.

.2 Daily log must be available for inspection upon request by Departmental Representative.

.3 Visitor log must be available for inspection upon request by Departmental Representative.

1.7 INSTRUCTION AND TRAINING

.1 Before commencing work, provide Departmental Representative proof that worker had instruction and training in potential heath hazards of mould exposure, handling of hazardous materials, in personal hygiene including protective clothing, in entry and exit from Mould Contaminated Work Area, and in use of disposal procedures including building materials. This training can be performed as part of a program to comply with requirements of the OHSA Hazard Communication Standard (29 CFR 1910.1200).

.1 Workers shall complete respirator pre-screening in accordance with CSA Z94.4.

.2 Instruction and training related to respirators includes at minimum:

.1 Fitting of equipment.

.2 Inspection and maintenance of equipment.

.3 Disinfecting of equipment.

.4 Limitations of equipment.

.3 Instruction and training must be provided by designated construction safety advisor.

1.8 WORKER PROTECTION

.1 Respirators suitable for protection against mould and acceptable to Provincial Authority having jurisdiction Non-powered disposable filter-type respirator of type [N95 OSHA 29CFR 1910.134] [half-face equipped with replaceable HEPA filter cartridges] [full-face air purifying respirators (APR) equipped with replaceable HEPA filter cartridges], personally issued to work and marked as to efficiency and purpose.

.2 Gloves and eye protection.

.3 Disposable paper coveralls including head covering.

.4 Ensure that no person required to enter Mould Contaminated Work Area has facial hair that affects seal between respirator and face.

.5 Eating, drinking and chewing are not permitted in Mould Contaminated Work Area.

.6 Before leaving Mould Contaminated Work Area, dispose of protective clothing as waste as specified.

.7 Ensure workers wash hands and face after leaving Mould Contaminated Work Area. Facilities for washing are specified by the Departmental Representative.

1.9 VISITOR PROTECTION

.1 Protective clothing and approved respirators Non-powered disposable filter-type respirator of type half face with eye protection to be worn by Authorized Visitors to Mould Contaminated Work Area.

.2 Instruct Authorized Visitors in use of protective clothing, respirators, and procedures.

.3 Instruct Authorized Visitors in proper procedures to be followed in entering into and exiting from Mould contaminated work area.

1.10 HOURS OF WORK – NOT USED

Part 2 PRODUCTS

2.1 MATERIALS

.1 Drop Sheets: fibre reinforced polyethylene 0.15 mm thick woven fibre reinforced fabric bonded both sides with polyethylene.

.2 Disposal bags: dust-tight 0.15 mm clear polyethylene waste bags.

.3 Wetting Agent: water to mist mould-containing material.

.4 Cleaning solution: detergent solution for damp wipe and/or mop.

.5 Fibre reinforced adhesive tape: used in sealing joints of fibre reinforced polyethylene sheets and for attachment of fibre reinforced polyethylene sheet to finished and unfinished surfaces. Fibre reinforced adhesive tape must be capable of adhering under both dry and wet conditions.

.6 Materials: provide materials such as fibre reinforced polyethylene sheeting, lumber, nails and hardware necessary to construct and dismantle barriers that isolate Mould Contaminated Work Area.

2.2 TOOLS AND EQUIPMENT

.1 Tools and equipment: suitable for use with microbial contamination and must be able to withstand de-contamination.

.2 Personnel protective equipment (protective clothing, personal respiratory filter cartridges, HEPA air filters, etc.): to be provided in sufficient quantities for duration of project.

.3 Vacuum cleaners: equipped with HEPA filters.

.4 Ladders and/or scaffolds: adequate length, strength and sufficient quantity to support work schedule.

.5 Exhaust air fan systems: equipped with HEPA filters and be capable of providing sufficient exhaust air to create a minimum pressure differential of 5 to 7 Pa and to allow sufficient flow of air through area.

Part 3 EXECUTION

3.1 PREPARATION OF MOULD CONTAMINATED WORK AREA

.1 Mould Contaminated Work Area and areas adjacent and around area to be unoccupied. Vacating is recommended in case of infants (less than 12 months old), elderly people, persons having undergone recent surgery, immune suppressed people or people with chronic inflammatory lung diseases.

.2 One supervisor for every ten trained workers is required.

.3 Approved supervisor must remain within Mould Contaminated Work Area at all times during disturbance, removal or other handling of mould-contaminated materials.

.4 .4 Turn off HVAC systems prior to starting remediation work to prevent contamination and dust dispersal to other areas of building.

.5 Seal off windows, doorways, skylights, ducts, grilles, diffusers and other openings between Mould Contaminated Work Area and uncontaminated areas outside Mould Contaminated Work Area with fibre reinforced polyethylene sheeting and fibre reinforced adhesive tape to minimize migration of contaminants to other parts of building.

.6 Clean movable objects within proposed Mould Contaminated Work Area using HEPA filtered vacuum equipment, damp wipe surfaces and remove such objects from Mould Contaminated Work Area to a secure and clean area.

.7 Clean fixed objects within proposed Mould Contaminated Work Area using HEPA filtered vacuum, damp wipe surfaces and cover with one layer of fibre reinforced polyethylene sheeting securely fastened with fibre reinforced adhesive tape.

.8 Remove visible dust from surfaces in Mould Contaminated Work Area where dust is likely to be disturbed during course of mould remediation work. Use HEPA vacuum and damp wipe the area.

.9 Do not use compressed air to clean up or remove dust from any surface.

.10 Erect critical barriers around perimeter of Mould Contaminated Work Area before remediation using single layer of 0.15 mm fibre reinforced polyethylene sheeting extending from floor slab to as close as possible to underside of above floor slab. Seal gaps due to ductwork, piping conduits with layer of 0.15 mm fibre reinforced polyethylene sheeting. For larger areas, a steel or wooden stud frame can be erected and fibre reinforced polyethylene sheeting attached to it.

.11 Use 0.15 mm fibre reinforced drop sheets tightly sealed with fibre reinforced adhesive tape over flooring in work areas.

.12 Ensure thatcontainment area is under negative pressure. Use HEPA filtered fan exhausted outside of Mould Contaminated Work Area to create negative pressure.

.13 In smaller easily contained areas, use HEPA vacuum cleaner nozzle within enclosure. Locate vacuum canister outside enclosure.

.14 Before beginning work, at each access to contaminated work area, install warning signs in both official languages in upper case 'Helvetica Medium' letters reading as follows, where number in parentheses indicates font size to be used: 'CAUTION MOULD HAZARD AREA (25 mm)/NO UNAUTHORIZED ENTRY (19 mm)/WEAR ASSIGNED PROTECTIVE EQUIPMENT (19 mm)/BREATHING MOULD DUST MAY CAUSE SERIOUS BODILY HARM (7 mm)'.

.15 Do not begin remediation work until barriers are inspected and authorization is given by Departmental Representative.

3.2 MICROBIAL REMEDIATION

.1 If remediation procedures are expected to generate dust or visible concentration of fungi is heavy (blanket as opposed to patchy coverage), then it is recommended that the Departmental Representative be consulted and that Maximum Precautions for Mould Remediation be followed using full containment.

.2 Use sprayer (low-velocity, fine-mist) to mist (not wet) materials containing mould to be cut. Perform work to reduce dust creation to lowest levels practicable.

.3 Non-porous and semi-porous materials can be cleaned using the cleaning solution and reused depending on depth to which microbial growth has penetrated substrate. Wood to be discarded if fungal growth has affected its soundness.

.4 Porous materials with more than 1 square metre of mould contamination and/or dampness to be removed, discarded and replaced.

.5 Porous materials identified as lightly contaminated that can be cleaned by HEPA vacuuming, washing, and damp wiping can be reused, but to be discarded and replaced if possible.

.6 Dispose of contaminated building materials as specified.

.7 During mould remediation, should Departmental Representative suspect contamination of areas outside enclosed Mould Contaminated Work Area, contractor to stop remediation work and immediately decontaminate affected areas. Eliminate causes of such contamination. Prohibit unprotected individuals from entering these contaminated areas until air and swab sampling and a visual inspection determines areas are free from contamination.

.8 Notify Departmental Representative of mould contaminated material discovered during work and not apparent from drawings, specifications or report pertaining to work. Do not disturb such material pending instructions from Departmental Representative.

3.3 REPAIR AND CLEAN-UP

.1 During Mould Remediation and immediately after completion of mould remediation, clean enclosure starting within top of enclosure and working down to floor. Clean areas using HEPA vacuum and by damp mopping with cleaning solution.

.2 Perform restoration of designated Mould Contaminated Work Area as specified.

.3 Leave areas dry and visibly free from contamination, debris and dust.

.4 After clean-up within barrier dismantle, barrier and dispose of as specified.

.5 Perform final thorough clean-up of work areas and adjacent areas affected by work using HEPA vacuum and/or damp wiping with cleaning solution.

3.4 WASTE DISPOSAL

.1 Place debris and mould-containing waste in doubled-bagged dust-tight 0.15 mm fibre reinforced clear polyethylene waste bags. Treat drop sheets and disposable protective clothing as waste; fold these items to contain dust, and place in plastic bags. Securely seal bags.

.2 Cover large items that have heavy mould growth with fibre reinforced polyethylene sheeting and sealed with fibre reinforced adhesive tape before they are removed from enclosure.

.3 Clean exterior of each waste-filled bag using damp cloths or HEPA vacuum prior to removal from Mould Contaminated Work Area.

.4 Remove waste bags from site and dispose. There is no special requirements for disposal of mouldy materials, as such they can be disposed of in landfill.

3.5 RE- ESTABLISHMENT OF OBJECTS AND SYSTEMS

.1 Return objects moved to temporary locations to their location. Ensure objects are cleaned before been moved into cleaned areas.

.2 Remount objects removed to former positions.

.3 Re-establish mechanical and electrical systems to proper working order. Install new filters into HVAC system[s] serving the affected area as part of remediation.

3.6 FINAL CLEARANCE

.1 Departmental Representative to conduct thorough visual inspection to detect visible accumulations of dust or bulk materials remaining in work area. Should dust, debris, microbial contamination, or residue be detected repeat cleaning, until area meets approval.

.2 Departmental Representative may take air samples inside of Mould Contaminated Work Area enclosures, both before and after work in accordance with recommended guidelines.

.3 Departmental Representative may perform final air monitoring of Mould Contaminated Work Area provided area has passed visual inspection and an appropriate settling period of 12 hours has passed. If air monitoring results are deemed unacceptable by Departmental Representative areas are to be re-cleaned with HEPA vacuum and damp wiped until levels are found to be acceptable by Departmental Representative.

END OF SECTION

Part 1 GENERAL

1.1 RELATED SECTIONS

.1 Section 03 20 00 – Concrete Reinforcing.

.2 Section 03 30 00 – Cast-In-Place Concrete.

.3 Section 07 92 00 - Joint Sealants.

1.2 REFERENCES

.1 Canadian Standards Association (CSA)

.1 CSA A23.1-14/A23.2-14, Concrete materials and methods of concrete construction/Test methods and standard practices for concrete.

.2 CSA O86-14, Engineering Design in Wood (Limit States Design).

.3 CSA O121-08(R2013), Douglas Fir Plywood.

.4 CSA O151-09(R2014), Canadian Softwood Plywood.

.5 CSA O153-13, Poplar Plywood.

.6 CAN3-O188.0-M78, Standard Test Methods for Mat-Formed Wood Particleboards and Waferboard.

.7 CSA O437 Series-93(R2011), Standards for OSB and Waferboard. NOT ON CSA WEB SITE

.8 CSA S269.1-1975(R2003), Falsework for Construction Purposes.

.9 CAN/CSA-S269.3-M92(R2013), Concrete Formwork.

.2 Council of Forest Industries of British Columbia (COFI)

.1 COFI Exterior Plywood for Concrete Formwork.

1.3 SHOP DRAWINGS

.1 Submit shop drawings for formwork and falsework in accordance with Section 01 33 00 – Submittal Procedures.

.2 Indicate method and schedule of construction, shoring, stripping and re-shoring procedures, materials, arrangement of joints, special architectural exposed finishes, ties, liners, and locations of temporary embedded parts. Comply with CSA S269.1, for falsework drawings. Comply with CAN/CSA-S269.3 for formwork drawings.

.3 Indicate formwork design data, such as permissible rate of concrete placement, and temperature of concrete, in forms.

.4 Indicate sequence of erection and removal of formwork/falsework as directed by Departmental Representative.

.5 Each shop drawing submission shall bear stamp and signature of qualified professional engineer registered or licensed in Province of Ontario, Canada.

1.4 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 74 20 and the Waste Reduction Workplan.

.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.

.4 Use sealers, form release and stripping agents that are non-toxic, biodegradable and have zero or low VOC's.

Part 2 PRODUCTS

2.1 MATERIALS

.1 Formwork materials:

.1 For concrete without special architectural features, use wood and wood product formwork materials to CSA O121.

.2 For concrete with special architectural features, use formwork materials to CSA A23.1/A23.2.

.2 Pan forms: Removable steel as indicated.

.3 Tubular column forms: round, spirally wound laminated fiber forms, internally treated with release material. Spiral pattern to show in hardened concrete.

.4 Form ties:

.1 For concrete not designated 'Architectural', use removable or snap-off metal ties, fixed or adjustable length, free of devices leaving holes larger than 25 mm dia. in concrete surface.

.2 For Architectural concrete, use snap ties complete with plastic cones and light grey concrete plugs.

.5 Form liner:

.1 Plywood: medium density overlay Douglas Fir to CSA O121 grade, square edge, urea formaldehyde free.

.6 Form release agent: non-toxic, low VOC.

.7 Form stripping agent: colourless mineral oil, non-toxic, low VOC, free of kerosene, with viscosity between 15 to 24 mm^2/s at 40°C, flashpoint minimum 150°C, open cup.

.8 Falsework materials: to CSA S269.1.

.9 Sealant: to Section 07 92 00.

Part 3 EXECUTION

3.1 FABRICATION AND ERECTION

.1 Verify lines, levels and centres before proceeding with formwork/falsework and ensure dimensions agree with drawings.

.2 Obtain Departmental Representative's approval for use of earth forms framing openings not indicated on drawings.

.3 Hand trim sides and bottoms and remove loose earth from earth forms before placing concrete.

.4 Fabricate and erect falsework in accordance with CSA S269.1 and COFI Exterior Plywood for Concrete Formwork.

.5 Refer to architectural drawings for concrete members requiring architectural exposed finishes.

.6 Do not place shores and mud sills on frozen ground.

.7 Provide site drainage to prevent washout of soil supporting mud sills and shores.

.8 Fabricate and erect formwork in accordance with CAN/CSA-S269.3 to produce finished concrete conforming to shape, dimensions, locations and levels indicated within tolerances required by CSA A23.1/A23.2.

.9 Align form joints and make watertight. Keep form joints to minimum.

.10 Use 25 mm chamfer strips on external corners and/or 25 mm fillets at interior corners, joints, unless specified otherwise.

.11 Form chases, slots, openings, drips, recesses, expansion and control joints as indicated.

.12 Construct forms for architectural concrete, and place ties as indicated and/or as directed. Joint pattern not necessarily based on using standard size panels or maximum permissible spacing of ties.

.13 Build in anchors, sleeves, and other inserts required to accommodate Work specified in other sections. Assure that all anchors and inserts will not protrude beyond surfaces designated to receive applied finishes, including painting.

.14 Line forms for following surfaces:

.1 Outer face of beams.

.15 Clean formwork in accordance with CSA A23.1/ A23.2, before placing concrete.

3.2 REMOVAL AND RESHORING

.1 Leave formwork in place for following minimum periods of time after placing concrete.

.1 2 days for walls and sides of beams.

.2 2 days for columns.

.3 5 days for beam soffits, slabs, decks and other structural members, or 2 days when replaced immediately with adequate shoring to standard specified for falsework.

.4 2 days for footings and abutments.

.2 Remove formwork when concrete has reached 75% of its design strength or minimum period noted above, whichever comes later, and replace immediately with adequate reshoring.

.3 Provide all necessary reshoring of members where early removal of forms may be required or where members may be subjected to additional loads during construction as required.

.4 Space reshoring in each principal direction at not more than 3000 mm apart.

.5 Re-use formwork and falsework subject to requirements of CSA A23.1/A23.2.

END OF SECTION

Part 1 GENERAL

1.1 RELATED REQUIREMENTS

.1 Section 03 30 00 Cast-In-Place Concrete.

.2 Section 04 22 00 Concrete Unit Masonry.

1.2 REFERENCES

.1 American Concrete Institute (ACI)

.1 ACI SP-66-04, ACI Detailing Manual 2004.

.2 ASTM International

.1 ASTM A1060/A1060M-14, Standard Specification for Zinc-Coated (Galvanized) Steel Welded Wire Reinforcement, Plain and Deformed, for Concrete.

.2 ASTM A1064/A1064M-15, Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete.

.3 Canada Green Building Council (CaGBC)

.1 LEED Canada For New Construction and Major Renovations 2009.

.4 CSA International

.1 CSA A23.1-14/A23.2-14, Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete.

.2 CSA A23.3-14, Design of Concrete Structures.

.3 CSA G30.18-09(R2014), Carbon Steel Bars for Concrete Reinforcement.

.4 CSA G40.20-13/G40.21-13, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.

.5 CSA W186-M1990(R2012), Welding of Reinforcing Bars in Reinforced Concrete Construction.

.5 Reinforcing Steel Institute of Canada (RSIC)

.1 RSIC-2004, Reinforcing Steel Manual of Standard Practice.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Prepare reinforcement drawings in accordance with RSIC Manual of Standard Practice.

.2 Shop Drawings:

.1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Ontario, Canada.

.1 Indicate placing of reinforcement and:

.1 Bar bending details.

.2 Lists.

.3 Quantities of reinforcement.

.4 Sizes, spacings, locations of reinforcement and mechanical splices if approved by Departmental Representative, with identifying code marks to permit correct placement without reference to structural drawings.

.2 Detail lap lengths and bar development lengths to CAN/CSA-A23.3, unless otherwise indicated.

1.4 QUALITY ASSURANCE

.1 Submit in accordance with Section 01 45 00 and as described in PART 2 - SOURCE QUALITY CONTROL.

.1 Mill Test Report: provide Departmental Representative with certified copy of mill test report of reinforcing steel, minimum 4 weeks prior to beginning reinforcing work.

.2 Submit in writing to Departmental Representative proposed source of reinforcement material to be supplied.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 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 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 Management Plan related to Work of this Section and in accordance with Section 01 35 21.

Part 2 PRODUCTS

2.1 MATERIALS

.1 Substitute different size bars only if permitted in writing by Departmental Representative.

.2 Reinforcing steel: billet steel, grade 400, deformed bars to CSA G30.18, unless indicated otherwise, minimum 30% recycled content.

.3 Reinforcing steel: weldable low alloy steel deformed bars to CSA G30.18, minimum 30% recycled content.

.4 Welded steel wire fabric: to ASTM A1060/A1060M, minimum 30% recycled content.

.1 Provide in flat sheets only.

.5 Welded deformed steel wire fabric: to ASTM A1060/A1060M, minimum 30% recycled content.

.1 Provide in flat sheets only.

.6 Chairs, bolsters, bar supports, spacers: to CSA A23.1/A23.2.

.7 Plain round bars: to CSA G40.20/G40.21.

2.2 FABRICATION

.1 Fabricate reinforcing steel in accordance with CSA A23.1/A23.2 and Reinforcing Steel Manual of Standard Practice by the Reinforcing Steel Institute of Canada.

.2 Obtain Departmental Representative's written approval for locations of reinforcement splices other than those shown on placing drawings.

.3 Upon approval of Departmental Representative, weld reinforcement in accordance with CSA W186.

.4 Ship bundles of bar reinforcement, clearly identified in accordance with bar bending details and lists.

2.3 SOURCE QUALITY CONTROL

.1 Provide Departmental Representative with certified copy of mill test report of reinforcing steel, showing physical and chemical analysis, minimum 4 weeks prior to beginning reinforcing work.

.2 Inform Departmental Representative of proposed source of material to be supplied.

Part 3 EXECUTION

3.1 FIELD BENDING

.1 Do not field bend or field weld reinforcement except where indicated or authorized by Departmental Representative.

.2 When field bending is authorized, bend without heat, applying slow and steady pressure.

.3 Replace bars, which develop cracks or splits.

3.2 PLACING REINFORCEMENT

.1 Place reinforcing steel in accordance with CSA A23.1/A23.2.

.2 Use plain round bars as slip dowels in concrete where indicated on Drawings.

.1 Paint portion of dowel intended to move within hardened concrete.

.2 When paint is dry, apply thick even film of mineral lubricating grease.

.3 Prior to placing concrete, obtain Departmental Representative's approval of reinforcing material and placement.

.4 Ensure cover to reinforcement is maintained during concrete pour.

3.3 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11.

.3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 20 and 01 35 21.

END OF SECTION

Part 1 GENERAL

1.1 RELATED SECTIONS

.1 Section 03 10 00 Concrete Forming and Accessories.

.2 Section 03 20 00 Concrete Reinforcing.

.3 Section 04 22 00 Concrete Unit Masonry.

1.2 REFERENCES

.1 Reference Standards:

.1 ASTM International

.1 ASTM C260/C260M-10a, Standard Specification for Air-Entraining Admixtures for Concrete.

.2 ASTM C309-11, Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.

.3 ASTM C494/C494M-15, Standard Specification for Chemical Admixtures for Concrete.

.2 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-37.2-M88, Emulsified Asphalt, Mineral Colloid-Type, Unfilled, for Dampproofing and Waterproofing and for Roof Coatings.

.2 CAN/CGSB-51.34-M86(R1988), Vapour Barrier, Polyethylene Sheet for Use in Building Construction.

.3 Canada Green Building Council (CaGBC)

.1 LEED Canada For New Construction and Major Renovations 2009.

.4 CSA International

.1 CSA A23.1-14/A23.2-14, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.

.2 CSA A283-06(R2011), Qualification Code for Concrete Testing Laboratories.

.3 CAN/CSA-A3000-13, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).

1.3 ADMINISTRATIVE REQUIREMENTS

.1 Pre-installation Meetings: in accordance with Section 01 32 16 convene pre-installation meeting one week prior to beginning concrete works.

.1 Ensure key personnel, site supervisor, Departmental Representative attend.

.1 Verify project requirements.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00.

.2 Shop Drawings:

.1 Submit placing drawings prepared in accordance with plans to clearly show size, shape, location and necessary details of reinforcing.

.2 Submit drawings shoring formwork and falsework design to: CSA A23.1/A23.2.

.3 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Ontario, Canada.

.3 Provide testing and inspection results and reports for review by Departmental Representative and do not proceed without written approval when deviations from mix design or parameters are found.

.4 At least 4 weeks prior to beginning Work, inform Departmental Representative of source of fly ash.

.1 Do not change source of fly ash without written approval of Departmental Representative.

.5 At least 4 weeks prior to beginning Work, submit to Departmental Representative samples of following materials proposed for use: curing compound, joint filler, and waterstops.

.6 Concrete pours: provide accurate records of poured concrete items indicating date and location of pour, quality, air temperature and test samples taken as described in PART 3 - FIELD QUALITY CONTROL.

.7 Concrete hauling time: provide for review by Departmental Representative deviations exceeding maximum allowable time of 120 minutes for concrete to be delivered to site of Work and discharged after batching.

.8 Sustainable Design Submittals:

.1 LEED Canada-NC Submittals: in accordance with Section 01 35 21.

.9 Provide two copies of WHMIS MSDS.

.10

1.5 QUALITY ASSURANCE

.1 Provide Departmental Representative, minimum 4 weeks prior to starting concrete work, with valid and recognized certificate from plant delivering concrete.

.1 Provide test data and certification by qualified independent inspection and testing laboratory that materials and mix designs used in concrete mixture will meet specified requirements.

.2 Quality Control Plan: provide written report to Departmental Representative verifying compliance that concrete in place meets performance requirements of concrete as established in PART 2 - PRODUCTS.

.3 Sustainability Standards Certification:

.1 Construction Waste Management: provide copy of plan.

.2 Recycled Content: 75%.

.1 Provide listing of recycled content products used, including details of required percentages or recycled content materials and products, showing their costs and percentages of post-consumer and pre-consumer content, and total cost of materials for project.

.2 When Supplementary Cementing Materials (SCMs) are used, provide evidence to certify reduction in cement from Base Mix to Actual SCMs Mix, as percentage.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Delivery and Acceptance Requirements:

.1 Concrete hauling time: deliver to site of Work and discharged within 120 minutes maximum after batching.

.1 Do not modify maximum time limit without receipt of prior written agreement from Departmental Representative and concrete producer as described in CSA A23.1/A23.2.

.2 Deviations to be submitted for review by Departmental Representative.

.2 Concrete delivery: ensure continuous concrete delivery from plant meets CSA A23.1/A23.2.

.2 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding and packaging materials in accordance with Section 01 74 20.

Part 2 PRODUCTS

2.1 DESIGN CRITERIA

.1 Alternative 1 - Performance: to CSA A23.1/A23.2, and as described in MIXES of PART 2 - PRODUCTS.

2.2 PERFORMANCE CRITERIA

.1 Quality Control Plan: ensure concrete supplier meets performance criteria of concrete as established by Departmental Representative and provide verification of compliance as described in PART 1 - QUALITY ASSURANCE.

2.3 MATERIALS

.1 Portland Cement: to CAN/CSA-A3001, Type GU.

.1 Reduction in cement from Base Mix to Actual Supplementary Cementing Materials (SCMs) Mix, as percentage.

.2 Blended hydraulic cement: Type GUb to CAN/CSA-A3001.

.3 Supplementary cementing materials: with minimum 20% Type F fly ash replacement, by mass of total cementitious materials to CAN/CSA-A3001.

.4 Water: to CSA A23.1/A23.2.

.5 Aggregates: to CSA A23.1/A23.2.

.6 Reinforcing bars: to CSA-G30.18, Grade 400, minimum 30% recycled content.

.7 Welded steel wire and deformed steel wire reinforcement: to ASTM A1064/A1064M; and zinc-coated (galvanized) steel welded wire and deformed steel welded wire reinforcement: to ASTM A1060/A1060M-14. Minimum 30% recycled content for all steel wire reinforcement.

.1 Provide in flat sheets only and adequately chair into position to obtain the specified concrete cover. Do not lay reinforcing sheets down and hook into position after concrete has been poured.

.8 Premoulded joint fillers:

.1 Bituminous impregnated fiber board: to ASTM D1751.

.9 Joint sealer/filler: grey to CAN/CGSB-19.24-M90, Type 1, Class B.

.10 Sealer: boiled linseed oil to ASTM D260 mixed with mineral spirits 1:1

.11 Other concrete materials: to CSA A23.1/A23.2.

2.4 MIXES

.1 Alternative 1 - Performance Method for specifying concrete: to meet Departmental Representative performance criteria to CSA A23.1/A23.2.

.1 Ensure concrete supplier meets performance criteria as established below and provide verification of compliance as in Quality Control Plan.

.2 Provide concrete mix to meet following plastic state requirements:

Workability: free of surface blemishes, colour variations and segregation.

.3 Provide concrete mix to meet following hard state requirements:

.1 Durability and class of exposure: as noted on the drawings

.2 Compressive strength as noted on the drawings.

.3 Slump: as noted on the drawings.

.4 Intended application: as noted on the drawings.

.5 Aggregate size as noted on the drawings.

.6 Other Special requirements: as noted on the drawings.

.4 Provide quality management plan to ensure verification of concrete quality to specified performance.

.5 Concrete supplier's certification: both batch plant and materials meet CSA A23.1/A23.2 requirements.

Part 3 EXECUTION

3.1 PREPARATION

.1 Obtain Departmental Representative's written approval before placing concrete.

.1 Provide 24 hours minimum notice prior to placing of concrete.

.2 Place concrete reinforcing in accordance with Section 03 20 00.

.3 During concreting operations:

.1 Development of cold joints not allowed.

.2 Ensure concrete delivery and handling facilitates placing with minimum of re-handling, and without damage to existing structure or Work.

.4 Pumping of concrete is permitted only after approval of equipment and mix.

.5 Ensure reinforcement and inserts are not disturbed during concrete placement.

.6 Prior to placing of concrete obtain Departmental Representative's approval of proposed method for protection of concrete during placing and curing in adverse weather.

.7 Protect previous Work from staining.

.8 Clean and remove stains prior to application for concrete finishes.

.9 Maintain accurate records of poured concrete items to indicate date, location of pour, quality, air temperature and test samples taken.

.10 In locations where new concrete is dowelled to existing work, drill holes in existing concrete.

.1 Place steel dowels of deformed steel reinforcing bars and pack solidly with epoxy grout to anchor and hold dowels in positions as indicated.

.11 Do not place load upon new concrete until authorized by Departmental Representative.

3.2 INSTALLATION/ APPLICATION

.1 Do cast-in-place concrete work to CSA A23.1/A23.2.

.2 Sleeves and inserts:

.1 Cast in sleeves, ties, slots, anchors, reinforcement, frames, conduit, bolts, waterstops, joint fillers and other inserts required to be built-in.

.2 Sleeves and openings greater than 100 mm x 100 mm not indicated, must be reviewed by Departmental Representative.

.3 Grout under base plates using procedures in accordance with manufacturer's recommendations which result in 100% contact over grouted area.

.4 Finishing and curing:

.1 Finish concrete to CSA A23.1/A23.2.

.2 Finish concrete floor to CSA A23.1/A23.2. Table 21, finish classification Class A.

.3 Formed surfaces exposed to view: sack rubbed finish.

.4 Interior floor slabs to be left exposed requiring smooth surface: initial finishing operations followed by final finishing comprising mechanical floating and steel troweling as specified in CSA A23.1/A23.2 to produce hard, smooth, dense troweled surface free from blemishes.

.5 Equipment pads: provide smooth troweled surface.

.6 Pavements, walks, curbs and exposed site concrete:

.1 Screed to plane surfaces and use aluminum floats.

.2 Provide round edges and joint spacings using standard tools.

.3 Trowel smooth to provide lightly brushed non-slip finish.

3.3 CONTROL JOINTS

.1 Cut and Form control joints in slabs on grade at locations indicated, to CSA A23.1/A23.2 and install specified joint sealer/filler.

3.4 EXPANSION AND ISOLATION JOINTS

.1 Install premoulded joint filler in expansion and isolation joints full depth of slab flush with finished surface to CSA A23.1/A23.2.

3.5 CURING

.1 Use curing compounds compatible with applied finish on concrete surfaces free of bonding agents and to CSA A23.1/A23.2.

3.6 SEALING APPLICATION

.1 After curing is complete, apply two even coats of linseed oil mixture to clean dry surfaces, each at 8 m^2 /L. Allow first coat to dry before applying second coat.

3.7 SITE TOLERANCES

.1 Concrete floor slab finishing tolerance to CSA A23.1/A23.2.

3.8 FIELD QUALITY CONTROL

.1 Site tests: conduct tests as follows in accordance with Section 01 45 00 and submit report as described in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS.

.1 Concrete pours.

.2 Slump.

.3 Air content.

.4 Compressive strength at 7 and 28 days.

.5 Air and concrete temperature.

.2 Inspection and testing of concrete and concrete materials will be carried out by testing laboratory designated by Departmental Representative for review to CSA A23.1/A23.2.

.1 Ensure testing laboratory is certified to CSA A283.

.3 Ensure test results are distributed for discussion at pre-pouring concrete meeting between Departmental Representative.

.4 Concrete testing: to CSA A23.1/A23.2 by testing laboratory designated and paid for by Departmental Representative.

.5 Departmental Representative will take additional test cylinders during cold weather concreting. Cure cylinders on job site under same conditions as concrete which they represent.

.6 Non-Destructive Methods for Testing Concrete: to CSA A23.1/A23.2.

.7 Inspection or testing by Departmental Representative will not augment or replace Contractor quality control nor relieve Contractor of his contractual responsibility.

3.9 CLEANING

.1 Clean in accordance with Section 01 74 11.

.2 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 20 and 01 35 21.

.1 Materials and Resources Credit MRc2.1 Construction Waste Management: Divert 50% From Landfill and MRc2.2 Construction Waste Management: Divert 75% from Landfill: prepare Construction Waste Management plan in accordance with Section 01 74 20.

.2 Divert unused concrete materials from landfill to local quarry or facility after receipt of written approval from Departmental Representative.

.3 Provide appropriate area on job site where concrete trucks and be safely washed.

.4 Divert unused admixtures and additive materials (pigments, fibres) from landfill to official hazardous material collections site as approved by Departmental Representative.

.5 Do not dispose of unused admixtures and additive materials into sewer systems, into lakes, streams, onto ground or in other location where it will pose health or environmental hazard.

.6 Prevent admixtures and additive materials from entering drinking water supplies or streams.

.7 Using appropriate safety precautions, collect liquid or solidify liquid with inert, noncombustible material and remove for disposal.

.8 Dispose of waste in accordance with applicable local, Provincial/Territorial and National regulations.

END OF SECTION

Part 1 GENERAL

1.1 SUMMARY

.1 This section includes for the supply, placement and quality control testing of lightweight insulating concrete and;

.1 Auxiliary leveling surface secured to existing roof deck.

.2 Insulation sumps and membrane underlayment.

1.2 RELATED REQUIREMENTS

.1 Section 07 52 00 – Modified Bituminous Membrane Roofing.

1.3 REFERENCE STANDARDS

.1 American Society for Testing and Materials (ASTM):

.1 ASTM C94/C94M-16, Standard Specification for Ready-Mixed Concrete.

.2 ASTM C150/C150M-16, Standard Specification for Portland Cement.

.3 ASTM C332-09, Standard Specification for Lightweight Aggregates for Insulating Concrete.

.4 ASTM C495/C495M-12, Standard Test Method for Compressive Strength of Lightweight Insulating Concrete.

.5 ASTM C578-15b, Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation.

.6 ASTM C726-12, Standard Specification for Mineral Fiber Roof Insulation Board.

.7 ASTM 1177/C1177M-13, Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing.

.8 ASTM C1288-14, Standard Specification for Discrete Non-Asbestos Fiber-Cement Interior Substrate Sheets.

.9 ASTM C1325-14, Standard Specification for Non-Asbestos Fiber-Mat Reinforced Cementitious Backer Units.

.2 Canadian Standards Association (CSA):

.1 CSA A23.1/A23.2-14, Concrete Materials and Methods of Concrete Construction / Test methods and standard practices for concrete.

.2 CAN/ULC-S702-14, Thermal Insulation, Mineral Fibre, for Buildings.

.3 Canada Green Building Council (CaGBC)

.1 LEED Canada-NC 2009, LEED (Leadership in Energy and Environmental Design): Green Building Rating System Reference Package For New Construction and Major Renovations (including Addenda).

.4 American National Standards Institute (ANSI)

.1 ANSI A118.9-1992, Test Methods and Specifications for Cementitious Backer Units.

.5 Factory Mutual Global (FM):

.1 FM 4454 Approval Standard for Lightweight Insulating Concrete Roof Deck.

.2 FM 4470 Approval Standard for Class 1 Roof Covers.

.3 Property Loss Prevention Data Sheets:

.1 1-28 Design Wind Loads and 1-28R Roof Systems.

.2 1-29 Roof Deck Securement and Above Deck Roof Components and 1-29R Roof Systems.

1.4 ADMINISTRATIVE REQUIREMENTS

.1 Pre-installation Conference: Conduct conference at Project site to comply with requirements in Section 01 31 19; meeting will address following items: to verify project requirements, structural substrate conditions, and coordination with other sections of the Work, manufacturer's installation instructions and manufacturer's warranty requirements.

.1 Coordinate the meeting to coincide with the pre-installation meeting requirements in Section 07 52 00.

.2 Confirm coordination and installation requirements of roofing membranes, requirements for maintaining warranty conditions for membranes during installation.

.3 Departmental Representative will complete the minutes and prepare a report for this meeting

.2 Site Access and Staging Area: Arrange location and extent for construction staging are with the Departmental Representative and as indicated on Drawing.

1.5 SUBMITTALS

.1 Make submittals in accordance with Section 01 33 00.

.2 Action Submittals: Provide the following submittals before starting any work of this Section:

.1 Product Data:

.1 Submit product data for each type of product specified, and manufacturer's recommended guidelines for achieving specified floor flatness and levelness tolerances, and repair methods for out-of-tolerance materials.

.2 Shop Drawings:

.1 Provide layout for expanded polystyrene insulation in a stair-step design and maintain a 1.5% slope as indicated on drawings.

.2 Provide layout of insulation sumps to maintain a minimum 8% slope.

.3 Provide calculation of lightweight insulting concrete average and minimum RSI-values.

.3 Informational Submittals: Provide the following submittals when requested by the Department Representative:

.1 Certificates:

.1 Submit confirmation that concrete mix design delivered to site is in accordance with mix design provided by the acceptable materials manufacturer.

.2 Submit confirmation that the proposed lightweight insulating concrete system confirming that the expanded polystyrene used as a component in the lightweight insulating concrete system is to be furnished by the supplier of the proposed lightweight insulating concrete system.

.3 Submit confirmation that the expanded polystyrene used as a component in the lightweight insulating concrete system approved by Factory Mutual forming the substrate for the roofing membrane system specified in Section 07 52 00.

.1 Submit confirmation that the proposed lightweight insulting concrete is compatible with roofing materials in accordance with Section 07 52 00.

.4 Submit confirmation that the proposed lightweight insulting concrete in conjunction of the roofing material specified in Section 07 52 00 archived an average of RSI-valve of 6.5 and RSI-value of 5.2 at the roof lowest point.

.5 Submit documentation confirming auxiliary levelling surface and lightweight insulting concrete system compliance with FM Global Windstorm Resistance Classification specified under Section 07 52 00 in conjunction with the roof membrane system also specified under Section 07 52 00.

.2 Site Quality Control Submittals: Submit on-site slurry density test results indicating as delivered and as installed conditions confirming that mix is in accordance with manufacturer’s slurry density adjustment chart.

.3 Manufacturer's field report: in accordance with Section 01 45 00.

.4 Reports: indicate procedures followed, ambient temperatures and weather conditions during application.

1.6 QUALITY ASSURANCE

.1 Qualifications: Provide proof of qualifications when requested by the Department Representative:

.1 Manufacturer: A firm experienced in manufacturing ready mixed lightweight concrete products and that complies with ASTM C94/C94M requirements for production facilities and equipment.

.2 Source Limitations: Obtain each type of cement of the same brand from the same manufacturer's plant and obtain admixtures through one source from a single manufacturer.

.3 Installer: Expansion of the slurry into lightweight concrete shall be conducted only by manufacturer’s qualified personnel, or by persons trained and qualified by the manufacturer, using equipment provided by the manufacturer.

1.7 FIELD CONDITIONS

.1 Environmental Requirements:

.1 Precipitation: Apply when no precipitation during application. Ensure materials and building interiors are protected from moisture damage and contamination.

.2 Ambient Conditions

.1 Install lightweight insulating concrete in accordance with manufacturer's restrictions and coordinate with Section 07 52 00 roofing membrane restrictions.

Part 2 PRODUCTS

2.1 PERFORMANCE CRITERIA:

.1 Provide a lightweight insulated concrete system that forms a part of a tested roofing assembly and resists corner, perimeter and field-of-roof uplift pressures specified in Section 07 52 00.

.2 Compatibility: Verify that lightweight insulated concrete materials are provided by the same manufacturer or are compatible with one another when provided by different manufacturers.

.3 Compatibility between lightweight insulated concrete system and the roofing system is essential. Provide written declaration to Departmental Representative stating that lightweight insulated concrete system is compatible with roofing materials and components specified in Section 07 52 00.

.4 Thermal Performance: Provide a lightweight insulated concrete system to provide an average RSI-value of 6.33 and a minimum RSI-value of 5.2.

2.2 MATERIALS

.1 Portland Cement: In accordance with ASTM C150, Type I, II, or III.

.2 Water: In accordance with CSA A23.1/A23.2, and meeting the manufacturers requirements; water of questionable quality may be permitted where tests results are submitted showing 28 day compressive strength is minimum 90% of those made with a known acceptable water and an identical material mix.

.3 Expand Polystyrene (EPS) Insulation Board:

.1 Minimum 16 kg/m^3 in accordance with ASTM C578 Type 1.

.2 Thickness in accordance with reviewed shop drawings and with minimum RSI-value per 25mm of 0.68.

.3 Have bond holes approximately 3% of the board area.

.4 Rigid Mineral Wool Insulation Board: Meeting the requirements of CAN/ULC-S702 and ASTM C726 and;

.1 Density: Minimum 48 kg/m^3.

.2 Thermal Resistance: Minimum RSI-value per 25 mm of 0.77.

.5 Auxiliary Levelling Surface (Cement Board): cementitious, water durable, board; surfaced with fiberglass reinforcing mesh on front and back; long edges wrapped; to ANSI A118.9, ASTM C1288 and ASTM C1325, 13 mm thick, edges tapered, 1200 mm wide x maximum practical length. Compressive strength: Not less than 15.51 MPa (2250 lbs. per sq. in.) when tested in accordance with ASTM D2394. Water absorption: Not greater than 8 percent when tested for 24 hours in accordance with ASTM C473.

2.3 AGGREGATE TYPE LIGHWEIGHT INSULATING CONCRETE

.1 General:

.1 Consist of a slurry of Portland cement, water and vermiculite aggregate.

.2 Tested in accordance with ASTM C495.

.3 Density:

.1 Compressive strength: 2068 kPa.

.2 Aggregate: Vermiculite concrete aggregate in accordance with ASTM C332, and with volume ratio of 1:3.5.

.3 Concrete Mix Design:

.1 Wet density: 960 to 1089 kg/m^3.

.2 Dry density: Minimum 561 kg/m^3

2.4 INSULATION SUMPS

.1 Insulation Sumps: 1.2 m x 1.2 m premanufactured insulation sump with a minimum 8% slope and 610 mm x 610 mm central flat with membrane underlayment board. Sump thicknesses to meet minimum average RSI-values indicated in 2.1 above.

.1 Manufactured of rigid mineral wool board insulation.

.2 Thickness in accordance with reviewed shop drawings.

.3 Membrane Underlayment: Glass mat faced gypsum board or high performance mineral fibre cover-board, meeting the requirements of ASTM - C1177, having a non-combustible core, primed ready for mopped application of SBS base sheets;

.1 Thickness: 13 mm.

.2 Surfacing: Fiberglass mat with non-asphaltic coating.

.4 Insulation and membrane underlayment adhesive: Low rise polyurethane adhesive.

Part 3 EXECUTION

3.1 EXAMINATION

.1 Inspect existing conditions and substrates upon which work of this section is dependent. Report to the Department Representative in writing any defects or discrepancies. Commencement of work implies acceptance of existing conditions and assuming full responsibility for the finished condition of the work.

.2 Defective work resulting from application to unsatisfactory conditions will be considered the responsibility of those performing the work of this section.

3.2 PREPARATION

.1 Ensure existing site condition are in satisfactory condition for commencement of the work in this section.

.2 Examine work for defects and discrepancies and report to the Departmental Representative in writing. Do not proceed work until surfaces are satisfactory.

.3 Coordinate demolition work in accordance with Section 02 41 99.

3.3 AUXILIARY LEVELLING SURFACE INSTALLATION

.1 Fasten cement board to surfaces of wood deck in accordance with requirements of FM , Bulletin 1-28 for installation of boards to decking for wind uplift pressures specified using FM Global Windstorm Resistance Classification specified in Section 07 52 00:

.1 Provide a minimum of 16 screws and washers for each 1220 mm x 2440 mm board.

.2 Increase fasteners amounts for perimeters and corners to meet Factory Mutual standards.

.2 Cut boards neatly where slopes change directions; do not break boards to conform to deck slopes; place boards perpendicular to timber deck for continuous support at extremities.

.3 Verify that surface onto which lightweight concrete is being placed is free of standing water or other deleterious material that could affect bond or performance or the material.

3.4 PLACING

.1 Place a minimum 8 mm thick insulating concrete slurry coat over the top of levelling board.

.2 Trowel the slurry around projections wider or longer than 25mm to form a drainage cricket or saddle.

.3 The slurry top coat is to be allowed to dry completely to attain a minimum fastener pullout resistance of 275 kPa prior to the venting base sheet. Manufacturer technical representative required to be present during pull-strength tests.

.4 Place the thickness of expanded polystyrene insulation panels shown in the reviewed shop drawings prior applying insulating concrete slurry coat to the substrate.

.5 Insulation sumps installation:

.1 Install wood block frame of appropriate height centered on each existing drain location to accommodate a 1.2 x 1.2 m tapered insulation drainage sump.

.2 Adhere the insulation sump to the vapour retarder using adhesive to meet requirements of FM Global Windstorm Resistance Classification specified in Section 07 52 00.

.3 Adhere membrane underlayment in adhesive to meet requirements of FM Global Windstorm Resistance Classification specified in Section 07 52 00.

.6 The maximum allowable panel step in a stair-step design is 25 mm. Fill the holes in the expanded polystyrene insulation panels and place a 25 mm minimum thickness of insulating concrete over top of the expanded polystyrene insulation panels within the same day's application.

.7 Install ready-mix insulating concrete with manufacturer approved equipment and pump into place. Install in accordance with manufacturer's instruction.

.1 Install the lightweight insulating concrete to provide the average and minimum RSI-values indicated in 2.1 above with a minimum 1.5% slope to drain.

.8 Prior to the application of the roof membrane system, scrape any ridges, trowel markings or other protrusions, and fill any voids as required to create a smooth surface for the membrane.

3.5 CURING

.1 Prevent roof-top traffic from newly placed lightweight concrete until material has attained sufficient strength to withstand the loads with no damage, using suitable warning signs and barricades.

.2 Cure concrete at a temperature of 10°C minimum until sufficient strength has been attained to prevent damage by subsequent temperature effects as directed by the acceptable material manufacturer.

.3 Moist cure concrete by covering or periodically dampened concrete after initial setting to prevent premature drying arising from exposure to direct sunlight, wind or other causes of rapid drying.

.4 Do not allow rain (moisture) entering the concrete after cast and finish.

3.6 LIMITATION

.1 Do not leave exposed for longer than 5 days after installation.

3.7 SITE QUALITY CONTROL

.1 Concrete production shall conform to the requirements of the manufacturer's mix design.

.2 Require site attendance of lightweight concrete materials manufacturer's representative during installation of Work.

.1 Submit Manufacturer's field reports.

.3 Production quality control testing shall be provided by the material manufacturer and shall be conducted by a person trained and certified by the manufacturer as follows:

.1 Density: Measured and recorded once for every 10m³, or once per 20 minutes for continuous production, whichever is more frequent; maintain density to within ±5% of the design density.

.4 Inspections:

.1 Inspection and testing of lightweight insulated concrete application Inspection and testing of roofing application will be carried out by testing laboratory designated by Departmental Representative as follows:

.1 Random samples the top placement of insulating concrete to verify the thickness and density, and to secure and test compressive strength cylinder in accordance with ASTM C495.

.2 Random verification of insulation board securement and layout as well as insulating concrete thickness.

.3 Review of installation procedures for conformance with the requirements of roof membrane and roofing system specified Section 07 52 00.

.4 Repair or replace insulated concrete system as directed by the Departmental Representative.

3.8 PATCHING

.1 Perform patching and repairing of lightweight insulating concrete using manufacturer's recommended materials to meet the requirements of roof membrane and roofing system specified Section 07 52 00 as directed by the Departmental Representative.

3.9 CLEANING

.1 Clean up accidental spills immediately and restore the affected areas to original condition at no cost to the Department Representative.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Requirements for masonry repair and replacement in existing masonry system.

.2 Drawings contain details that suggest directions for general configuration of masonry system components; these details can be developed further by the Masonry Subcontractor provided that the final installation provides a weather tight installation and maintains relationships with other building elements.

.3 Existing brick veneer assembly is comprised of the following:

.1 90 mm face brick

.2 290mm (lower level) /190 mm (upper level) concrete masonry

.3 Wood strapping

.4 Plaster on plaster lathe

1.2 RELATED REQUIREMENTS

.1 Section 02 41 99 – Demolition

.2 Section 04 05 00 – Common Work Results For Masonry

.3 Section 04 05 12 – Masonry Mortar And Grout

.4 Section 04 05 19 – Masonry Anchorage And Reinforcing

.5 Section 07 62 00 – Sheet Metal Flashing and Trim

1.3 REFERENCE STANDARDS

.1 American Society for Testing and Materials (ASTM):

.1 ASTM B633-11, Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel

.2 ASTM C207-06 (R2011), Standard Specification for Hydrated Lime for Masonry Purposes

.3 ASTM C494M-08a, Standard Specification for Chemical Admixtures for Concrete

.4 ASTM E488-96(2003), Standard Test Methods for Strength of Anchors in Concrete and Masonry Elements

.5 ASTM F593-13, Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs

.6 ASTM F594-09e1, Standard Specification for Stainless Steel Nuts

.2 Canadian Standards Association (CSA):

.1 CSA A82.1-M87 (R2003), Burned Clay Brick (Solid Masonry Units Made From Clay or Shale)

.2 CSA A82.2-M78 (R2003), Methods of Sampling and Testing Brick

.3 CAN/CSA A165 Series-04, Concrete Unit Masonry with Update

.4 CAN/CSA A179-04 (R2009), Mortar and Grout for Unit Masonry

.5 CSA A3000-08, Cementitious Materials Compendium

1.4 ADMINISTRATIVE REQUIREMENTS

.1 Pre-Construction Meetings: Meet on site at the location of required openings and repairs in accordance with Section 01 31 19 – Project Meetings before ordering materials to review existing conditions affecting work of this Section, determine membrane and flashing types, patching and repair procedures and protection of interior components from water infiltration and weather, attended by the following:

.1 Departmental Representative

.2 Contractor

.3 Masonry Subcontractor

.2 Sequencing: Install masonry repair materials to coincide with removal of existing masonry system; remove existing masonry in size and quantity that can be completely repaired in the same day including installation of flashings.

.3 Scheduling: Schedule masonry repairs when installation of construction requiring openings in masonry is substantially complete.

1.5 SUBMITTALS

.1 Provide requested information in accordance with Section 01 33 00 – Submittal Procedures.

.2 Action Submittals: Provide the following submittals before starting any work of this Section:

.1 Shop Drawings: Submit shop drawings prepared by or under the supervision of a qualified professional engineer describing method of brick removal.

1.6 QUALITY ASSURANCE

.1 Obtain exposed masonry units of a uniform texture and colour, or a uniform blend within the ranges accepted for these characteristics, through one source from a single manufacturer for each product required.

.2 Obtain mortar ingredients of a uniform quality, including colour for exposed masonry, from a single manufacturer for each cementitious component and from one source or producer for each aggregate; select ingredients to reduce the potential for efflorescence.

.3 Departmental Representative will limit use of defective units in exposed work as follows; referenced masonry unit standards allow for a certain percentage of units to exceed tolerances and to contain chips, cracks, or other defects exceeding limits stated in the standard, notwithstanding the requirements of these standards:

.1 Brick veneer with chipped edges or corners, or units having cracks on the face shall not be laid or used in exposed masonry.

.2 Do not use units where dimensions vary from specified dimensions by more than stated tolerances for units exposed in the completed Work or where use of these units will impair the quality of completed masonry.

1.7 SITE CONDITIONS

.1 Existing Conditions: Protect openings using tarps, dams and diversion materials to prevent water or snow from entering interior of building.

.2 Ambient Conditions: Install materials during dry weather and temperatures are within manufacturer's written minimum and maximum application range.

Part 2 Products

2.1 MATERIALS

.1 Existing Brick:

.1 Use hard, sound, and clean brick salvaged on site as approved by Departmental Representative.

.2 Salvaged brick with chipped edges or corners, or units having cracks on the face shall not be laid or used in exposed masonry.

.3 It is expected that salvaged brick quanitities will be sufficient to complete work of this Section; provide new brick to match existing only if quantity of salvaged masonry required for repair and replacement in existing masonry system does not meet requirements specified in .1 and .2 above.

.1 Mix salvaged brick with new brick specified above so that both types are distributed evenly on finished wall.

.2 Mortar: In accordance with CSA A179, and as follows:

.1 Cement Type: White Portland Cement in accordance with CSA A3000, Type GU to match existing.

.2 Masonry Cement: In accordance with CSA A8.

.3 Quick Lime: In accordance with ASTM A5.

.4 Hydrated Lime: In accordance with ASTM C207; Type S or SA.

.5 Aggregates: In accordance with CSA A179, and as follows:

.1 Mortar Aggregates: Use brands of materials and source of aggregate identical to materials used in existing adjacent masonry system installation.

.1 If identical materials are unavailable, use materials that visually match existing adjacent surfaces to the fullest extent possible.

.2 Grout Aggregates: In accordance with CSA A179 and to match existing.

.6 Cold Weather Admixture:

.1 Non-chloride, non-corrosive, accelerating admixture in accordance with CSA A179 and ASTM C494, Type C, and recommended by manufacturer for use in masonry mortar of composition indicated.

.7 Water: Potable in accordance with CSA A179.

.8 Grout: In accordance with CSA A179, Table 3.

2.2 GALVANIZING

.1 The following galvanizing requirements apply to steel anchors, ties, reinforcing and accessories where requirements are not otherwise specifically listed:

.1 Ties and Reinforcing:

.1 Mill Galvanized (Interior Use): In accordance with ASTM A116, Class 3.

.2 Hot Dip Galvanized (Exterior, including inner wythe of exterior wall construction and High Humidity Use): In accordance with ASTM A153/A153M, Class B-2.

.2 Hot Dip Hardware and Bolts: In accordance with ASTM A153/A153M, Class B-2 regardless of location.

.3 Hot Dip Sheet Steel: In accordance with ASTM A653/A653M, Coating Designation Z600, regardless of location.

.4 Structural Shapes and Pipes: In accordance with ASTM A123/A123M, Grade 85, regardless of location.

2.3 REINFORCEMENT

.1 Reinforcing Bars: Deformed bars, all Grade 400, in accordance with CSA A371 and CSA G30.18; having recycle content eligible for contribution towards LEED Certification.

.2 Masonry Joint Reinforcement: In accordance with to CSA A371 and ASTM A496, with corrosion protection in accordance with CSA S304 and CSA A370, and as follows:

.1 Exterior Walls: Hot dip galvanized, carbon steel.

.2 Wire Size for Side Rods: W1.7 or 3.8 mm diameter.

.3 Wire Size for Cross Rods: W1.7 or 3.8 mm diameter.

.4 Spacing of Cross Rods, Tabs, and Cross Ties: At a maximum of 400 mm O/C.

.5 Lengths: A minimum of 3000 mm.

.3 Connectors: In accordance with to CSA A370 and CSA S304 with mill galvanized finish.

.4 Single Wythe Masonry Joint Reinforcement: Either ladder or truss type with single pair of side rods.

.5 Multi-Wythe Masonry Joint Reinforcement: Ladder type with 1 side rod at each face shell of hollow masonry units more than 100 mm in width, plus 1 side rod at each wythe of masonry 100 mm or less in width.

2.4 TIES AND ANCHORS

.1 Ties and anchors specified in this section shall be designed in accordance with CSA A370 for non-conventional masonry connectors as follows:

.1 Deflection: Maximum 2 mm, including free play, when acted upon by a lateral load of 0.45 kN, in all possible positions of adjustment.

.2 Positive restraint at position of maximum adjustment.

.3 Free play of multi-component ties maximum 1.2 mm when assembled in all possible configurations.

.4 Anchors shall allow vertical adjustment but resist tension and compression forces perpendicular to plane of wall.

.2 Brick Veneer/Concrete Masonry Unit Substrate Tie Systems:

.1 Face of Masonry Mount:

.1 Backer Plate: Fabricated from steel meeting requirements of CSA A370 and ASTM A1011/A1011M; hot dip galvanized in accordance with ASTM A123/A123M; designed to transfer wind loads to framing.

.2 Ties: Wire ties fabricated from steel wire in accordance with CSA G30.18; length to allow to extend minimum 50 mm into masonry unit joint hot dip galvanized in accordance with ASTM A153/A153M.

.3 Fasteners: Self tapping metal screws to metal stud backup as recommended by tie manufacturer consisting of close tolerance bits for use in percussion drills, and hammer driven anchors with pullout strengths of 3.75 kN for hollow concrete masonry unit with a 25 mm embedment.

.3 Post Installed Anchors: Provide chemical or torque controlled expansion anchors, with capability to sustain, without failure, a load equal to six times the load imposed when installed in solid or grouted unit masonry and equal to four times the load imposed when installed in concrete when tested in accordance with ASTM E488 conducted by a qualified independent testing agency, and as follows:

.1 Indoor Locations: Carbon-steel components zinc-plated in accordance with ASTM B633, Class Fe/Zn 5.

.2 Outdoor and High Humidity Locations: Alloy Group 1 or 2 stainless steel bolts complying with ASTM F593/ASTM F738M and nuts complying with ASTM F594/ASTM F836M.

.3 Fastening Into Solid Concrete or Solidly Grouted Installation: Two component, injectable adhesive specifically manufactured for use in installing dowels or threaded anchor rods and inserts into new or existing concrete or grout, and as follows:

.1 Epoxy Composition: Sealed packaging containing resin, hardener, cement and water; components providing the following properties:

.1 Compressive Strength ASTM C579: 71.8 MPa

.2 Tensile Strength ASTM C307: 15.9 MPa

.3 Flexural Strength ASTM C580: 29.3 MPa

.4 Modulus of Elasticity ASTM C307: 7032 MPa

.5 Water Absorption ASTM D570: 0.12%

.6 Curing Time: Rapid set, high strength and stiffness; maximum time 45 minutes at 20°C.

.4 Flashing:

.1 Metal Flashing: Provide metal flashing materials to match existing adjacent masonry flashing and in accordance with Section 07 62 00.

.2 Flexible Flashing (Membrane Flashing not Exposed to Exterior View):

.1 Coordinate supply and installation of flexible flashing materials with Section 07 25 13, provide only materials that are compatible with acceptable materials listed in Section 07 25 13 and that form the basis of the contract.

.2 Self adhering rubberized asphalt flashing; non-extruding composite flashing membrane compatible with air and vapour membrane; consisting of pliable, adhesive rubberized asphalt compound, bonded to a high density, cross laminated polyethylene film to produce an overall thickness of a minimum of 0.76 mm and specifically manufactured for use as a through wall flashing and damp course membrane.

.3 Adhesives, Primers, and Seam Tapes for Flashings: Flashing manufacturer's standard products or products recommended by flashing manufacturer for bonding flashing sheets to each other and to substrates.

Part 3 Execution

3.1 EXAMINATION

.1 Verify that substrates and conditions are in accordance with manufacturer’s written recommendations and installation guidelines before starting work of this Section.

.2 Check for evidence of repairs, cracks, moisture and dampness, not noted on Drawings, and notify Departmental Representative before starting Work.

.3 Testing: Examine joints visually for obvious signs of deteriorated masonry; test joints not visually deteriorated as follows:

.1 Test for voids and weakness by using hammers or other approved means.

.2 Perform testing and coordinate with Departmental Representative so that unsound joints can be marked and recorded.

.4 Start of masonry work will be interpreted as meaning masonry system conditions are in accordance with manufacturer’s requirements.

.5 If mould is encountered, do not disturb; immediately notify Departmental Representative.

3.2 PREPARATION

.1 Building Protection: Provide tarps and hoarding as required to protect existing building finishes and assemblies from work of this Section; clean any spills and repair any damaged materials resulting from work of this Section.

.2 Opening Protection: Provide suitable protection during preparation and installation of new openings in masonry to prevent water or weather from entering interior spaces:

.1 Lap protective coverings over existing masonry to prevent water ingress

.2 Secure protective coverings against wind blow-off

.3 Leave protective covering in place for duration of the work

.3 Place safety devices and signs near work area as directed in accordance with Section 01 51 00 - Temporary Controls and Facilities.

.4 Install and remove self supporting scaffolding in accordance with Section 01 51 00 - Temporary Controls and Facilities.

3.3 BRICK REMOVAL AND SALVAGE

.1 Verify locations and dimensions of areas of Work with Departmental Representative.

.2 In areas of work, identify salvageable brick with Departmental Representative.

.3 Remove identified areas of salvageable brick as follows:

.1 Cut out non-loadbearing masonry in length as practicable.

.2 During removal, protect sound areas to remain. Use mechanical hand methods of removal. Obtain Departmental Representative's approval for use of power tools before commencing work.

.4 Carefully clean, and store brick for re-use.

3.4 BRICK REPLACEMENT

.1 Clean dust and brick fragments from slot. Before proceeding with Work, inspect cleaned surface with Departmental Representative.

.2 Dampen slot's surfaces before applying mortar.

.3 Apply mortar and lay brick.

.4 Finish joints to match those of existing masonry.

.5 Clean finished masonry.

.1 Remove mortar splashings on exposed masonry.

.2 Clean masonry with low pressure clean water and soft bristle brush.

3.5 REPAIRING, CLEANING AND REPOINTING

.1 Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units; install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.

.2 Repointing:

.1 Enlarge voids and holes, except weep holes, and completely fill with mortar during the tooling of joints.

.2 Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance.

.3 Prepare joints for sealant application, where applicable.

.3 Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.

.4 After mortar is thoroughly set and cured, clean exposed masonry as follows:

.1 Remove large mortar particles by hand with wooden paddles and non-metallic scrape hoes or chisels.

.2 Brush efflorescence off of surfaces using a stiff bristled brush to the greatest extent possible.

.3 Do not attempt any wet cleaning methods unless Meteorological Service of Canada weather forecast indicates drying conditions and temperatures greater than 7°C for a minimum of three (3) days after cleaning of masonry surfaces:

.1 Local weather forecast and trends can be viewed at http://www.weatheroffice.ec.gc.ca/.

.2 Wet cleaning can cause additional efflorescence bloom if not allowed to dry sufficiently.

.4 Attempt cleaning with plain water and stiff bristled brushes before proceeding to chemical or acidic cleaning methods.

.5 Test cleaning methods on sample wall panel; leave one-half of panel un-cleaned for comparison purposes.

.6 Obtain Departmental Representative's approval of sample cleaning before proceeding with cleaning of masonry.

.7 Protect adjacent stone and non-masonry surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.

.8 Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.

.9 Clean brick by bucket-and-brush hand-cleaning method described in BIA Technical Notes 20 and 23.

.10 Clean concrete masonry by cleaning method indicated in NCMA TEK 8-2A and 8-3A applicable to type of stain on exposed surfaces.

.11 Clean masonry with a proprietary acidic cleaner applied in accordance with manufacturer's written instructions only when other cleaning methods have not succeeded.

3.6 SITE QUALITY CONTROL

.1 Inspection and testing of masonry application may be carried out by testing laboratory designated by Departmental Representative.

END OF SECTION

Part 1 GENERAL

1.1 RELATED REQUIREMENTS

.1 Section 04 05 12 - Mortar and Masonry Grout.

.2 Section 04 05 19 - Masonry Anchorage and Reinforcing.

.3 Section 04 22 00 - Concrete Unit Masonry.

.4 Section 07 92 00 - Joint Sealants.

1.2 REFERENCES

.1 Canada Green Building Council (CaGBC)

.1 LEED Canada For New Construction and Major Renovations 2009.

.2 CSA Group

.1 CSA A165 Series-14, CSA Standards on Concrete Masonry Units (Consists of A165.1, A165.2 and A165.3).

.2 CSA A179-14, Mortar and Grout for Unit Masonry.

.3 CSA A371-14, Masonry Construction for Buildings.

1.3 ADMINISTRATIVE REQUIREMENTS

.1 Pre-installation meetings: comply with Section 01 31 19. Conduct pre-installation meeting one week prior to commencing work of this Section to:

.1 Verify project requirements, including mock-up requirements.

.2 Verify substrate conditions.

.3 Co-ordinate products, installation methods and techniques.

.4 Sequence work of related sections.

.5 Co-ordinate with other building subtrades.

.6 Review manufacturer's installation instructions.

.7 Review masonry cutting operations, methods and tools and determine worker safety and protection from dust during cutting operations.

.8 Review warranty requirements.

.2 Sequencing: sequence with other work in accordance with Section 01 32 16. Comply with manufacturer's written recommendations for sequencing construction operations.

.3 Scheduling: schedule with other work in accordance with Section 01 32 16.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00.

.2 Product Data:

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

.2 Submit 2 copies of WHMIS MSDS in accordance with Section 01 35 29.

.3 Shop Drawings:

.1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Ontario, Canada.

.2 Submit shop drawings detailing temporary bracing required, designed to resist wind pressure and lateral forces during installation.

.4 Samples:

.1 Provide samples as follows:

.1 2 of each type of masonry anchorage, reinforcement and connector proposed for use, supplemented by specific requirements in Section 04 05 19.

.5 Certificates: submit manufacturer's product certificates certifying materials comply with specified requirements.

.6 Test and Evaluation Reports:

.1 Test reports to certify compliance of masonry units and mortar ingredients with specified performance characteristics and physical properties.

.2 Submit data for masonry units, in addition to requirements set out in referenced CSA and ASTM Standards, indicating initial rates of absorption.

.7 Installer Instructions: provide manufacturer's installation instructions, including storage, handling, safety and cleaning.

.8 Manufacturer's Reports: provide written reports prepared by manufacturer's on-site personnel to include:

.1 Verification of compliance of work with Contract.

.2 Site visit reports providing detailed review of installation of work, and installed work.

.9 Sustainable Design Submittals:

.1 LEED Canada submittals: in accordance with Section 01 35 21.

.2 Construction Waste Management:

.1 Submit project Waste Management Plan highlighting recycling and salvage requirements.

.2 Submit calculations on end-of-project recycling rates, salvage rates, and landfill rates demonstrating that 75% of construction wastes were recycled or salvaged.

.3 Recycled Content:

.1 Submit listing of recycled content products used, including details of required percentages or recycled content materials and products, showing their costs and percentages of post-consumer and post-industrial content, and total cost of materials for project.

.4 Regional Materials: submit evidence that project incorporates required percentage 20% of regional materials and products, showing their cost, distance from project to furthest site of extraction or manufacture, and total cost of materials for project.

1.5 CLOSEOUT SUBMITTALS

.1 Submit manufacturer's instructions for care, cleaning and maintenance of prefaced masonry units for incorporation into manual specified in Section 01 78 00.

1.6 EXTRA MATERIALS

.1 Submit manufacturer's instructions in accordance with Section 01 78 00 covering maintenance requirements and parts catalogue, with cuts and identifying numbers.

1.7 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 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 or indoors in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect material from nicks, scratches, and blemishes.

.3 Keep materials dry until use.

.4 Store under waterproof cover on pallets or plank platforms held off ground by means of plank or timber skids.

.5 Replace defective or damaged materials with new.

.4 Develop Construction Waste Management Plan related to Work of this Section and in accordance with Section 01 35 21.

.5 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding and packaging materials as specified in Construction Waste Management Plan in accordance with Section 01 74 20 and Section 01 35 21.

1.8 SITE CONDITIONS

.1 Ambient Conditions: assemble and erect components when temperatures are above 4 degrees C.

.2 Weather Requirements: to CSA A37.

.3 Cold weather requirements:

.1 To CSA A371 with following requirements.

.1 Maintain temperature of mortar between 5 degrees C and 50 degrees C until batch is used or becomes stable.

.2 Maintain ambient temperature of masonry work and it's constituent materials between 5 degrees C and 50 degrees C and protect site from windchill.

.3 Maintain temperature of masonry above 0 degrees C for minimum of 3 days, after mortar is installed.

.4 Preheat unheated wall sections in enclosure for minimum 72 hours above 10 degrees C, before applying mortar.

.2 Hot weather requirements:

.1 Protect freshly laid masonry from drying too rapidly, by means of waterproof, non-staining coverings.

.2 Keep masonry dry using waterproof, non-staining coverings that extend over walls and down sides sufficient to protect walls from wind driven rain, until masonry work is completed and protected by flashings or other permanent construction.

.3 Spray mortar surface at intervals and keep moist for maximum of 3 days after installation.

Part 2 PRODUCTS

2.1 MATERIALS

.1 Masonry materials are specified elsewhere in Related Requirements.

Part 3 EXECUTION

3.1 INSTALLERS

.1 Experienced and qualified masons to carry out erection, assembly and installation of masonry work.

3.2 EXAMINATION

.1 Examine conditions, substrates and work to receive work of this Section.

.2 Examine openings to receive masonry units. Verify opening size, location, and that opening is square and plumb, and ready to receive work of this Section.

.1 Inform Departmental Representative of unacceptable conditions immediately upon discovery.

.2 Proceed with installation after unacceptable conditions have been remedied and after receipt of written approval from Departmental Representative.

.3 Verification of Conditions:

.1 Verify that:

.1 Substrate conditions which have been previously installed under other sections or contracts, are acceptable for product installation in accordance with manufacturer's instructions prior to installation of concrete block.

.2 Field conditions are acceptable and are ready to receive work.

.3 Built-in items are in proper location, and ready for roughing into masonry work.

.2 Commencing installation means acceptance of existing substrates.

3.3 PREPARATION

.1 Surface Preparation: prepare surface in accordance with manufacturer's written recommendations.

.2 Establish and protect lines, levels, and coursing.

.3 Protect adjacent materials from damage and disfiguration.

3.4 INSTALLATION

.1 Do masonry work in accordance with CSA A371 except where specified otherwise.

.2 Build masonry plumb, level, and true to line, with vertical joints in alignment, respecting construction tolerances permitted by CSA A371.

.3 Layout coursing and bond to achieve correct coursing heights, and continuity of bond above and below openings, with minimum of cutting.

3.5 CONSTRUCTION

.1 Exposed masonry:

.1 Remove chipped, cracked, and otherwise damaged units, in accordance with CSA A165, in exposed masonry and replace with undamaged units.

.2 Jointing:

.1 Allow joints to set just enough to remove excess water, then tool with round jointer to provide smooth, joints true to line, compressed, uniformly concave joints where concave joints are indicated.

.2 Allow joints to set just enough to remove excess water, then rake joints uniformly to 6 mm depth and compress with square tool to provide smooth, compressed, raked joints of uniform depth where raked joints are indicated.

.3 Strike flush joints concealed in walls and joints in walls to receive plaster, tile, insulation, or other applied material except paint or similar thin finish coating.

.3 Cutting:

.1 Cut out for electrical switches, outlet boxes, and other recessed or built-in objects.

.2 Make cuts straight, clean, and free from uneven edges.

.4 Building-In:

.1 Build in items required to be built into masonry.

.2 Prevent displacement of built-in items during construction. Check plumb, location and alignment frequently, as work progresses.

.3 Brace door jambs to maintain plumb. Fill spaces between jambs and masonry with mortar.

.5 Support of loads:

.1 Use 20 MPa concrete to Section 03 30 00, where concrete fill is used in lieu of solid units.

.2 Use grout to CSA A179 where grout is used in lieu of solid units.

.3 Install building paper below voids to be filled with concrete or grout; keep paper 25 mm back from faces of units.

.6 Provision for movement:

.1 Leave 3 mm space below shelf angles.

.2 Leave 6 mm space between top of non-load bearing walls and partitions and structural elements. Do not use wedges.

.3 Built masonry to tie in with stabilizers, with provision for vertical movement.

.7 Loose steel lintels:

.1 Install loose steel lintels. Center over opening width.

.8 Interface with other work:

.1 Cut openings in existing work as indicated.

.2 Openings in walls: reviewed by Departmental Representative.

.3 Make good existing work. Use materials to match existing.

3.6 SITE TOLERANCES

.1 Tolerances in notes to CSA A371 apply.

3.7 FIELD QUALITY CONTROL

.1 Site Tests, Inspection:

.1 Perform field inspection and testing in accordance with Section 01 45 00.

.2 Notify inspection agency minimum of 24 hours in advance of requirement for tests.

3.8 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11.

.1 Leave Work area clean at end of each day.

.2 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 20 and 01 35 21.

.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.9 PROTECTION

.1 Temporary Bracing:

.1 Provide temporary bracing of masonry work during and after erection until permanent lateral support is in place.

.2 Bracing approved by Departmental Representative.

.3 Brace masonry walls as necessary to resist wind pressure and lateral forces during construction.

.2 Moisture Protection:

.1 Keep masonry dry using waterproof, non staining coverings that extend over walls and down sides sufficient to protect walls from wind driven rain, until completed and protected by flashing or other permanent construction.

.2 Cover completed and partially completed work not enclosed or sheltered with waterproof covering at end of each work day. Anchor securely in position.

.3 Air Temperature Protection: protect completed masonry as recommended in 1.9, SITE CONDITIONS.

END OF SECTION

Part 1 GENERAL

1.1 SECTION INCLUDES

.1 Requirements for mortar and grout for concrete masonry.

1.2 RELATED REQUIREMENTS

.1 Section 04 01 52 - Unit Masonry Repair and Replacement: mortar and grout requirements for clay masonry work.

.2 Section 04 05 00 – Common Work Results for Masonry

.3 Section 04 05 19 – Masonry Anchorage and Reinforcing

.4 Section 04 22 00 – Concrete Unit Masonry

1.3 REFERENCES

.1 Canada Green Building Council (CaGBC)

.1 LEED Canada For New Construction and Major Renovations 2009.

.2 CSA Group

.1 CSA A23.1-14/A23.2-14, Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete.

.2 CSA A179-14, Mortar and Grout for Unit Masonry.

.3 CSA A371-14, Masonry Construction for Buildings.

.4 CAN/CSA-A3000-13, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).

.3 South Coast Air Quality Management District (SCAQMD)

.1 SCAQMD Rule 1168-05, Adhesive and Sealant Applications.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for masonry mortar and grout and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Submit 2 copies of WHMIS MSDS in accordance with Section 01 35 29. Indicate VOC's mortar, grout, parging, colour additives and admixtures. Expressed as grams per litre (g/L).

.3 Manufacturers' Instructions: submit manufacturer's installation instructions.

.4 Sustainable Design Submittals:

.1 LEED Canada submittals: in accordance with Section 01 35 21.

.2 Construction Waste Management:

.1 Submit project Waste Management Plan highlighting recycling and salvage requirements.

.2 Submit calculations on end-of-project recycling rates, salvage rates, and landfill rates demonstrating that 75% of construction wastes were recycled or salvaged.

.3 Recycled Content:

.1 Submit listing of recycled content products used, including details of required percentages or recycled content materials and products, showing their costs and percentages of post-consumer and post-industrial content, and total cost of materials for project.

.4 Regional Materials: submit evidence that project incorporates required percentage 20% of regional materials and products, showing their cost, distance from project to furthest site of extraction or manufacture, and total cost of materials for project.

1.5 QUALITY ASSURANCE

.1 Test Reports: submit certified test reports including sand gradation tests in accordance with CSA A179 showing compliance with specified performance characteristics and physical properties, and in accordance with Section 04 05 00.

.2 Certificates: submit product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 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 or indoors in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect masonry mortar and grout from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

.4 Develop Construction Waste Management Plan related to Work of this Section and in accordance with Section 01 35 21.

.5 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding and packaging materials as specified in Construction Waste Management Plan in accordance with Section 01 74 20 and Section 01 35 21.

1.7 SITE CONDITIONS

.1 Ambient Conditions: maintain materials and surrounding air temperature to:

.1 Minimum 5 degrees C prior to, during, and 48 hours after completion of masonry work.

.2 Maximum 32 degrees C prior to, during, and 48 hours after completion of masonry work.

.2 Weather Requirements: CSA A371 and as specified in Section 04 05 00.

Part 2 PRODUCTS

2.1 MATERIALS

.1 Use same brands of materials and source of aggregate for entire project.

.2 Cement:

.1 Portland Cement: to CAN/CSA-A3000, Type GU - General use hydraulic cement (Type 10) gray colour.

.1 Use low VOC products in compliance with SCAQMD Rule 1168.

.2 Masonry Cement: to CAN/CSA-A3002 and CSA A179, Type S.

.3 Mortar Cement: to CAN/CSA-A3002 and CSA A179, Type S.

.1 Use low VOC products in compliance with SCAQMD Rule 1168.

.4 Packaged Dry Combined Materials for mortar: to CSA A179, Type S, using gray colour cement.

.3 Aggregate: supplied by one supplier.

.1 Fine Aggregate: to CSA A179, natural sand.

.2 Course Aggregate: to CSA A179.

.4 Water: clean and potable.

.5 Lime:

.1 Hydrated Lime: to CSA A179, Type S.

.6 Bonding Agent: latex type.

.7 Polymer Latex: organic polymer latex admixture of butadiene-styrene type non-emulsifiable bonding admixture.

2.2 MORTAR MIXES

.1 Mortar for exterior masonry above grade:

.1 Load Bearing: type S based on property specifications.

.2 Non-Load Bearing: S based on property specifications.

.2 Mortar for interior masonry:

.1 Load Bearing: type S based on property specifications.

.2 Non-Load Bearing: S based on property specifications.

.3 Pointing Mortar: CSA A179, Type S using property specification with maximum 2 percent ammonium stearate or calcium stearate per cement weight.

.4 Stain Resistant Pointing Mortar: one part Portland cement, 1/8 part hydrated lime, and two parts graded (80 mesh) aggregate, proportioned by volume. Add aluminum tristearate, calcium stearate, or ammonium stearate to 2 percent of Portland cement by weight.

2.3 MORTAR MIXING

.1 Use pre-blended, pre-coloured mortar prepackaged under controlled factory conditions. Ingredients batching limitations to be within 1% accuracy.

.2 Mix mortar ingredients in accordance with CSA A179 in quantities needed for immediate use.

.3 Maintain sand uniformly damp immediately before mixing process.

.4 Do not use anti-freeze compounds including calcium chloride or chloride based compounds.

.5 Do not add air entraining admixture to mortar mix.

.6 Use a batch type mixer in accordance with CSA A179.

.7 Pointing mortar: prehydrate pointing mortar by mixing ingredients dry, then mix again adding just enough water to produce damp unworkable mix that will retain its form when pressed into ball. Allow to stand for not less than 1 hour no more than 2 hours then remix with sufficient water to produce mortar of proper consistency for pointing.

.8 Re-temper mortar only within two hours of mixing, when water is lost by evaporation.

.9 Use mortar within 2 hours after mixing at temperatures of 32 degrees C, or 2-1/2 hours at temperatures under 10 degrees C.

2.4 GROUT MIXES

.1 Bond Beams: grout mix 10 to 12.5 MPa strength at 28 days; 200-250 mm slump; mixed in accordance with CSA A179 fine grout.

.2 Lintels: grout mix 10 to 12.5 MPa strength at 28 days; 200-250 mm slump; mixed in accordance with CSA A179 fine grout.

.3 Grout: Minimum compressive strength of 12.5 MPa at 28 days. Maximum aggregate size and grout slump: CSA A179.

2.5 GROUT MIXING

.1 Mix batched and delivered grout in accordance with CSA A23.1/A23.2 transit mixed.

.2 Mix grout ingredients in quantities needed for immediate use in accordance with CSA A179 fine grout.

.3 Add admixtures in accordance with manufacturer's instructions; mix uniformly.

.4 Do not use calcium chloride or chloride based admixtures.

2.6 MIX TESTS

.1 Testing Mortar Mix:

.1 Test mortar to requirements of Section 01 45 00, and in accordance with CSA1 79, for mortar based on property specification. Test prior to construction and during construction for:

.1 Compressive strength.

.2 Consistency.

.3 Mortar aggregate ratio.

.4 Sand/cement ratio.

.5 Water content and water/cement ratio.

.6 Air content.

.7 Splitting tensile strength.

.2 Testing Grout Mix:

.1 Test grout to requirements of Section 01 45 00 and in accordance with CSA A179, for grout based on property specification. Test prior to construction and during construction for:

.1 Compressive strength.

.2 Sand/cement ratio.

.3 Water content and water/cement ratio.

.4 Slump.

Part 3 EXECUTION

3.1 EXAMINATION

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

.1 Apply bonding agent to existing concrete surfaces.

.2 Plug clean-out holes with block masonry units. Brace masonry for wet grout pressure.

3.3 CONSTRUCTION

.1 Do masonry mortar and grout work in accordance with CSA A179 except where specified otherwise.

3.4 MIXING

.1 All pointing mortar can be mixed using a regular paddle mixer. Only electric motor mixers are permissible. Mixers run on hydrocarbons are not permitted, due to fumes. Mixing by hand must be pre-approved by the Departmental Representative.

.2 Clean all mixing boards and mechanical mixing machine between batches.

.3 Mortar must be weaker than the units it is binding.

.4 Contractor to appoint one individual to mix mortar, for duration of project. In the event that this individual must be changed, mortar mixing must cease until the new individual is trained, and mortar mix is tested.

3.5 MORTAR PLACEMENT

.1 Install mortar to manufacturer's instructions.

.2 Install mortar to requirements of CSA A179.

.3 Remove excess mortar from grout spaces.

3.6 GROUT PLACEMENT

.1 Install grout in accordance with manufacturer's instructions.

.2 Install grout in accordance with CSA A179.

.3 Work grout into masonry cores and cavities to eliminate voids.

.4 Do not install grout in lifts greater than 400 mm, without consolidating grout by rodding.

.5 Do not displace reinforcement while placing grout.

3.7 FIELD QUALITY CONTROL

.1 Site Tests, Inspection: in accordance with Section 04 05 00 supplemented as follows:

.1 Test and evaluate mortar prior to construction and during construction in accordance with CSA A179.

.2 Test and evaluate grout prior to construction and during construction to CSA A179; test in conjunction with masonry unit sections specified.

3.8 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11.

.1 Leave Work area clean at end of each day.

.2 Remove droppings and splashings using clean sponge and water.

.3 Clean masonry with low pressure clean water and soft natural bristle brush.

.4 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11.

.5 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 20 and 01 35 21.

.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.9 PROTECTION

.1 Cover completed and partially completed work not enclosed or sheltered with waterproof covering at end of each work day. Anchor securely in position.

END OF SECTION

Part 1 GENERAL

1.1 SECTION INCLUDES

.1 Requirements for concrete masonry anchorage and reinforcing.

1.2 RELATED REQUIREMENTS

.1 Section 04 01 52 - Unit Masonry Repair and Replacement: anchorage and reinforcing requirements for clay masonry work.

.2 Section 04 05 00 - Common Work Results for Masonry

.3 Section 04 05 12 - Mortar and Masonry Grout.

.4 Section 04 22 00 - Concrete Unit Masonry.

1.3 REFERENCES

.1 ASTM International

.1 ASTM A36/A36M-14, Standard Specification for Carbon Structural Steel.

.2 ASTM A82/A82M-07, Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.

.3 ASTM A307-14, Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60000 PSI Tensile Strength.

.2 Canada Green Building Council (CaGBC)

.1 LEED Canada For New Construction and Major Renovations 2009.

.3 CSA Group

.1 CSA A23.1-14/A23.2-14, Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete.

.2 CSA A179-14, Mortar and Grout for Unit Masonry.

.3 CSA A370-14, Connectors for Masonry.

.4 CSA A371-14, Masonry Construction for Buildings.

.5 CSA G30.18-09(R2014), Carbon Steel Bars for Concrete Reinforcement.

.6 CSA S304.1-14, Design of Masonry Structures.

.7 CSA W186-M1990(R2012), Welding of Reinforcing Bars in Reinforced Concrete Construction.

.4 Reinforcing Steel Institute of Canada (RSIC)

.1 Reinforcing Steel Manual of Standard Practice, 2004.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for anchorage and reinforcing materials 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 drawings detailing bar bending details, anchorage details lists and placement drawings

.3 On placement drawings, indicate sizes, spacing, location and quantities of reinforcement and connectors.

.4 Manufacturers' Instructions: submit manufacturer's installation instructions.

.5 Sustainable Design Submittals:

.1 LEED Canada submittals: in accordance with Section 01 35 21.

.2 Construction Waste Management:

.1 Submit project Waste Management Plan highlighting recycling and salvage requirements.

.2 Submit calculations on end-of-project recycling rates, salvage rates, and landfill rates demonstrating that 75% of construction wastes were recycled or salvaged.

.3 Recycled Content:

.1 Submit listing of recycled content products used, including details of required percentages or recycled content materials and products, showing their costs and percentages of post-consumer and post-industrial content, and total cost of materials for project.

.4 Regional Materials: submit evidence that project incorporates required percentage 20% of regional materials and products, showing their cost, distance from project to furthest site of extraction or manufacture, and total cost of materials for project.

1.5 QUALITY ASSURANCE

.1 Test Reports: submit certified test reports showing compliance with specified performance characteristics and physical properties, and in accordance with Section 04 05 00.

.2 Certificates: submit product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

1.6 SITE MEASUREMENTS

.1 Make site measurements necessary to ensure proper fit of members.

1.7 DELIVERY, STORAGE AND HANDLING

.1 In accordance with Section 04 05 00.

Part 2 PRODUCTS

2.1 MATERIALS

.1 Bar reinforcement: Steel to CSA A371 and CSA G30.18, Grade 400.

.2 Connectors: to CSA A370 and CSA S304.1.

.3 Corrosion protection: to CSA S304.1.

.4 Fasteners: installed post-construction:

- .1 Screw Shields and Plugs: plastic or nylon, placed directly into solid masonry units.
- .2 Bolts and Screws: size and type to suit application, locate where indicated.
- .3 Nails: case-hardened cut or spiral nails, size and type to suit fastening application.
- .4 Powder-Driven Fasteners: pin styles and lengths to suit fastening application in accordance with manufacturers use, load and hold recommendations.
- .5 Adhesives: epoxies, mastics and contact cements for fastening applications, use in accordance with manufacturers' recommendations.

.5 Ties: uncoated steel finish.

- .1 Corrugated to: CSA A370.
- .2 Joint Reinforcement Ties: to CSA A370:
  - .1 Single Wythe Joint Reinforcement: ladder type:
    - .1 Cold drawn steel wire conforming to ASTM A1064/A1064M.

.6 Anchors: to CSA A370:

- .1 Wedge Anchors: expansion anchors type wedge and bolt, sized to suit application.
- .2 Self-Contained Anchors: type double-glass/plastic vial system, with epoxy resin and hardener.
- .3 Anchor Bolts: conventional (unpatented) anchors, steel uncoated finish.

.7 Conventional Bolts:

- .1 Bolts: to ASTM A36/A36M, bar stock shop threaded, straight bolts with square or hex-headed nuts.
- .2 Plate anchors: steel to ASTM A36/A36M, weld square of circular steel plate perpendicular to axis of steel bar threaded on opposite end.
- .3 Through bolt rods: to ASTM A307 threaded rod or threaded ASTM A36/A36M bar stock.

.8 Adhesive Anchors: proprietary systems, pre-mixed, self-contained system with double glass vial system to contain epoxy, consisting of resin, hardener and aggregate.

2.2 FABRICATION

.1 Fabricate reinforcing in accordance with CSA A23.1/A23.2 and Reinforcing Steel Manual of Standard Practice by the Reinforcing Steel Institute of Canada.

.2 Fabricate connectors in accordance with CSA A370.

.3 Obtain Departmental Representative's approval for locations of reinforcement splices other than shown on placing drawings.

.4 Upon approval of Departmental Representative, weld reinforcement in accordance with CSA W186.

.5 Ship reinforcement and connectors, clearly identified in accordance with drawings.

2.3 SOURCE QUALITY CONTROL

.1 Upon request, provide Departmental Representative with certified copy of mill test report of reinforcement steel and connectors, showing physical and chemical analysis, minimum 5 weeks prior to commencing reinforcement work.

.2 Upon request inform Departmental Representative of proposed source of material to be supplied.

Part 3 EXECUTION

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for anchorage and reinforcing materials 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 PREPARATION

.1 Direct and coordinate placement of metal anchors for masonry supplied to other Sections.

3.3 INSTALLATION

.1 Supply and install masonry connectors and reinforcement in accordance with CSA A370, CSA A371, CSA A23.1/A23.2 and CSA S304.1 unless indicated otherwise.

.2 Prior to placing concrete, mortar or grout, obtain Departmental Representative's approval of placement of reinforcement and connectors.

.3 Supply and install additional reinforcement to masonry as indicated.

3.4 BONDING AND TYING

.1 Install unit, adjustable, single wythe and multiple wythe joint reinforcement where indicated and in accordance with CSA A370 and CSA A371 and in accordance with manufacturer's instructions.

.1 Install horizontal joint reinforcement 400 mm on centre.

.2 Place masonry joint reinforcement in first and second horizontal joints above and below openings. Extend minimum 400 mm each side of opening.

.3 Place joint reinforcement continuous in first and second joint below top of walls.

.4 Lap joint reinforcement ends minimum 150 mm.

3.5 REINFORCED LINTELS AND BOND BEAMS

.1 Reinforce masonry beams, masonry lintels and bond beams as indicated.

.2 Place and grout reinforcement in accordance with CSA S304.1, CSA A371, and CSA A179.

.3 Support and position reinforcing bars in accordance with CSA A371.

3.6 GROUTING

.1 Grout masonry in accordance with CSA S304.1, CSA A371 and CSA A179 and as indicated.

3.7 ANCHORS

.1 Supply and install metal anchors in accordance with CSA A370 and CSA A371 and as indicated.

3.8 LATERAL SUPPORT AND ANCHORAGE

.1 Supply and install lateral support and anchorage in accordance with CSA S304.1 and as indicated.

3.9 MOVEMENT JOINTS

.1 Reinforcement will not be continuous across movement joints unless otherwise indicated.

3.10 FIELD BENDING

.1 Do not field bend reinforcement and connectors except where indicated or authorized by Departmental Representative.

.2 When field bending is authorized, bend without heat, applying a slow and steady pressure.

.3 Replace bars and connectors which develop cracks or splits.

3.11 FIELD QUALITY CONTROL

.1 Site inspections in accordance with Section 04 05 00.

.2 Obtain Departmental Representative approval of placement of reinforcement and connectors, prior to placing mortar or grout.

3.12 FIELD TOUCH-UP

.1 Touch up damaged and cut ends of epoxy coated or galvanized reinforcement steel and connectors with compatible finish to provide continuous coating.

3.13 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11.

.3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 20 and 01 35 21.

.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

Part 1 GENERAL

1.1 RELATED REQUIREMENTS

.1 Section 04 05 00 – Common Work Results for Masonry

.2 Section 04 05 12 - Mortar and Masonry Grout.

.3 Section 04 05 19 – Masonry Anchorage and Reinforcing

.4 Section 07 92 00 - Joint Sealants.

1.2 REFERENCES

.1 Canada Green Building Council (CaGBC)

.1 LEED Canada For New Construction and Major Renovations 2009.

.2 CSA Group

.1 CSA A165 Series-14, CSA Standards on Concrete Masonry Units consists: A165.1, A165.2, A165.3.

.2 CSA A371-14, Masonry Construction for Buildings.

.3 CSA S304-14, Design of Masonry Structures.

.3 South Coast Air Quality Management District (SCAQMD)

.1 SCAQMD Rule 1168-05, Adhesive and Sealant Applications.

.4 Underwriters Laboratories of Canada (ULC)

.1 CAN/ULC-S101-14, Standard1 Methods of Fire Endurance Tests of Building Construction and Materials.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for concrete masonry units and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Sustainable Design Submittals:

.1 LEED Canada submittals: in accordance with Section 01 35 21.

.2 Construction Waste Management:

.1 Submit project Waste Management Plan highlighting recycling and salvage requirements.

.2 Submit calculations on end-of-project recycling rates, salvage rates, and landfill rates demonstrating that 75% of construction wastes were recycled or salvaged.

.3 Recycled Content:

.1 Submit listing of recycled content products used, including details of required percentages or recycled content materials and products, showing their costs and percentages of post-consumer and post-industrial content, and total cost of materials for project.

.4 Regional Materials: submit evidence that project incorporates required percentage 20% of regional materials and products, showing their cost, distance from project to furthest site of extraction or manufacture, and total cost of materials for project.

1.4 QUALITY ASSURANCE

.1 Test Reports: submit certified test reports showing compliance with specified performance characteristics and physical properties, and in accordance with Section 04 05 00.

.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

.1 Deliver, store and handle materials in accordance with Section 01 61 00 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.

.1 Offload concrete unit masonry packages using equipment that will not damage the surfaces.

.2 Do not use brick tongs to move or handle masonry.

.3 Storage and Handling Requirements:

.1 Store materials off ground or indoors and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Do not double stack cubes of concrete unit masonry.

.3 Cover masonry units with non-staining waterproof membrane covering.

.4 Allow air circulation around units.

.5 Installation of wet or stained masonry units is prohibited.

.6 Keep concrete unit masonry in individual cardboard packaging provided by manufacturer until units are ready to be installed.

.7 Store and protect concrete unit masonry from nicks, scratches, and blemishes.

.8 Replace defective or damaged materials with new.

.4 Develop Construction Waste Management Plan related to Work of this Section and in accordance with Section 01 35 21.

.5 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding and packaging materials as specified in Construction Waste Management Plan in accordance with Section 01 74 20 and Section 01 35 21.

Part 2 PRODUCTS

2.1 MATERIALS

.1 Standard concrete block units: to CSA A165 Series (CSA A165.1).

.1 Classification: H/15/A/M.

.2 Dimensions Nominal: width as indicated x 200 mm high x 400 mm long.

.3 Special shapes: provide square units for exposed corners. Provide purpose-made shapes for lintels, beams and bond beams. Provide additional special shapes as indicated.

.2 Fire rated concrete block units: to CSA A165 Series (CSA A165.1) as modified below.

.1 Classification: H/15/A/M except as modified by fire resistance requirements specified below.

.2 Fire resistant characteristics: aggregate used in units and equivalent thickness of units to the National Building Code of Canada 2015, and in accordance with CAN/ULC-S101, for fire-resistance ratings indicated.

.3 Size: modular.

.4 Special shapes: provide square units for exposed corners. Provide purpose-made shapes for lintels and bond beams and provide additional shapes as indicated.

2.2 REINFORCEMENT

.1 Reinforcement in accordance with Section 04 05 19.

2.3 CONNECTORS

.1 Connectors in accordance with Section 04 05 19.

2.4 MORTAR MIXES

.1 Mortar and mortar mixes in accordance with Section 04 05 12.

2.5 GROUT MIXES

.1 Grout and grout mixes in accordance with Section 04 05 12.

2.6 CLEANING COMPOUNDS

.1 Use low VOC products in compliance with SCAQMD Rule 1168.

.2 Compatible with substrate and acceptable to masonry manufacturer for use on products.

.3 Cleaning compounds compatible with concrete unit masonry and in accordance with manufacturer's written recommendations and instructions.

2.7 TOLERANCES

.1 Tolerances for standard concrete unit masonry tolerances in accordance with CSA A165.1, supplemented as follows:

.1 Maximum variation between units within specific job lot not to exceed 2 mm.

.2 No parallel edge length, width or height dimension for individual unit to differ by more than 2 mm.

.3 Out of square tolerance not to exceed 2 mm.

.2 Tolerances for architectural concrete masonry units in accordance with CSA A165.1, supplemented as follows:

.1 Maximum variation in length or height between units within specific job lot for specified dimension not to exceed 2 mm.

.2 No parallel edge length, width or height dimension for individual unit to differ by more than 2 mm.

.3 Out of square tolerance not to exceed 2 mm.

.4 Maximum variation in width between units within specific job lot for specified dimension not to exceed 2 mm.

Part 3 EXECUTION

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for concrete unit masonry 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 PREPARATION

.1 Protect adjacent finished materials from damage due to masonry work.

3.3 INSTALLATION

.1 Concrete block units:

.1 Bond: running.

.2 Coursing height: 200 mm for one block and one joint.

.3 Jointing: concave where exposed or where paint or other finish coating is specified.

.2 Special Shapes:

.1 Install special units to form corners, returns, offsets, reveals and indents without cut ends being exposed and without losing bond or module.

.2 Install reinforced concrete block lintels over openings in masonry where steel or reinforced concrete lintels are not indicated.

.3 End bearing: not less than 200 mm as indicated on drawings.

.4 Install special site cut shaped units.

3.4 REINFORCEMENT

.1 Install reinforcing in accordance with Section 04 05 19.

3.5 CONNECTORS

.1 Install connectors in accordance with Section 04 05 19.

3.6 MORTAR PLACEMENT

.1 Place mortar in accordance with Section 04 05 12.

3.7 GROUT PLACEMENT

.1 Place grout in accordance with Section 04 05 12.

3.8 CONSTRUCTION

.1 Cull out masonry units, in accordance with CSA A165 with chips, cracks, broken corners, excessive colour and texture variation.

.2 Build in miscellaneous items such as bearing plates, steel angles, bolts, anchors, inserts, sleeves and conduits.

.3 Construct masonry walls using running bond unless otherwise noted.

.4 Build around frames previously set and braced. Fill behind hollow frames within masonry walls with mortar or grout and embed anchors.

.5 Fit masonry closely against electrical and plumbing outlets so collars, plates and covers overlap and conceal cuts.

.6 Install movement joints and keep free of mortar where indicated.

.7 Hollow Units: spread mortar setting bed from outside edge of face shells. Gauge amount of mortar on top and end of unit to create full joints, equivalent to shell thickness. Avoid excess mortar.

.8 Solid Units: apply mortar over entire vertical and horizontal surfaces. Avoid bridging of airspace between brick veneer and backup wall with mortar.

.9 Ensure compacted head joints. Use full or face-shell joint as indicated.

.10 Tamp units firmly into place.

.11 Do not adjust masonry units after mortar has set. Where resetting of masonry is required, remove, clean and reset units in new mortar.

.12 Tool exposed joints concave; strike concealed joints flush.

.13 After mortar has achieved initial set up, tool joints.

.14 Do not interrupt bond below or above openings.

3.9 REPAIR/RESTORATION

.1 Upon completion of masonry, fill holes and cracks, remove loose mortar and repair defective work.

3.10 FIELD QUALITY CONTROL

.1 Site Tests, Inspection: in accordance with Section 04 05 00 supplemented as follows:

.1 Concrete masonry units will be sampled and tested by independent testing agency appointed and paid by Departmental Representative in accordance with CSA S304.1.

.2 Notify inspection agency minimum of 24 hours in advance of requirement for tests.

.2 Manufacturer's Field Services: in accordance with Section 04 05 00.

3.11 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11.

.1 Leave Work area clean at end of each day.

.2 Standard Concrete Unit Masonry:

.1 Allow mortar droppings on masonry to partially dry then remove by means of trowel, followed by rubbing lightly with small piece of block. Clean wall surface with suitable brush or burlap.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11.

.3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 20 and 01 35 21.

.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.12 PROTECTION

.1 Brace and protect concrete unit masonry in accordance with Section 04 05 00.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 05 12 00 – Structural Steel Framing.

1.2 DEFINITIONS

.1 Non-Exposed Standard Structural Steel: Structural steel that is concealed in final construction; that is not subject to weathering or aggressive conditions.

1.3 REFERENCE STANDARDS

.1 American Society for Testing and Materials (ASTM):

- .1 ASTM A123/A123M-13, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
- .2 ASTM A153/A153M-05, Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
- .3 ASTM A780-01 (2006), Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings
- .4 ASTM D4417-03, Standard Test Methods for Field Measurement of Surface Profile of Blast Cleaned Steel

.2 Canadian General Standards Board (CGSB):

- .1 CAN/CGSB-1.108-M89, Bituminous Solvent Type Paint
- .2 CAN/CGSB-1.181, Single Component Organic Zinc Rich Primer

.3 Canadian Standards Association (CSA):

- .1 CSA W47.1-09, Certification of Companies for Fusion Welding of Steel
- .2 CSA W48-01, Filler Metals and Allied Materials for Metal Arc Welding
- .3 CSA W55.3-1965 (R1998), Resistance Welding Qualification Code for Fabricators of Structural Members Used in Buildings
- .4 CSA W59-M1989 (R1998), Welded Steel Construction (Metal Arc Welding)
- .5 CSA W178.2-1996, Certification of Welding Inspectors

.4 Canadian Welding Bureau (CWB Group Industry Services):

- .1 CWB 113E, 94-1, Weld Quality and Examination Methods Study Guide

.5 Canadian Institute of Steel Construction (CISC):

- .1 CISC Code of Standard Practice 7th Edition, 2009

.6 The Society for Protective Coatings (SSPC)/National Association of Corrosion Engineers (NACE International):

- .1 Coating Materials Guidelines
- .2 Surface Preparation Guidelines:
  - .1 SSPC-SP3, Power Tool Cleaning

1.4 ADMINISTRATIVE REQUIREMENTS

.1 Pre-Installation Conference: Conduct a pre-installation conference at Project site in accordance with requirements of Section 01 31 19 before starting any work of this Section to review requirements for finishing architecturally exposed structural steel:

.1 Agenda for pre-installation conference will include, but not be limited to coordinate requirements for shipping, special handling, attachment of safety cables and temporary erection bracing, touch up painting, fabrication and erection procedures, and other requirements affecting metalwork finishing for the project.

.2 Coordinate installation of anchors for members that connect to the work of other trades as follows:

.1 Furnish setting drawings, templates, and directions for installing anchors, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry.

.2 Deliver such items to the project site in time for installation.

.3 Indicate anchorage concepts shop drawings.

1.5 SUBMITTALS

.1 Provide requested information in accordance with Section 01 33 00.

.2 Action Submittals: Provide the following submittals before starting any work of this Section:

.1 Product Data: Submit product data for each type of coating products and primers indicating:

.1 Submit components and application procedures of the paint system as a single coordinated submittal and indicate compatibility and maximum recoat times for each product.

.2 Identify required surface preparation, primer, intermediate coat (if applicable) and finish coat.

.2 Shop Drawings: Submit shop drawings detailing fabrication of components, as follows:

.1 Include details that clearly identify requirements listed in for Fabrication and Erection; provide connections consistent with concepts shown on the architectural or structural drawings.

.2 Indicate type, size, finish and length of bolts, distinguishing between shop and site bolts; identify high strength bolted slip critical, direct tensioned shear/bearing connections; indicate which direction bolt heads should be oriented in final assembly.

.3 Clearly indicate which surfaces or edges are exposed and class of surface preparation.

.4 Indicate special tolerances and erection requirements as noted on the drawings or defined herein.

.3 Samples: Submit samples indicating welds and finishing techniques prior to starting any architecturally exposed welding and finishing work, as follows:

.1 Finish samples with primer listed in for use in this Section.

.2 Prepare samples free of tool marks, foundry identification marks, pits and scale and other defects detrimental to finished appearance.

.3 Sample will be used by the Departmental Representative to determine acceptability of welds and surface preparation for architecturally exposed structural steel fabrications on site.

.4 Departmental Representative may request modifications to the submitted sample; fabricator shall make the changes as indicated until acceptance is obtained from the Departmental Representative.

1.6 DELIVERY, STORAGE, AND HANDLING

.1 Delivery and Acceptance Requirements: Use special care in handling to prevent twisting or warping of members:

.1 Erect pre-painted finish pieces using padded slings or other methods to protect them from damage arising from handling including, but not limited to, the following:

.2 Provide padding as required to protect while rigging and aligning member's frames.

.3 Weld tabs for temporary bracing and safety cabling only at points concealed from view in the completed structure or where approved by the Departmental Representative during the pre-installation meeting.

.4 Submit methods of removing temporary erection devices and finishing, and refinishing pre-painted pieces for review and acceptance by the Departmental Representative prior to erection.

.2 Storage and Handling Requirements: Store materials to permit easy access for review and identification; store steel members off ground by using pallets, platforms, or other supports; protect steel members and packaged materials from erosion and deterioration.

Part 2 Products

2.1 METAL MATERIALS

.1 Coordinate requirements of this Section with related requirements of referenced Division 5 – Metals technical specification sections.

2.2 GALVANIZING

.1 Hot Dip Galvanized Finish: Hot dip galvanize in accordance with ASTM A123/A123M to locations indicated; 300 g/m^2 minimum zinc coating; galvanize components after assembly where size permits.

2.3 SHOP COATINGS

.1 Isolation Coating: Acid and alkali resistant asphaltic paint to CAN/CGSB-1.108.

.1 Apply an isolation coating to contact surfaces of following components in contact with cementitious materials and dissimilar metals except stainless steel:

.1 Exterior components

.2 Interior components exposed to high humidity conditions

2.4 SHOP CONNECTIONS

.1 Bolted Connections: Make in accordance with Section 05 12 00.

.1 Provide bolt type and finish as specified in this section; align bolt heads as indicated on shop and erection drawings.

.2 Welded Connections:

.1 Comply with requirements specified in Section 05 05 00 and 05 12 00.

.2 Make appearance and quality of welds consistent with mock-up.

.3 Assemble and weld built-up sections by methods that maintain alignment of members without warp exceeding tolerances of this section.

2.5 SITE REPAIR COATINGS

.1 Zinc Rich Paint: Single component organic zinc anticorrosive primer in accordance with CAN/CGSB-1.181 and as follows:

.1 Clean metal to SSPC SP3- Power Tool Cleaning in accordance with surface preparation requirements and environmental exposure limitations listed in CAN/CGSB-1.181

.2 Apply two (2) coats zinc rich paint to all surfaces exposed after assembly to manufacturer’s minimum dry film thickness.

.3 Apply coating immediately after cleaning

Part 3 Execution

3.1 EXAMINATION

.1 Verify exposure of steel components, architectural or non-exposed, and finish assemblies as specified.

.2 Report any discrepancy and potential problem areas to Departmental Representative for direction before commencing finishing operations.

3.2 ADJUSTING AND CLEANING

.1 Site Touch-Up and Repair Galvanized Finishes:

.1 Galvanized Surfaces: Clean site welds, bolted connections, and abraded areas and repair galvanizing in accordance with ASTM A780.

END OF SECTION

Part 1 GENERAL

1.1 RELATED SECTIONS

.1 Section 05 31 00 - Steel Decking.

.2 Section 05 50 01 – Metal Fabrications.

1.2 REFERENCES

.1 American Society for Testing and Materials International, (ASTM)

.1 ASTM A36/A36M-14, Standard Specification for Carbon Structural Steel.

.2 ASTM A123/A123M-13, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

.3 ASTM A193/A193M-12b, Standard Specification for Alloy Steel and Stainless Steel Bolting for High Temperature or High Pressure Service and Other Special Purpose Applications.

.4 ASTM A325-14, Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.

.2 Canada Green Building Council (CaGBC)

.1 LEED Canada For New Construction and Major Renovations 2009.

.3 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-85.10-99, Protective Coatings for Metals.

.4 Canadian Institute of Steel Construction (CISC)/Canadian Paint Manufacturer's Association (CPMA).

.1 CISC/CPMA 1-73b, Quick-Drying One-Coat Paint for Use on Structural Steel.

.2 CISC/CPMA 2-75, Quick-Drying Primer for use on Structural Steel.

.5 Canadian Standards Association (CSA)

.1 CSA G40.20-13/G40.21-13, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.

.2 CSA S16-14, Design of Steel Structures.

.3 CSA S136-12 Package, North American Specification for the Design of Cold Formed Steel Structural Members.

.4 CSA W47.1-09(R2014), Certification of Companies for Fusion Welding of Steel.

.5 CSA W48-14, Filler Metals and Allied Materials for Metal Arc Welding.

.6 CSA W55.3-08(R2013), Certification of Companies for Resistance Welding of Steel and Aluminum.

.7 CSA W59-13, Welded Steel Construction (Metal Arc Welding).

.6 Master Painters Institute

.1 MPI-INT 5.1-98, Structural Steel and Metal Fabrications.

.2 MPI-EXT 5.1-98, Structural Steel and Metal Fabrications.

.7 The Society for Protective Coatings (SSPC)

.1 SSPC SP 6/NACE No. 3-00, Commercial Blast Cleaning.

1.3 DESIGN REQUIREMENTS

.1 Design details and connections in accordance with requirements of CSA S16 and CSA S136 to resist forces, moments, shears and allow for movements indicated.

.2 Shear connections:

.1 Select framed beam shear connections from an industry accepted publication such as "Handbook of the Canadian Institute of Steel Construction" when connection for shear only (standard connection) is required.

.2 Select or design connections to support reaction from maximum uniformly distributed load that can be safely supported by beam in bending, provided no point loads act on beam, when shears are not indicated.

.3 Submit sketches and design calculations stamped and signed by qualified professional engineer licensed in Province of Ontario, Canada for non standard connections.

1.4 SHOP DRAWINGS

.1 Submit shop drawings including fabrication and erection documents and materials list in accordance with Section 01 33 00.

.2 Erection drawings: indicate details and information necessary for assembly and erection purposes including:

.1 Description of methods.

.2 Sequence of erection.

.3 Type of equipment used in erection.

.4 Temporary bracings.

.3 Ensure Fabricator drawings showing designed assemblies, components and connections are stamped and signed by qualified professional engineer licensed in the province of Ontario, Canada.

1.5 QUALITY ASSURANCE

.1 Submit 2 copies of mill test reports 4 weeks prior to fabrication of structural steel.

.1 Mill test reports to show chemical and physical properties and other details of steel to be incorporated in project.

.2 Provide mill test reports certified by metallurgists qualified to practice in province of Ontario, Canada.

.2 Provide structural steel Fabricator's affidavit stating that materials and products used in fabrication conform to applicable material and products standards specified and indicated.

.1 Delegated Design Engineer: Retain a professional engineer, registered in the Province of the Work, to design fabrication and erection of the Work of this Section in accordance with applicable Building Code and Contract Documents requirements including the following:

.1 Seal and signature to fabrication and erection documents and design submittals

.2 Site review of installed components.

.3 Completion of Letters or Commitment and Supervision specified in Section 01 33 50.

1.6 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 74 20.

.2 Remove from site and dispose of packaging materials at appropriate recycling facilities.

.3 Collect and separate for disposal paper, plastic, polystyrene, corrugated cardboard, packaging material in appropriate on-site for recycling in accordance with Waste Management Plan.

.4 Divert unused metal materials from landfill to metal recycling facility approved by Departmental Representative.

.5 Divert unused paint material from landfill to official hazardous material collections site approved by Departmental Representative.

.6 Do not dispose of unused paint materials into sewer systems, into lakes, streams, onto ground or in other location where it will pose health or environmental hazard.

Part 2 PRODUCTS

2.1 MATERIALS

.1 Steel sections and plates: to CAN/ G40.20/G40.21, Grade 350W for W and HSS sections, 300W for plates, bars, angles and channels; minimum 75% recycled content for all steel.

.2 Welding materials: to CSA W59 and certified by CWB.

.3 Welding electrodes: to CSA W48 Series.

.4 Unheaded Rods: ASTM A36/A36M.

.5 Headed Bolts: ASTM A325/A325M, Type 1; heavy hex steel structural bolts and heavy hex carbon steel nuts.

.6 Washers: ASTM A36/A36M.

.7 Shop paint primer: to CISC/CPMA 1 for interior steel, and CISC/CPMA 2 for exterior steel.

.8 Hot dip galvanizing: galvanize steel, where indicated, to ASTM A123/A123M, minimum zinc coating of 600 g/m^2, Coating Grade 85.

2.2 FABRICATION

.1 Fabricate structural steel in accordance with CSA S16 and in accordance with reviewed shop drawings.

.2 Continuously seal members by continuous welds where indicated. Grind smooth.

.3 Provide holes in top flanges.

2.3 SHOP PAINTING

.1 Clean, prepare surfaces and shop prime structural steel in accordance with CSA S16 except where members to be encased in concrete.

.2 Clean members, remove loose mill scale, rust, oil, dirt and other foreign matter. Prepare surface according to SSPC-SP-6.

.3 Apply one coat of primer in shop to steel surfaces, except:

.1 Surfaces to be encased in concrete.

.2 Surfaces to receive field installed stud shear connections.

.3 Surfaces and edges to be field welded.

.4 Faying surfaces of friction-type connections.

.5 Below grade surfaces in contact with soil.

.4 Apply paint under cover, on dry surfaces when surface and air temperatures are above 5 degrees C.

.5 Maintain dry condition and 5 degrees C minimum temperature until paint is thoroughly dry.

.6 Strip paint from bolts, nuts, sharp edges and corners before prime coat is dry.

Part 3 EXECUTION

3.1 GENERAL

.1 Structural steel work: in accordance with CSA S16.

.2 Welding: in accordance with CSA W59.

.3 Companies to be certified under Division 01 or 2.1 of CSA W47.1 for fusion welding of steel structures and/or CSA W55.3 for resistance welding of structural components.

3.2 CONNECTION TO EXISTING WORK

.1 Verify dimensions and condition of existing work, report discrepancies and potential problem areas to Departmental Representative for direction before commencing fabrication.

3.3 MARKING

.1 Mark materials in accordance with CSA G40.20/G40.21. Do not use die stamping. If steel is to be left in unpainted condition, place marking at locations not visible from exterior after erection.

.2 Match marking: shop mark bearing assemblies and splices for fit and match.

3.4 ERECTION

.1 Erect structural steel, as indicated and in accordance with CSA S16 and in accordance with reviewed erection drawings.

.2 Field cutting or altering structural members: to approval of Departmental Representative.

.3 Clean with mechanical brush and touch up shop primer to bolts, rivets, welds and burned or scratched surfaces at completion of erection.

.4 Continuously seal members by continuous welds where indicated. Grind smooth.

3.5 FIELD QUALITY CONTROL

.1 Inspection and testing of materials and workmanship will be carried out by testing laboratory designated by Departmental Representative.

.2 Provide safe access and working areas for testing on site, as required by testing agency and as authorized by Departmental Representative.

.3 Submit test reports to Departmental Representative within 2 weeks of completion of inspection.

.4 Departmental Representative will pay costs of tests.

3.6 FIELD PAINTING

.1 Paint in accordance with Section 09 91 23.

.1 Touch up damaged surfaces and surfaces without shop coat with primer to SSPC-SP-6 except as specified otherwise. Apply in accordance with CAN/CGSB-85.10.

END OF SECTION

Part 1 GENERAL

1.1 RELATED SECTIONS

.1 Section 09 91 23 – Interior Painting.

.2 Section 05 12 23 - Structural Steel for Buildings.

1.2 REFERENCES

.1 American Society for Testing and Materials International, (ASTM)

.1 ASTM A653/A653M-15, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

.2 ASTM A792/A792M-10(2015), Standard Specification for Steel Sheet, 55%Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.

.2 Canada Green Building Council (CaGBC)

.1 LEED Canada For New Construction and Major Renovations 2009.

.3 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-1.181-99, Ready-Mixed Organic Zinc-Rich Coating.

.4 Canadian Standards Association (CSA International)

.1 CSA C22.2 No.79-1978(R2013), Cellular Metal and Cellular Concrete Floor Raceways and Fittings.

.2 CSA S16-14, Design of Steel Structures.

.3 CSA S136-12 PACKAGE, North American Specification for the Design of Cold Formed Steel Structural Members.

.4 CSA W47.1-09(R2014), Certification of Companies for Fusion Welding of Steel Structures.

.5 CSA W55.3-08(R2013), Certification of Companies for Resistance Welding of Steel and Aluminum.

.6 CSA W59-13, Welded Steel Construction, (Metal Arc Welding).

.5 Canadian Sheet Steel Building Institute (CSSBI)

.1 CSSBI 10M-08, Standard for Steel Roof Deck.

.2 CSSBI 12M-08, Standard for Composite Steel Deck.

1.3 DESIGN REQUIREMENTS

.1 Design steel deck using limit states design in accordance with CSA S136 and,CSSBI 10M and CSSBI 12M.

.2 Steel deck and connections to steel framing to carry dead, live and other loads including lateral loads, diaphragm action, composite deck action, and uplift as indicated.

.3 Deflection under specified live load not to exceed 1/240 of span, except that when gypsum board ceilings are hung directly from deck, live load deflection not to exceed 1/360 of span.

1.4 SHOP DRAWINGS

.1 Submit shop drawings erection and shoring drawings in accordance with Section 01 33 00.

.2 Submit drawings stamped and signed by qualified professional engineer registered or licensed in Province of Ontario, Canada.

.3 Submit design calculations if requested by Departmental Representative.

.4 Indicate deck plan, profile, dimensions, base steel thickness, metallic coating designation, connections to supports and spacings, projections, openings, reinforcement details and accessories.

.5 Indicate details of temporary shoring of steel deck, such as location, time and duration of placement and removal of shoring for concrete fill decks.

1.5 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 74 20.

.2 Divert unused metal from landfill to metal recycling facility approved by Departmental Representative.

.3 Dispose of unused paint material at official hazardous material collections site approved by Departmental Representative.

.4 Do not dispose of unused paint material into sewer system, into streams, lakes, onto ground or in other location where it will pose health or environmental hazard.

.5 Dispose of unused caulking material at official hazardous material collections site approved by Departmental Representative.

Part 2 PRODUCTS

2.1 MATERIALS

.1 Zinc-iron Alloy (ZF) coated steel sheet: to ASTM A653/A653M structural quality Grade 255, minimum 30% recycled content, with ZF75 coating, for interior surfaces not exposed to weather, painted finish, 0.76 and 0.91mm minimum base steel thickness.

.2 Decks to be painted: zinc-iron alloy coated decks suitable for finish painting.

.3 Zinc (Z) coated steel sheet: to ASTM A653/A653M structural quality Grade 255, minimum 30% recycled content, with ZF275, coating, regular spangle surface, not chemically treated for paint finish, for exterior surfaces exposed to weather, 0.76 and 0.91mm minimum base steel thickness.

.4 Closures: as indicated in accordance with manufacturer's recommendations.

.5 Cover plates, cell closures and flashings: steel sheet with minimum base steel thickness of 0.76 mm, minimum 30% recycled content. Metallic coating same as deck material.

.6 Primer: zinc rich, ready mix to CAN/CGSB-1.181, Ecologo certified.

.7 Caulking: to Section 07 92 00.

2.2 TYPES OF DECKING

.1 Steel roof deck: 0.76mm minimum base steel thickness, 38mm maximum deep profile, interlocking side laps. Flat sheet for cellular deck, 0.76mm minimum base steel thickness.

Part 3 EXECUTION

3.1 GENERAL

.1 Structural steel work: in accordance with CSA S136 and CSSBI 10M and CSSBI 12M.

.2 Welding: in accordance with CSA W59, except where specified otherwise.

.3 Companies to be certified under Division 1 or 2.1 of CSA W47.1 for fusion welding of steel and/or CSA W55.3 for resistance welding.

3.2 ERECTION

.1 Erect steel deck as indicated and in accordance with CSA S136, CSSBI 10M and CSSBI 12M and in accordance with reviewed erection drawings.

.2 Lap ends: to 50 mm minimum.

.3 Immediately after deck is permanently secured in place, touch up metallic coated top surface with compatible primer where burned by welding.

3.3 CLOSURES

.1 Install closures in accordance with approved details.

3.4 OPENINGS AND AREAS OF CONCENTRATED LOADS

.1 No reinforcement required for openings cut in deck which are smaller than 150 mm square.

.2 Frame deck openings with any one dimension between 150 to 300 mm as recommended by manufacturer, except as otherwise indicated.

.3 For deck openings with any one dimension greater than 300 mm and for areas of concentrated load, reinforce in accordance with structural framing details, except as otherwise indicated.

3.5 CONNECTIONS

.1 Install connections in accordance with CSSBI recommendations as indicated.

END OF SECTION

Part 1 GENERAL

1.1 RELATED REQUIREMENTS

.1 Section 06 16 43 – Gypsum Sheathing: Glass mat gypsum substrate sheathing.

1.2 REFERENCES

.1 ASTM International

.1 ASTM A123/A123M-13, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

.2 ASTM A653/A653M-13, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

.3 ASTM A792/A792M-10, Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.

.2 Canada Green Building Council (CaGBC)

.1 LEED Canada For New Construction and Major Renovations 2009.

.3 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-1.181-99, Ready-Mixed Organic Zinc-Rich Coating.

.4 CSA International

.1 CSA W47.1-09(R2014), Certification of Companies for Fusion Welding of Steel.

.2 CSA W55.3-08(R2013), Certification of Companies for Resistance Welding of Steel and Aluminum.

.3 CSA W59-13, Welded Steel Construction (Metal Arc Welding).

.4 CSA S136-12 Package, North American Specification for the Design of Cold Formed Steel Structural Members.

.5 Canadian Sheet Steel Building Institute (CSSBI)

.1 CSSBI 51-06, Lightweight Steel Framing Manual - 2nd Edition.

.2 CSSBI S5-11, Guide Specification for Wind Bearing Steel Studs.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for structural metal studs 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 Indicate design loads, member sizes, materials, design thickness exclusive of coatings, coating specifications, connection and bracing details, screw sizes and spacing, and anchors.

.3 Indicate locations, dimensions, openings and requirements of related work.

.4 Indicate welds by welding symbols as defined in CSA W59.

.4 Samples:

.1 Submit samples of framing components for review.

.2 Submit duplicate 300 x 300 mm samples of each type.

.5 Certificates: prior to beginning Work, submit: 2 certified copies of mill reports covering material properties.

.6 Manufacturer Reports:

.1 Submit manufacturer's written report, within 3 days of review, verifying compliance of Work, as described in PART 3 - FIELD QUALITY CONTROL.

.7 Sustainable Design Submittals:

.1 LEED Canada-NC Submittals: in accordance with Section 01 35 21.

.2 Construction Waste Management:

.1 Submit project Waste Management Plan highlighting recycling and salvage requirements.

.2 Submit calculations on end-of-project recycling rates, salvage rates, and landfill rates demonstrating that 75% of construction wastes were recycled or salvaged.

.3 Recycled Content:

.1 Submit listing of recycled content products used, including details of required percentages or recycled content materials and products, showing their costs and percentages of post-consumer and post-industrial content, and total cost of materials for project.

.4 Regional Materials: submit evidence that project incorporates required percentage 20% of regional materials and products, showing their cost, distance from project to furthest site of extraction or manufacture, and total cost of materials for project.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 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 Store and protect structural metal studs from nicks, scratches, and blemishes.

.3 Protect steel studs during transportation, site storage and installation.

.4 Handle and protect galvanized materials from damage to zinc coating.

.5 Replace defective or damaged materials with new.

.4 Develop Construction Waste Management Plan related to Work of this Section and in accordance with Section 01 35 21.

.5 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding and packaging materials as specified in Construction Waste Management Plan in accordance with Section 01 74 20 and Section 01 35 21.

Part 2 Products

2.1 MATERIALS

.1 Steel: to CSA S136, fabricated from ASTM A653/A653M, Grade 340 steel.

.2 Zinc coated steel sheet: quality to ASTM A653/A653M, with Z275 designation coating.

.3 Aluminum-zinc alloy coated steel sheet: quality to ASTM A792/A792M, with AZM150 designation coating.

.4 Welding materials: to CSAW59 and certified by Canadian Welding Bureau.

.5 Screws: pan head, self-drilling, self-tapping sheet metal screws, corrosion protected with minimum zinc coating thickness of 0.008 mm, length 16 mm

.6 Anchors: concrete expansion anchors or other suitable drilled type fasteners.

.7 Bolts, nuts, washers: hot dipped galvanized to CAN/CSA-G164, 600 g/m^2 zinc coating.

.8 Touch up primer: zinc rich, to CAN/CGSB 1-GP-181.

2.2 STEEL STUD DESIGNATIONS

.1 Colour code: to CSSBI Technical Bulletin Vol.7, No. 2.

2.3 METAL FRAMING

.1 Steel studs: to CSA S136, fabricated from metallic coated steel, depth as indicated.

.1 Minimum steel thickness of 0.84 mm unless noted in section 2.4 below.

.2 Stud tracks: fabricated from same material and finish as steel studs, depth to suit.

.1 Bottom track: single piece.

.2 Top track: single piece vertically slotted premanufactured track.

.3 Bridging: fabricated from same material and finish as studs, 38 x 12 x 1.09 mm minimum thickness.

.4 Angle clips: fabricated from same material and finish as studs, 38 x 38 mm x depth of steel stud, 1.37 mm minimum thickness.

.5 Tension straps and accessories: as recommended by manufacturer.

2.4 DESIGN REQUIREMENTS

.1 Perform design, fabrication and erection of the work of this Section based on Limit States Design principles using factored loads and resistances, determined in accordance with CAN/CSA S136. Perform design to comply with CAN/CSA S832-06 Seismic Risk Reduction of Operational and Functional Components of Buildings.

.2 Design wall framing system capable of withstanding design loads within limits and under design loads as follows:

.1 Dead Loads: Weights of materials and construction supported by studs.

.2 Wind Loads: Wind Loads: q_{50} for strength, modified by the appropriate exposure, gust and pressure (internal and external) factors in accordance with commentary "B" of the NBC 2015 structural commentaries.

.3 Earthquake Loads as per NBC 2015 requirements. Perform design to comply with CAN/CSA S832-06 Seismic Risk Reduction of Operational and Functional Components of Buildings.

.4 Design framing systems to provide for movement of framing members without damage or overstressing, sheathing failure, connection failure, undue strain on fasteners and anchors, or other detrimental effects when subject to a maximum ambient temperature change of 70°C.

.5 Design framing system to maintain clearances at openings, to allow for construction tolerances, and to accommodate live load deflection of primary building structure upward and downward movement of 25 mm; or larger gap as may be required to accommodate structural movement.

.6 Design deflection detail so that free floating vertical members are restrained from horizontal movement by means of continuous bridging, nested or boxed tracks, or sliding or flexible web connections.

.7 Maximum allowable deflection under q50 sustained wind loading shall be as follows:

.1 Behind brick masonry veneer and tiled and stone panels – stud deflection limited to L/720.

.8 Allow for movement of the structure; design lightweight steel framing end connections to accommodate floor and roof deflections such that studs are not loaded axially; limit free play and movement in connections perpendicular to the plane of framing to ±0.50 mm relative to the building structure.

.9 Design connections between light steel framing members using bolts, welding or sheet metal screws.

.10 Design bridging to prevent member rotation and member translation perpendicular to the minor axis, and as follows:

.1 Design for secondary stress effects due to torsion between lines of bridging.

.2 Collateral contribution of sheathing materials may be used to help restrain member rotation and translation perpendicular to the minor axis for wind bearing studs.

.3 Design bridging at 1530 mm centres maximum, closer spacing may be required by design to satisfy structural requirements; spaced at even intervals over the span of the member.

.3 Stud, sill and top track sizes and thicknesses, and fastening details indicated in this Section and on the Drawings shall be considered as minimums only, spacing indicated as maximum permissible, except where changes are required to meet design criteria, and as follows:

.1 Design head, sill and jamb members to frame openings larger than 100 mm in any dimension.

.2 Design components or assemblies to accommodate specified tolerances of the structure.

.3 Sill and Top Tracks:

.1 Single slotted track system, min 65 mm depth to suit vertical deflection and width of studs.

.2 Sill tracks, minimum 33 mm deep flanges and width of studs.

.4 Movement Connection Clips: Purpose made clip designed to allow structural member vertical movement and to transfer wind suction or pressure to structural frame.

.5 Maximum design spacing of stud members shall not exceed 406 mm centres.

.6 Maximum spacing for top and bottom track connections to the structure shall not exceed 810 mm centres.

.7 Minimum design thickness for wall framing members shall be as follows:

.1	92 mm:	0.84 mm
.2	101 mm:	0.84 mm
.3	140 mm:	0.84 mm
.4	152 mm:	0.84 mm
.5	184 mm:	0.91 mm
.6	203 mm:	1.12 mm

.8 Bridging Channel: 1.12 mm minimum.

.9 Clip Angles: 1.52 mm minimum.

2.5 SOURCE QUALITY CONTROL

.1 Ensure mill reports covering material properties are reviewed by Departmental Representative.

Part 3 Execution

3.1 GENERAL

.1 Do welding in accordance with CSA W59.

.2 Certification of companies: CSA W47.1 for fusion welding and CSA W55.3 for resistance welding.

.3 Do work to CSSBI S5.

3.2 ERECTION

.1 Install damproofing course under stud at slab or grade.

.2 Erect components to requirements of reviewed shop drawings.

.3 Anchor tracks securely to structure at 600 mm on centre maximum, unless lesser spacing prescribed on shop drawings.

.4 Erect studs plumb, aligned and securely attached with two screws minimum.

.5 Seat studs into bottom tracks and single piece top track.

.6 Install 65.0 mm minimum vertically slotted track at top of walls where required to accommodate vertical deflection.

.1 Do not fasten tracks together.

.2 Stagger joints and.

.7 Install studs at not more than 50.0 mm from abutting walls, openings, and each side of corners and terminations with dissimilar materials.

.8 Brace steel studs with horizontal internal bridging at 1220mm maximum. Fasten bridging to steel clips fastened to steel studs with screws or by welding.

.9 Frame openings in stud walls to adequately carry loads by use of additional framing members and bracing as detailed on shop drawings.

.10 Touch up welds with coat of zinc rich primer.

3.3 ERECTION TOLERANCES

.1 Plumb: not to exceed 1/500th of member length.

.2 Camber: not to exceed 1/1000th of member length.

.3 Spacing: not more than +/- 3.0 mm from design spacing.

.4 Gap between end of stud and track web: not more than 4.0 mm.

3.4 CUTOUTS

.1 Maximum size of cutouts for services as follows:

Member Depth	Across Member Depth	Along Member Length	Centre to Centre Spacing (mm)
92	40 max.	105 max.	600 min.
101	40 max.	105 max.	600 min.
152	65 max.	115 max.	600 min.

.2 Limit distance from centerline of last unreinforced cutout to end of member to less than 300 mm.

3.5 FIELD QUALITY CONTROL

.1 Manufacturer's Field Services:

.1 Obtain written report from manufacturer's verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in PART 1 - SUBMITTALS.

.2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.

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

END OF SECTION

Part 1 GENERAL

1.1 REFERENCES

.1 American National Standards Institute (ANSI):

.1 ANSI/NAAMM MBG 531-09, Metal Bar Grating Manual.

.2 American Society for Testing and Materials International, (ASTM):

.1 ASTM A47/A47M-99(2014), Standard Specification for Ferritic Malleable Iron Castings.

.2 ASTM A123/A123M-13, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

.3 ASTM A269-1431, Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service.

.4 ASTM A536-84(2014), Standard Specification for Ductile Iron Castings.

.5 ASTM A627-03(2011), Standard Test Methods for Tool-Resisting Steel Bars, Flats, and Shapes for Detention and Correctional Facilities.

.6 ASTM A666-15, Standard Specification for Annealed or Cold Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.

.7 ASTM A786/A786M-05(2009), Standard Specification for Hot-Rolled Carbon, Low-Alloy, High-Strength Low-Alloy, and Alloy Steel Floor Plates.

.8 ASTM A1011/A1011M-14, Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength.

.9 ASTM B36/B36M-13, Standard Specification for Brass Plate, Sheet, Strip, And Rolled Bar.

.10 ASTM B135M-10, Standard Specification for Seamless Brass Tube, Metric.

.11 ASTM F593-13a, Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs.

.12 ASTM F1267-12, Standard Specification for Metal, Expanded, Steel.

.3 Canadian General Standards Board (CGSB):

.1 CAN/CGSB-1.181-99, Ready-Mixed Organic Zinc-Rich Coating

.4 Canadian Standards Association (CSA):

.1 CSA B651-12, Accessible Design for the Built Environment.

.2 CSA G40.20-13/G40.21-13, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.

.3 CSA W59-13, Welded Steel Construction (Metal Arc Welding).

.5 The Master Painters Institute (MPI) / Architectural Painting Specification Manual - February 2004.

.1 MPI #79 - Primer, Alkyd, Anti-Corrosive for Metal.

.6 National Association of Architectural Metal Manufacturers (NAAMM):

.1 NAAMM AMP-92, Metal Stair Manual.

1.2 DESIGN REQUIREMENTS

.1 Design metal fabrications in accordance with CSA B651.

1.3 SUBMITTALS

.1 Submit shop drawings and product data of each item specified in accordance with Sections 01 33 00 and 01 78 00.

.1 Indicate materials, core thicknesses, finishes, connections, joints, method of anchorage, number of anchors, supports, reinforcement, details and accessories.

.2 Indicate each item's conformance with CSA B651.

.3 Each shop drawing submission shall bear signature and stamp of qualified professional engineer registered or licensed in province of Ontario.

Part 2 PRODUCTS

2.1 MATERIALS

2.2 MATERIALS

.1 Steel sections and plates: to CSA G40.20/ G40.21, Grade 350W and 300W respectively, minimum 30% recycled content.

.2 Steel pipe: to ASTM A53/A53M double extra strong, black finish, minimum 30% recycled content.

.3 Welding materials: to CSA W59.

.4 Welding electrodes: to CSA W48 Series.

.5 Bolts and anchor bolts: to ASTM A307.

.6 Grout: non-shrink, non-metallic, flowable, 15 MPa at 24 hours.

.7 Steel gratings welded: bearing bars, cross bars, bent connecting bars and anchors, welding quality, mild carbon steel to ASTM A1011/A1011M.

2.3 FABRICATION

.1 Fabricate work square, true, straight and accurate to required size, with joints closely fitted and properly secured.

.2 Use self-tapping shake-proof round headed screws on items requiring assembly by screws or as indicated.

.3 Where possible, fit and shop assemble work, ready for erection.

.4 Ensure exposed welds are continuous for length of each joint. File or grind exposed welds smooth and flush.

2.4 FINISHES

.1 Galvanizing: hot dipped galvanizing with zinc coating 600 g/m^2, Coating Grade 85, to ASTM A123/A123M.

.2 Shop coat primer: in accordance with chemical component limits and restrictions requirements and VOC limits of CCD-047a.

.3 Zinc primer: zinc rich, ready mix in accordance with chemical component limits and restrictions requirements and VOC limits of CCD-047a.

2.5 SHOP PAINTING

.1 Primer: VOC limit 250 g/L maximum to GS-11.

.2 Apply one shop coat of primer to metal items, with exception of galvanized or concrete encased items.

.3 Use primer unadulterated, as prepared by manufacturer. Paint on dry surfaces, free from rust, scale, grease. Do not paint when temperature is lower than 7 degrees C.

.4 Clean surfaces to be field welded; do not paint.

2.6 ANGLE LINTELS

.1 Steel angles: galvanized or prime painted, sizes indicated for openings. Provide 200 mm minimum bearing at ends.

.2 Weld or bolt back-to-back angles to profiles as indicated.

.3 Finish: shop painted.

.1 Primer: VOC limit 250 g/L maximum to GS-11 when applied onsite.

2.7 FABRICATION

.1 Fit joints in true planes and securely fasten.

.2 Weld to CSA W59. File or grind welds smooth and flush with adjoining surface.

.3 Fabricate gratings within limits given in Metal Bar Grating Manual, Revised 1979.

.4 Shop assemble work.

Part 3 EXECUTION

3.1 INSTALLATION

.1 Supply other sections with templates, instructions and built-in items.

.2 Install work straight, plumb and level to a tolerance of 1:600.

.3 Provide required reinforcing and anchorage.

.4 Touch-up burnt, scratched or chipped primer.

3.2 LOOSE ANGLE LINTELS

.1 Supply masonry section with steel loose angle lintels of sizes required to suit masonry openings.

.2 Apply alkyd primer to interior lintels. Galvanize exterior lintels.

.3 Provide 150 mm bearing at ends.

.4 Weld or bolt together back-to-back angles.

3.3 COUNTER BRACKETS

.1 Supply and install steel brackets, supports and angles for support of counters.

.2 Drill for countersunk screws and anchor bolts.

.3 Apply alkyd primer.

3.4 LATERAL SUPPORT ANGLES FOR MASONRY PARTITIONS

.1 Supply masonry section with steel angles to provide lateral support of masonry partitions where they abutt the underside of deck.

.2 Apply alkyd primer.

3.5 LATERAL SUPPORT ANCHORS FOR MASONRY PARTITIONS

.1 Supply masonry section with one piece, galvanized steel anchors to provide lateral support of masonry partitions where they abutt the underside of deck.

3.6 WINDOW SUPPORT BRACKETS

.1 Supply and install steel window support brackets.

.2 Weld required shapes and supply anchors.

.3 Galvanize after fabrication.

3.7 BOLLARDS

.1 Supply concrete section with steel bollards for mounting and filling with concrete.

.2 Galvanize bollards.

3.8 GRATINGS

.1 Supply concrete section with steel angles for mounting in concrete at grating edge.

.2 Fabricate gratings within the limits shown on page 15 of the Metal Bar Grating Manual, Revised 1979.

.3 Weld required grating anchors.

.4 Apply alkyd primer.

.5 Touch up burnt, scratched or chipped primer.

3.9 ELEVATOR MACHINE BEAM

.1 Supply elevator machine beam of size required to suit loading and elevator openings.

.2 Apply alkyd primer.

3.10 STRUCTURAL STEEL SHAPES FOR SUPPORT OF POINT SUPPORTED GLASS ASSEMBLIES

.1 Supply steel shapes as shown on Drawings.

.2 Apply alkyd primer.

END OF SECTION

Part 1 GENERAL

1.1 SECTION INCLUDES

.1 Requirements for new metal stairs, ladders, and balustrades.

.2 Requirements for replacing existing balustrades at existing steel pan and cast-in-place concrete stairs.

1.2 REFERENCES

.1 American National Standards Institute/National Association of Architectural Metal Manufacturers (ANSI/NAAMM)

.1 ANSI/NAAMM MBG 531-09, Metal Bar Grating Manual.

.2 ASTM International

.1 ASTM A53/A53M-12, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.

.2 ASTM A123/A123M-13, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

.3 ASTM A307-14, Standard Specification for Carbon Steel Bolts, Studs and Threaded Rod, 60,000 PSI Tensile Strength.

.4 ASTM A325M-14, Standard Specification for Structural Bolts, Steel, Heat Treated, 830 MPa Minimum Tensile Strength (Metric).

.3 Canada Green Building Council (CaGBC)

.1 LEED Canada For New Construction and Major Renovations 2009.

.4 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).

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

.1 Material Safety Data Sheets (MSDS).

.6 The Master Painters Institute (MPI) / Architectural Painting Specification Manual 2015.

.1 MPI #18 - Primer, Zinc Rich, Organic.

.2 MPI #23 - Primer, Metal, Surface Tolerant.

.3 MPI #79 - Primer, Alkyd, Anti-Corrosive for Metal.

.7 National Association of Architectural Metal Manufactures (NAAMM)

.1 NAAMM AMP 510-92, Metal Stair Manual.

.8 The Society for Protective Coatings (SSPC)

.1 Systems and Specifications Manual, Volume 2, 2008 Edition.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for stairs and ladders 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 Indicate construction details, sizes of steel sections and thickness of steel sheet.

.3 Indicate fasteners, welds and connection details between stringers; treads; risers; headers; newels; platforms; struts, columns and hangers; railings; handrails; brackets; reinforcements; anchors; and welded and bolted connections.

.4 Sustainable Design Submittals:

.1 LEED Canada-NC Submittals: in accordance with Section 01 35 21.

.2 Construction Waste Management:

.1 Submit project Waste Management Plan recycling and salvage requirements.

.2 Submit calculations on end-of-project recycling rates, salvage rates, and landfill rates demonstrating that 75% of construction wastes were recycled or salvaged.

.3 Recycled Content:

.1 Submit listing of recycled content products used, including details of required percentages or recycled content materials and products, showing their costs and percentages of post-consumer and post-industrial content, and total cost of materials for project.

.4 Regional Materials: submit evidence that project incorporates required percentage 20% of regional materials and products, showing their cost, distance from project to furthest site of extraction or manufacture, and total cost of materials for project.

.5 Low-Emitting Materials:

.1 Submit listing of adhesives and sealants and paints and coatings used in building, showing compliance with VOC and chemical component limits or restrictions requirements.

1.4 QUALITY ASSURANCE

.1 Test Reports: submit certified test reports showing compliance with specified performance characteristics and physical properties.

.2 Certifications: submit product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

1.5 COORDINATION

.1 Coordinate fabrication schedule with construction progress to avoid delaying the work.

.2 Coordinate with Departmental Representative so that site dimensions correspond to established dimensions.

.3 Coordinate shop priming and finishing requirements.

.4 Coordinate installation of anchorages for metal stairs and balustrades:

.1 Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry.

.2 Deliver anchorage and setting materials to site so as not to cause delay to the Project.

.5 Supply items required to be built-in by other Sections, with instructions for installation for work not installed by this Section; install finish hardware and items supplied under other Sections required for completion of components of this Section.

.6 Coordinate nosing with specified stair finishes and set top of nosing level with top of floor finish; set materials flush with concrete surfaces where no floor finish is indicated.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 and with manufacturer's written instructions.

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

.3 Storage and Handling Requirements:

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

.2 Store and protect materials from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

.4 Develop Construction Waste Management Plan related to Work of this Section and in accordance with Section 01 35 21.

.5 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding, and packaging materials as specified in Construction Waste Management Plan in accordance with Section 01 74 20 and Section 01 35 21.

Part 2 PRODUCTS

2.1 SYSTEM DESCRIPTION

.1 Design Requirements:

.1 Design metal stair, balustrade and landing construction and connections to NBC vertical and horizontal live load requirements.

.2 Detail and fabricate stairs to NAAMM Metal Stairs Manual.

2.2 MATERIALS

.1 Steel sections: to CSA G40.20/G40.21 Grade 300 W, minimum 30% recycled content.

.2 Steel plate: to CSA G40.20/G40.21, Grade 260 W, minimum 30% recycled content.

.3 Steel pipe: to ASTM A53/A53M, standard weight, schedule 40 seamless black.

.4 Welding materials: to CSA W59.

.5 Fasteners: Fasteners and mountings shall be non-loosening type and installed so that they will be hidden at completion; drawing sections together to proper, true alignment and capable of site adjustment, as follows:

.1 Bolts: To ASTM A307, hot-dip galvanized in contact with slabs-on-grade.

.2 High Strength Bolts: To ASTM A325.

.3 Spanner type, flat headed machine screws and bolts, with decorative dome nuts on visible screw and bolt extensions to locations indicated on drawings; stainless steel or plain finish to suit materials being fastened.

.6 Anti-slip Nosings: (Stair 1): Surface applied, 35 mm wide, 6 mm high, extruded aluminum with slip resistant inserts consisting of photoluminescent aluminum oxide and silicon carbide granules in an epoxy matrix locked into the extruded channels of the base, projecting minimum of 1.5 mm above extruded channels, colour safety glow.

.7 Vinyl Stair Treads (Stair 2-4): Coordinate with Section 09 65 16 – Resilient Sheet Flooring.

.8 Sheet rubber flooring (Stair Landings): Coordinate with Section 09 65 16 – Resilient Sheet Flooring.

.9 Tactile Warning Surface for Stair Landings: Surface applied, full width of tread by 610 mm deep, vitrified polymer composite (VPC) surface applied warning tiles with truncated dome texture to meet CSA, AODA, ADA and ISO specifications.

.1 Colour: to be selected by Departmental Representative from manufacturer's standard range.

2.3 FABRICATION

.1 Fabricate in accordance with NAAMM, Metal Stair Manual.

.2 Weld connections where possible, otherwise bolt connections. Countersink exposed fastenings, cut off bolts flush with nuts. Make exposed connections of same material, colour and finish as base material on which they occur.

.3 Accurately form connections with exposed faces flush:

.1 Make mitres and joints tight.

.2 Make risers of equal height.

.4 Grind or file exposed welds and steel sections smooth.

.5 Shop fabricate stairs in sections as large and complete as practicable.

2.4 STEEL PAN STAIRS

.1 Fabricate stairs with closed riser steel pan construction.

.2 Form treads and risers from 3 mm thick steel plate. Secure treads and risers to L 35 x 35 x 5 horizontal and vertical welded to stringers.

.3 Form wall stringers from MC 310 x 15.8.

.4 Form outer stringers from MC 310 x 15.8 with 5 mm thick plate fascia welded on.

.5 Form landings from 3 mm thick steel plate, reinforced by L 55 x 55 x 6 mm spaced at 400 mm on centre.

.6 Provide clip angles for fastening of furring channels, where applied finish is indicated for underside of stairs and landings.

.7 Extend stringers around mid landings to form steel base.

.8 Close ends of stringers where exposed.

2.5 PIPE BALUSTRADES

.1 Construct balusters and handrails from steel pipe.

.2 Cap and weld exposed ends of balusters and handrails.

.3 Terminate at abutting wall with end flange.

2.6 CONCRETE FILL AND REINFORCING MATERIALS

.1 Concrete: Normal weight, ready mixed concrete conforming to CAN/CSA A3000, and having minimum 20 MPa compressive strength at 28 days.

.2 Welded wire fabric: Minimum 150 x 150 MW9.1/9.1 conforming to ASTM A185.

2.7 FINISHES

.1 Galvanizing: hot dipped galvanizing with zinc coating 600 g/m^2, Coating Grade 85, to ASTM A123/A123M.

.2 Shop coat primer: to MPI# 23. Ecologo certified.

.3 Zinc primer: zinc rich, ready mix to CAN/CGSB-1.181.

2.8 SHOP PAINTING

.1 Clean surfaces in accordance with Steel Structures Painting Council Manual Volume 2.

.2 Apply one coat of shop primer except interior surfaces of pans.

.3 Apply two coats of primer of different colours to parts inaccessible after final assembly.

.4 Use primer as prepared by manufacturer without thinning or adding admixtures. Paint on dry surfaces, free from rust, scale, grease, do not paint when temperature is below 7 degrees C.

.5 Do not paint surfaces to be field welded.

Part 3 EXECUTION

3.1 EXAMINATION

.1 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts are acceptable for metal stairs and ladders 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 INSTALLATION OF STAIRS

.1 Provide anchorage devices and fasteners to other Sections where necessary for securing metal stairs to in place construction; include threaded fasteners for concrete and masonry inserts, through-bolts, lag bolts, and other connectors.

.2 Install in accordance with NAAMM, Metal Stair Manual.

.3 Install plumb and true in exact locations, using welded connections wherever possible to provide rigid structure.

.4 Hand items over for casting into concrete or building into masonry to appropriate trades together with setting templates.

.5 Do welding work in accordance with CSA W59 unless specified otherwise.

.6 Fastenings:

.1 Use self-tapping shake proof flat round oval headed screws on items requiring assembly by screws or as indicated.

.2 Weld connections where possible, otherwise bolt connections.

.3 Countersink exposed fastenings, cut off bolts flush with nuts.

.4 Make exposed connections of same material, colour and finish as base material on which they occur.

.5 Provide fastenings, including anchor bolts, bolts, lag screws, expansion bolts, straps, brackets, etc. required for the fabrication and erection of work of this Section.

.7 Touch up shop primer to bolts, welds, and burned or scratched surfaces at completion of erection.

3.3 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11.

.3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 20 and 01 35 21.

.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

.4 Perform cleaning as soon as possible after installation to remove construction and accumulated environmental dirt.

.5 Clean and wax plastic handrails immediately prior to final inspection.

.6 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

3.4 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by metal stairs and ladders installation.

3.5 STAIR AND RAILING SCHEDULE

.1 Stair 3, new extension to roof:

.1 Configuration: Parallel Run

.2 Stringers: Structural Steel Channel, size in accordance with delegated design requirements; having a minimum 25 mm clear between tip of nosing and back of tread to face of channel; close ends of stringers where exposed.

.3 Treads and Risers:

.1 Construction: Concrete filled pan, closed riser with sanitary cove; Deflection: L/360

.4 Landings: Concrete filled steel pan reinforced with channels, to provide smooth soffit surface.

.5 Railings: Pipe, return ends to wall.

.6 Handrails: Pipe Rail

.7 Usage Classification: Industrial

.8 Finish: Prime ready for paint as specified in Section 09 91 00.

3.6 PIPE HAND AND GUARD RAILING SCHEDULE

.1 Provide handrails and brackets of the minimum diameter, standard weight pipe required to resist design loads, outer diameter 42 mm unless otherwise indicated on the drawings, and as follows:

.1 Return ends of metal wall handrails toward wall with radius corner and stop handrail 13 mm from wall with flat end.

.2 Space brackets at a maximum of 1200 mm and not more than 300 mm from the ends.

.3 Design railings, and supports, in accordance with loads specified in the Building Code.

.4 At least one handrail at side of stairway or ramp shall extend horizontally not less than 300 mm beyond top and bottom of stairway or ramp in accordance with Building Code.

.5 Weld posts to cast-in designed to resist post loads in accordance with the Building Code.

.6 Cap the ends of tube rails with 3 mm steel plate. Weld all around.

.7 Usage Classification:

.1 Stair 2-4 – Industrial.

.8 Finish: Prime ready for paint as specified in Section 09 91 00.

3.7 LADDER SCHEDULE

.1 Elevator Pit Ladders: Provide one (1) ladder for each pit and confirm location with elevator supplier, and as follows:

.1 Side Rails: Nominal 65 mm x 10 mm side rails at 450 mm O/C, extend side rails to 1220 mm above the entry floor level.

.2 Rungs: Smooth bar stock, nominal 19 mm diameter shouldered and welded at maximum 300 mm O/C, starting at 300 mm above pit floor level.

.3 Ladder Mounts: 65 mm x 10 mm brackets mounted at maximum of 1500 mm O/C with a support at the top of the side rails, and the rungs at 150 mm from the wall face.

.4 Usage Classification: Industrial.

.5 Finish: Prime ready for paint as specified in Section 09 91 00.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Prefabricated custom-designed aluminum bar gratings.

.2 Miscellaneous installation hardware and accessories.

1.2 RELATED REQUIREMENTS

.1 Section 06 10 00 – Rough Carpentry: Wood nailers, curbs, and blocking.

1.3 REFERENCE STANDARDS

.1 American Society for Testing of Materials (ASTM):

.1 ASTM B 221-08, Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes

.2 The National Association of Architectural Metal Manufacturers (NAAMM):

.1 ANSI/NAAMM- MBG-531-09 Metal Bar Grating Manual

1.4 PERFORMANCE REQUIREMENTS

.1 Structural Performance of Gratings: Provide gratings capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:

.2 Walkways: Uniform load of 4.79 kN/sq. m).

.3 Limit deflection to L/240 or 6 mm, whichever is less.

1.5 SUBMITTALS

.1 Submit shop drawings in accordance with Section 01 33 00.

.2 Product Data: Submit manufacturer’s catalog pages including load tables, anchor details and standard installation details.

.3 Shop drawings: Submit for review shop drawings for the fabrication and erection of all gratings, based on construction drawings of current issue. Include plans, elevations, and details of sections and connections as required. Show type and location of all fasteners.

.4 Samples of Grating and Anchorage system shall be submitted for review.

.5 For items where design is delegated to fabricator, provide shop drawings signed and sealed by the professional engineer registered in Province of Work, responsible for the design.

.6 Sustainable Design Submittals: Coordinate project sustainable design requirements with Section 01 35 21; in addition, provide information for following specific requirements of this Section:

1.6 DELEGATED DESIGN REQUIREMENTS

.1 Provide delegated design.

.2 Retain a Professional Engineer, registered in the Province of Work, to design details and connections of steel handrails, and ascertain that the following will comply with the requirements of the Building Code and the Contract Documents:

.1 Selection and design of connections not detailed on the Contract Documents;

.2 Fabrication of components;

.3 Erection of the work of this Section.

1.7 QUALITY ASSURANCE

.1 Fabrication tolerances shall be in accordance with applicable provisions and recommendations of ANSI/NAAMM 531-09 Metal Bar Grating Manual.

.2 Welding: Qualify procedures and personnel according to the following:

.1 AWS D1.2, "Structural Welding Code--Aluminum."

1.8 PROJECT CONDITIONS

.1 Site Measurements: Verify actual locations of walls and other construction contiguous with gratings by site measurements before fabrication and indicate measurements on Shop Drawings.

1.9 COORDINATION

.1 Coordinate installation of anchorages for gratings, grating frames, and supports. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

Part 2 Products

2.1 MATERIALS

.1 Aluminum, General: Provide alloy and temper recommended by aluminum producer for type of use indicated, and with not less than the strength and durability properties of alloy and temper designated below for each aluminum form required.

.2 Extruded Bars and Shapes: ASTM B 221 (ASTM B 221M), alloys as follows:

.1 6061-T6 or 6063-T6, for bearing bars of gratings and shapes.

.2 6061-T1, for grating crossbars.

2.2 FABRICATION

.1 Shop Assembly: Fabricate grating sections in shop to greatest extent possible to minimize site splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.

.2 Cut, drill, and punch material cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1 mm, unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

.3 Form from materials of size, thickness, and shapes indicated, but not less than that needed to support indicated loads.

.4 Fit exposed connections accurately together to form hairline joints.

.5 Aluminum I-Bar Swage Lock Grating type 19-SGI-4: Fabricated by assembled square cross bars through diamond shaped hole in rectangular bearing bars and are permanently locked in place by swaging. – ADD8

.1 Bearing Bar Spacing: 50 mm on center.

.2 Bearing Bar Depth: based on loading requirements and clear span.

.3 Bearing Bar Flange Thickness: 6 mm to provide 44.5 mm space between bars.

.4 Top Surface of Bearing Bars: Striated

.5 Cross Bar Spacing: 100 mm on center.

.6 Fabricate cutouts in grating sections for penetrations indicated. Arrange cutouts to permit grating removal without disturbing items penetrating gratings. Band ends and cuts in grating with bars of same size and material as bearing bars.

.7 Fabrication Tolerances shall be in accordance with ANSI/NAAMM MBG 531-09 Metal Bar Grating Manual.

.8 Removable Grating Sections: Fabricate with banding bars attached by welding to entire perimeter of each section. Include anchors and fasteners of type indicated or, if not indicated, as recommended by manufacturer for attaching to supports.

.1 Provide not less than four flange blocks for each section of aluminum I-bar grating, with block designed to fit over lower flange of I-shaped bearing bars.

2.3 GRATING FRAMES AND SUPPORTS

.1 Frames and Supports for Metal Gratings: Fabricate from metal shapes, plates, and bars of welded construction to sizes, shapes, and profiles indicated and as necessary to receive gratings. Miter and weld connections for perimeter angle frames. Cut, drill, and tap units to receive hardware and similar items.

.1 Unless otherwise indicated, fabricate from same basic metal as gratings.

.2 Unless otherwise indicated, space anchors 600 mm o.c. and provide minimum anchor units in the form of steel straps 32 mm wide by 6 mm thick by 200 mm long.

2.4 ALUMINUM FINISHES

.1 Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

.2 Class I, Clear Anodic Finish: AA-M12C22A41 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, clear coating 0.018 mm or thicker) complying with AAMA 611.

Part 3 Execution

3.1 SITE VERIFICATION

.1 Take site measurements prior to preparation of final shop drawings and fabrication where required to ensure proper fitting of the work.

3.2 INSTALLATION

.1 Install gratings to comply with recommendations of referenced metal bar grating standards that apply to grating types and bar sizes indicated, including installation clearances and standard anchoring details.

.2 Attach removable units to supporting members with type and size of clips and fasteners indicated or, if not indicated, as recommended by grating manufacturer for type of installation conditions shown.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 This Section includes requirements for supply and installation of pre-engineered, modular, glazed structural metal railings with glass guards or balustrades; using glass as the major structural component.

1.2 REFERENCE STANDARDS

.1 American Society for Testing and Materials (ASTM):

.1 ASTM A240/A240M-11b, Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications

.2 ASTM A269-07a, Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service

.3 ASTM A276-06, Standard Specification for Stainless Steel Bars and Shapes

.4 ASTM A554-03, Standard Specification for Welded Stainless Steel Mechanical Tubing

.5 ASTM A666-03, Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar

.6 ASTM B221-12 Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes

.7 ASTM C1107/C1107M-07a, Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink)

.8 ASTM E488-96 (2003,) Standard Test Methods for Strength of Anchors in Concrete and Masonry Elements

.9 ASTM E2353-06, Standard Test Methods for Performance of Glass in Permanent Glass Railing Systems, Guards, and Balustrades

.2 Canadian General Standards Board (CGSB):

.1 CAN/CGSB 12.20-M89, Structural Design of Glass for Buildings

1.3 ADMINISTRATIVE REQUIREMENTS

.1 Coordination: Coordinate installation of anchorages for railings; provide setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry and coordinate delivery so that items are at Project site in time for installation.

.1 Scheduling: Schedule installation so wall attachments are made only to completed walls; do not support railings temporarily by any means that do not satisfy structural performance requirements.

1.4 SUBMITTALS

.1 Submit in accordance with Section 01 33 00 – Submittal Procedures:

.2 Action Submittals:

.1 Product Data: Submit product data for product lines of railings assembled from standard components, and for grout, anchoring cement, and coating products.

.2 Shop Drawings: Submit shop drawings indicating plans, elevations, sections, details, and attachments to other work including; but not limited to, the following:

.1 Structural analysis data for installed products indicated to meet design loads signed and sealed by a qualified professional engineer responsible for preparation.

.2 Sections and plans of railings indicating dimensions and assembly of components.

.3 Indicate fasteners, welds and connection details between railings; handrails; brackets; reinforcements; anchors; and welded and bolted connections.

.4 Methods and locations of all exposed fastenings.

.5 Methods and locations of specified finishes.

.6 Verify dimensions with site conditions before fabricating:

.1 Shop drawings shall indicate verified or established dimensions only.

.2 Terms containing words similar to “verify” or “confirmed by others” will not be acceptable.

.3 Samples: Submit samples for verification by Departmental Representative for each type of exposed finish required and as follows:

.1 Sections of each distinctly different linear railing member, including handrails, top rails, posts, and balusters.

.2 Each type of glass required.

.3 Fittings and brackets.

.4 Welded connections.

.5 Assembled Samples of railing systems, made from full size components, including top rail, post, handrail, and infill:

.1 Show method of finishing members at intersections.

.2 Samples need not be full height.

.3 Informational Submittals: Provide the following submittals within two weeks of award of contract for work of this Section:

.1 Source Quality Control Submittals:

.1 Submit manufacturer’s testing results indicating compliance with applicable performance standards, codes and requirements of this specification

.2 Provide detailed description of results of tests performed including identification of glass rail, guard or balustrade assembly; detailed description of glazing materials, glass type and treatment, glass thickness and component manufacturer's details applicable to installation of work identified in this Section.

1.5 QUALITY ASSURANCE

.1 Regulatory Requirements: Manufacture glass guard and balustrade supports and components in accordance with CAN/CGSB 12.20 and ASTM E2353.

.2 Appearance of Finished Installation: Information on Drawings and in Specifications establishes requirements for system's aesthetic effects and performance characteristics:

.1 Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction.

.2 Performance characteristics are indicated by criteria subject to verification by one or more methods including structural analysis, preconstruction testing, field testing, and in-service performance.

.3 Do not modify intended aesthetic effects, as judged solely by Departmental Representative, except as specifically directed and accepted by the Departmental Representative'.

.4 Submit comprehensive explanatory data to Departmental Representative for review where modifications are proposed to meet performance characteristics.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.

.2 Store materials in clean, dry area indoors in accordance with manufacturer's written instructions.

.3 Do not store materials directly on floor.

.4 Keep materials in manufacturer's original, unopened containers and packaging until installation.

.5 Protect materials and finish during handling and installation to prevent damage.

.6 Protect glass infill panels from edge damage.

1.7 SITE CONDITIONS

.1 Site Measurements: Verify dimensions by site measurements before fabrication and indicate measurements on shop drawings where prefabricated decorative metal railing systems are indicated to fit between, around or be fastened to other construction; coordinate fabrication schedule with construction progress to avoid delaying the Work.

.2 Established Dimensions: Establish dimensions and proceed with fabricating where prefabricated decorative metal railing systems without site measurements where site measurements cannot be made without delaying the Work; coordinate construction to ensure that actual site dimensions correspond to established dimensions; allow for trimming and fitting.

Part 2 Products

2.1 STRUCTURAL METAL RAILINGS

.1 Design Requirements: Design railings capable of withstanding the effects of gravity loads and the following loads and stresses in accordance with Authorities Having Jurisdiction and the following:

.1 Handrails, Top Rails and Guards:

.1 Uniform load of 0.75 kN/m applied in any direction.

.2 Concentrated load of 1.00 kN at any point applied horizontally to top rail and 1.5 k/N applied vertically to top rail.

.3 Individual elements within the assembly designed for a concentrated load of 0.5 kN at any point in the element.

.4 Loads indicated for top rail need not occur simultaneously.

.5 Design loads for balustrades are same as for railings.

.2 Infill of Guards:

.1 Uniform load of 1.2 kN/m^2 applied horizontally.

.2 Loads indicated for infill load and other loads do not occur simultaneously.

.3 Loading Locations:

.1 Height: Apply load at minimum 1070 mm from floor.

.2 Free Standing Glass: Capped by a rail that is continuous over three lites; glass guard shall resist factored design load after failure of alternate lites.

.3 Maximum Deflection: Limit deflection of guard at point of application of load to a maximum of 40 mm; determined by glass failure or removed glass in accordance with CAN/CGSB 12.20 and ASTM E2353.

.2 Component Materials:

.1 Provide materials free from pitting, seam marks, roller marks, stains, discolorations and other imperfections where exposed to view on finished units.

.2 Aluminum: Aluminum alloy and temper recommended by manufacturer for type of use and finish indicated and as follows:

.1 Extruded Bar and Tube: Meeting requirements of ASTM B221, alloy 6063-T5 or T52.

.2 Extruded Structural Pipe and Tube: Meeting requirements of ASTM B429, alloy 6063-T832.

.3 Drawn Seamless Tube: Meeting requirements of ASTM B210M, alloy 6063-T832

.4 Plate and Sheet: Meeting requirements of ASTM B209M, Alloy 6061-T6.

.5 Die and Hand Forgings: Meeting requirements of ASTM B247M, alloy 6061-T6.

.6 Castings: Meeting requirements of ASTM B26M, alloy A3546-T6.

.3 Stainless Steel:

.1 Sheets and Plates: Meeting requirements of ASTM A240/A240M and A666.

.2 Bars and Shapes: Meeting requirements of ASTM A276.

.3 Tubing: Meeting requirements of ASTM A269 and A554.

.3 Pre-Engineered Structural Glass Railings:

.1 Mounting Configuration: Type V One Side Support with Surface Attached/Bolted Handrail– Structural

.2 Handrails: Round; stainless steel; directional satin finish.

.3 Structural Glass Panels: Tempered glass as specified in Section 08 80 50 in thicknesses not less than manufacturer's structural performance requirements for installations indicated, and as follows:

.1 Colour: Clear acid etch

.2 Sizes: Fabricate to sizes required with edge clearances and tolerances in accordance with glass manufacturer.

.3 Thickness: 16 mm

.4 Shapes: Straight.

.5 Edge: 1 mm maximum chamfer, grind and polish exposed edges before tempering.

.6 Labelling: Permanently mark glass with certification label of safety glazing certification council or other certification agency acceptable to Authority Having Jurisdiction.

.4 Handrail Brackets: Rectangular; stainless steel; directional satin finish.

.5 Floor Mount Plates: Recessed mounted extruded aluminum shoe of width to accommodate glass thickness with stainless steel, satin directional finish decorative cladding.

.6 Handrail Stainless steel, round, satin directional finish.

.7 Handrail Brackets:

.1 Type: Bolt through.

.2 Material: Stainless steel.

.3 Finish: Directional satin finish.

.8 Hardware: Stainless steel, Type 304, finish to match adjacent materials.

.4 Accessories:

.1 Anchors: Provide post installed anchors as recommended by manufacturer for anchoring to concrete slab and metal stud gypsum board wall assemblies, and as follows:

.1 Material: Stainless steel, Type 304.

.2 Safety Factor: Capable to sustain, without failure, load imposed with a safety factor of 4, as determined by testing in accordance with ASTM E488.

.2 Brackets and Flanges: Cast of formed metal of same type of material and finish as supported rails and as follows:

.1 Provide cast brackets with flange tapped for concealed anchorage to threaded hanger bolt.

.2 Provide formed or cast brackets with predrilled holes for exposed bolt anchorage.

.3 Provide formed steel brackets with predrilled holes for bolted anchorage and with snap-on covers that match rail finish and conceals bracket base and bolt head.

.4 Provide brackets with interlocking pieces that conceal anchorage; locate set screws on bottom of brackets.

.3 Welding Rods and Bare Electrodes: Select in accordance with CWB specifications for metal alloy welded; provide type and alloy recommended by producer of metal being welded and as required for color match, strength, and compatibility in fabricated items.

.4 Bituminous Paint: Cold applied asphalt emulsion in accordance with ASTM D1187, to separate dissimilar metals and concrete in contact with aluminum components.

.5 Non-Shrink, Non-Metallic Grout: Factory packaged, non-staining, non-corrosive, non-gaseous expanding grout, having a minimum 55 MPa compressive strength; in accordance with ASTM C1107; specifically recommended by manufacturer for interior applications.

.6 Anchoring Cement: Manufacturer recommended, factory packaged, non-shrink, non-staining, hydraulic controlled expansion cement formulation for mixing with water at Project site to create pourable anchoring, patching and grouting compound.

2.2 FABRICATION

.1 Fabricate decorative metal railings for compliance with structural requirements of building code and requirements of Authority Having Jurisdiction.

.2 Cutting Metal: Machine square ends, without burrs; bevel ends to produce smooth rigid hairline joints where exposed.

.3 Railing Materials: Fabricate decorative metal railing materials straight and true, without scratches, grind marks, creases, and other surface blemishes.

.4 Structural Infill Panels: Fabricate infill panels to appear visually flat; cut laminated and tempered glass to final size and shape before heat treatment; provide for proper edge clearance and bite on glass.

.5 Shop Assembly:

.1 Pre-assemble decorative metal railings before shipping to greatest extent possible to minimize field splicing and assembly.

.2 Disassemble units only as necessary for shipping and handling limitations.

.3 Clearly mark units for re-assembly and for coordination with shop drawings.

.4 Ship finished materials with protective coverings.

2.3 SOURCE QUALITY CONTROL

.1 Tests: Conduct testing in accordance with ASTM E2353 and provide written report indicating the following:

- .1 Static Strength.
- .2 Impact Performance.
- .3 Post Breakage Retention Characteristics.
- .4 Include detailed description of:
  - .1 Bill of Materials.
  - .2 Assembly drawing with glazing details.
  - .3 Performance level and load used.
  - .4 Statement by test method as to the performance of the glass rail, guard or balustrade specimen(s).
  - .5 Method of installation or installation fastening used.
  - .6 Test methods used; with results indicated as pass or fail; numeric values are not required for precision or bias measurements.

Part 3 Execution

3.1 EXAMINATION

.1 Examine areas to receive structural metal railings and note conditions that adversely affect installation or subsequent use of decorative railing system; coordinate with Contractor for correction of unacceptable site conditions.

.2 Starting work by this Section will signify acceptance of conditions.

3.2 INSTALLATION

.1 Install decorative metal railings in accordance with manufacturer’s written instructions and reviewed shop drawings, and as follows:

- .1 Install decorative metal railings plumb, level, square, true to line, and rigid.
- .2 Fit exposed connections to form tight, hairline joints.
- .3 Attach decorative metal railings securely in place using anchors and other components supplied or approved by manufacturer.
- .4 Attach decorative metal railings to supports; ensure exposed surfaces of decorative metal railings are smooth with no sharp, rough, or uneven areas.
- .5 Do not damage material finishes by welding, cutting, or abrading; do not cut, drill, or alter glass infill panels.
- .6 Adjust railings before anchoring so that they match alignment at abutting joints.
- .7 Use anchorage devices and fasteners where necessary for securing railings and for properly transferring loads to in-place construction.

.2 Site Tolerances:

- .1 Variation from Plumb, Posts: Maximum 3 mm in 1 metre.
- .2 Offset from True Alignment: Maximum 6 mm in 3.6 metres of length, non-cumulative.

.3 Align handrails so variations from level for horizontal members and variations from parallel, with rake of steps and ramps for sloping members: Maximum 6 mm in 7.6 metres of length, non-cumulative.

3.3 SITE QUALITY CONTROL

.1 Tests: Departmental Representative will conduct testing using a third party testing agency in accordance with ASTM E2353 and provide written report indicating the following:

.1 Static Strength.

.2 Impact Performance.

.3 Post Breakage Retention Characteristics.

.4 Include detailed description of:

.1 Bill of Materials.

.2 Assembly drawing with glazing details.

.3 Performance level and load used.

.4 Statement by test method as to the performance of the glass rail, guard or balustrade specimen(s).

.5 Method of installation or installation fastening used.

.6 Test methods used; with results indicated as pass or fail; numeric values are not required for precision or bias measurements.

.5 Testing will be performed on a sample glass installation consisting of three panels of decorative metal and glass railing system at a location near actual site installed materials.

.6 Replace broken or deformed materials resulting from passed tests; reconfigure and retest assemblies resulting from failed tests.

3.4 CLOSEOUT ACTIVITIES

.1 Adjusting: Repair minor damages to finish in accordance with manufacturer’s instructions; replace materials that cannot be satisfactorily repaired.

.2 Cleaning: Clean decorative metal railings promptly after installation in accordance with manufacturer’s instructions.

.3 Protection: Protect installed decorative metal railings from damage during construction.

END OF SECTION

Part 1 GENERAL

1.1 REFERENCES

.1 American Wood Protection Association (AWPA):

.1 AWPA P5-15, Standard for Waterborne Preservatives.

.2 CSA International

.1 CAN/CSA-O80 Series-15, Wood Preservation, Includes Update No. 1 (2008).

.2 CSA B111-1974(R2003), Wire Nails, Spikes and Staples.

.3 CSA O112-M Series 1977(R2006), Standards for Wood Adhesives.

.4 CSA O121-08 (R2013), Douglas Fir Plywood.

.5 CSA O141-05 (R2014), Softwood Lumber.

.3 Canada Green Building Council (CaGBC)

.1 LEED Canada-NC 2009, LEED (Leadership in Energy and Environmental Design): Green Building Rating System Reference Package For New Construction and Major Renovations (including Addenda).

.4 National Lumber Grades Authority (NLGA)

.1 Standard Grading Rules for Canadian Lumber 2014.

1.2 QUALITY ASSURANCE

.1 Lumber by grade stamp of an agency certified by Canadian Lumber Standards Accreditation Board.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for wood products and accessories and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Sustainable Design Submittals:

.1 LEED Canada-NC Submittals: in accordance with Section 01 35 21.

.2 Construction Waste Management:

.1 Submit project Waste Management Plan highlighting recycling and salvage requirements.

.2 Submit calculations on end-of-project recycling rates, salvage rates, and landfill rates demonstrating that 95% of construction wastes were recycled or salvaged.

.3 Regional Materials: submit evidence that project incorporates required percentage 20% of regional materials and products, showing their cost, distance from project to furthest site of extraction or manufacture, and total cost of materials for project.

.4 Wood Certification: submit vendor's Chain-of-Custody Certificate number for CAN/CSA-Z809, SFI or Forestry Stewardship Council (FSC) certified wood.

.5 Low-Emitting Materials:

.1 Submit listing of adhesives and sealants and paints and coatings used in building, showing compliance with VOC and chemical component limits or restriction requirements.

.2 Submit listing of composite wood products used in building, stating that they contain no added urea-formaldehyde resins, and laminate adhesives used in building, stating that they contain no urea-formaldehyde.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 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 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 of pallets, crates, padding and packaging materials as specified in Waste Reduction Workplan in accordance with Section 01 74 20.

Part 2 PRODUCTS

2.1 MATERIALS

.1 Lumber: softwood, S4S, moisture content S-DRY graded and stamped in accordance with following standards:

.1 CSA O141.

.2 NLGA Standard Grading Rules for Canadian Lumber.

.2 Preservative treated plywood: Douglas Fir to CSA O121, G1S good one side, pressure treated with CCA to CAN/CSA-O80.9, minimum retention 4.0 kg/m^3 by assay.

.1 Preservative: chromated copper arsenate (CCA) to AWPA P5 as amended by CAN/CSA-O80-Series.

.3 Furring, blocking, nailing strips, strapping, grounds, rough bucks, bracing, bridging, curbs, fascia backing and sleepers: NLGA spruce, pine or fir (SPF), 121c. and pine, 113d.

2.2 ACCESSORIES

.1 Sealants: in accordance with Section 07 92 00.

.2 General purpose adhesive: to CSA O112 Series.

.3 Nails, spikes and staples: to CSA B111.

.4 Bolts: 12.5 mm diameter unless indicated otherwise, complete with nuts and washers.

.5 Proprietary fasteners: toggle bolts, expansion shields and lag bolts, screws and lead or inorganic fibre plugs, recommended for purpose by manufacturer.

Part 3 EXECUTION

3.1 EXAMINATION

.1 Verification of Conditions: verify conditions of substrates previously installed under other Sections are acceptable for product 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 PREPARATION

.1 Treat surfaces of material with wood preservative, before installation.

.2 Apply preservative by dipping, or by brush to completely saturate and maintain wet film on surface for minimum 3 minute soak on lumber.

.3 Re-treat surfaces exposed by cutting, trimming or boring with liberal brush application of preservative before installation.

.4 Treat material as follows:

.1 Wood cants, fascia backing, curbs, nailers, sleepers on roof deck.

3.3 INSTALLATION

.1 Apply wood preservative to wood in contact with roofing.

.2 Treat surfaces of pressure treated wood which are cut or bored after pressure treatment with field applied wood preservative.

.3 Install members true to line, levels and elevations, square and plumb to a tolerance of 1:600 and rigidly secure in place.

.4 Install wood blocking to ensure that curbs and sleepers for HVAC and mechanical equipment are level.

.5 Wood blocking and plywood are considered part of the roof, made watertight by the end of each working day to eliminate moisture infiltration into the roof system.

.6 Install furring and blocking as required to space-out and other work as required.

.7 Install sleepers as indicated.

.8 Countersink bolts where necessary to provide clearance for other work.

.9 Secure exterior work with galvanized or non- ferrous fasteners.

.10 Apply continuous bead of sealant at junction between roof deck and abutting parapet wall.

3.4 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11.

.3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 20.

.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 ASTM International

.1 ASTM A653/A653M-15, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

.2 Canada Green Building Council (CaGBC)

.1 LEED Canada For New Construction and Major Renovations 2009.

.3 CSA International

.1 CSA B111-74(R2003), Wire Nails, Spikes and Staples.

.2 CSA O80 Series-15, Wood Preservation.

.3 CSA O86-14, Engineering Design in Wood.

.4 CAN/CSA-Z809-08(R2013), Sustainable Forest Management.

.4 Forest Stewardship Council (FSC)

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

.2 FSC-STD-20-002-2004, Structure and Content of Forest Stewardship Standards V2-1.

.3 FSC Accredited Certified Bodies.

.5 Green Seal Environmental Standards (GS)

.1 GS-36-00, Commercial Adhesives.

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

.1 Material Safety Data Sheets (MSDS).

.7 National Lumber Grades Authority (NLGA)

.1 NLGA Standard Grading Rules for Canadian Lumber 2010.

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

.1 SCAQMD Rule 1113-A2007, Architectural Coatings.

.2 SCAQMD Rule 1168-A2005, Adhesives and Sealants Applications.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for wood decking and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Submit two copies of WHMIS MSDS.

.3 Shop Drawings:

.1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Ontario, Canada.

.4 Certifications: submit certificates signed by manufacturer certifying materials comply with specified performance characteristics and physical properties.

.5 Sustainable Design Submittals:

.1 LEED Canada-NC Submittals: in accordance with Section 01 35 21.

.2 Construction Waste Management:

.1 Submit project Waste Management Plan highlighting recycling and salvage requirements.

.2 Submit calculations on end-of-project recycling rates, salvage rates, and landfill rates demonstrating that 75% of construction wastes were recycled or salvaged.

.3 Recycled Content:

.1 Submit listing of recycled content products used, including details of required percentages or recycled content materials and products, showing their costs and percentages of post-consumer and post-industrial content, and total cost of materials for project.

.4 Regional Materials: submit evidence that project incorporates required percentage 20% of regional materials and products, showing their cost, distance from project to furthest site of extraction or manufacture, and total cost of materials for project.

.5 Certified Wood:

.1 Submit listing of wood products and materials used, produced from wood obtained from forests certified by FSC Accredited Certification Body in accordance with FSC-STD-01-001.

.2 Submit vendor's FSC Chain-of-Custody Certificate number.

.6 Low-Emitting Materials:

.1 Submit listing of adhesives and sealants and paints and coatings used in building, comply with VOC and chemical component limits or restriction requirements.

.2 Submit listing of composite wood products used in building, stating that they contain no added urea-formaldehyde resins, and laminate adhesives used in building, stating that they contain no urea-formaldehyde.

1.3 QUALITY ASSURANCE

.1 Lumber identification: by grade stamp of an agency certified by Canadian Lumber Standards Accreditation Board.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 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 and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect wood decking from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

.4 Develop Construction Waste Management Plan related to Work of this Section and in accordance with Section 01 35 21.

.5 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding and packaging materials as specified in Construction Waste Management Plan in accordance with Section 01 74 20.

Part 2 PRODUCTS

2.1 MATERIALS

.1 Wood decking: to NLGA standard Grading Rules for Canadian Lumber commercial grade spruce-pine-fir as indicated on the drawings, predrilled at 750 mm on centre for lateral spiking, single tongue and groove and "Veed" one side. Kiln dry decking to 15% maximum moisture content. CAN/CSA-Z809, SFI or Forestry Stewardship Council (FSC) certified.

.2 Decking lengths: 1.8 to 6 m or longer with a minimum of 90% planks exceeding 3 m. Square end trimmed. For single spans shorter than 3 m use decking of same length as span.

.3 Nails: to CSA B111, galvanized finish; sizes to CSA O86. Supply 200 mm spiral spikes for lateral nailing.

.4 Splines: galvanized metal, as recommended by decking manufacturer.

.5 Wood preservative: odourless chemical type to CSA O80 for natural or stained finish.

.6 Wood preservative: water borne type to CSA O80 for stained finish.

.7 Adhesive and Sealants: in accordance with Section 07 92 00.

.1 Adhesives and Sealants: VOC limit 30g/L maximum to SCAQMD Rule 1168.

.2 Coatings: VOC limit 350g/L maximum to SCAQMD Rule 1113.

Part 3 EXECUTION

3.1 EXAMINATION

.1 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts are acceptable for wood decking installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Departmental Representative.

.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 INSTALLATION

.1 Do wood deck work to CSA O86 except where specified otherwise.

.2 Install decking to CSA O86, continuous over two span pattern.

.3 Supply minimum of 1 bearing support for each plank except extend cantilevers over two supports. Install sloping deck with tongues up. Join butt ends with splines to assure tight square fit.

.4 Stagger end joints in adjacent planks minimum of 0.5 m.

.1 Separate joints in same area by at least 2 intervening courses.

.2 Avoid joints in first fifth of end spans.

.3 Minimize joints in middle third of span.

.5 Apply preservative to end cuts of pressure treated lumber.

3.3 FIELD QUALITY CONTROL

.1 Testing:

.1 Testing moisture content of delivered material will be performed by testing laboratory designated by Departmental Representative.

.2 Departmental Representative will pay for costs of testing in accordance with Section 01 29 83.

.3 Testing moisture content of delivered material will be by testing laboratory designated by Departmental Representative.

3.4 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11.

.3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 20 and 01 35 21.

.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 wood decking installation.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Requirements for supply and installation of exterior grade gypsum sheathing panels for walls and soffits.

1.2 RELATED REQUIREMENTS

.1 Section 05 41 00 –Structural Metal Stud Framing

.2 Section 06 10 00 – Rough Carpentry

.3 Section 07 25 13 – Air and Vapour Membranes: Coordinate compatibility of primers and membranes with glass faced gypsum core sheathing materials.

.4 Section 07 42 29 – Ceramic Wall Panels

.5 Section 09 21 16 – Gypsum Board Assemblies: Interior wall framing and gypsum panels.

1.3 DEFINITIONS

.1 Refer to ASTM C11 for definitions of terms for gypsum board assemblies not defined in this Section or in other referenced standards.

1.4 REFERENCE STANDARDS

.1 American Society for Testing and Materials (ASTM):

.1 ASTM C11-13, Standard Terminology Relating to Gypsum and Related Building Materials and Systems

.2 ASTM C954-11, Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs from 0.033 in. (0.75 mm) to 0.112 in. (2.84 mm) in Thickness

.3 ASTM C1177/C1177M-13, Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing

.4 ASTM C1280-13, Standard Specification for Application of Exterior Gypsum Panel Products for Use as Sheathing

.2 Canadian Construction Association:

.1 Standard Construction Document CCA 82-2004, Mould Guidelines for the Canadian Construction Industry

.3 Gypsum Association (GA):

.1 GA-253-12, Application of Gypsum Sheathing

.2 GA-254-07, Fire Resistant Gypsum Sheathing

.4 Underwriters Laboratories of Canada (ULC):

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

1.5 ADMINISTRATIVE REQUIREMENTS

.1 Coordination with Air and Vapour Membranes: Coordinate with air and vapour membrane manufacturer and verify compatibility of exterior gypsum sheathing materials with membrane primers.

1.6 SUBMITTALS

.1 Provide required information in accordance with Section 01 33 00 – Submittal Procedures.

.2 Informational Submittals: Provide following submittals during the course of the Work:

.1 Fire Ratings: Submit ULC Assembly Listings and Materials cut sheets for fire rated assemblies as follows:

.1 Not later than 30 working days following Award of Contract, submit copies of ULC Assembly and Materials Listing for indicating ULC Number and how assembly meets the rating criteria for assemblies listed on drawings or meets requirements of Appendix D of the National Building Code for review by the Departmental Representative.

.2 Use the same system and material as would be required for a tested assembly for the project; ULC Listings are tested with the specific materials indicated; substitutions will not be permitted unless evidence of equivalency is confirmed.

.3 Submit manufacturer's product data for materials and prefabricated devices, providing descriptions are sufficient for identification at job site; include manufacturer's printed instructions for installation.

1.7 DELIVERY, STORAGE AND HANDLING

.1 Delivery and Acceptance Requirements: Deliver materials in original packages, containers, or bundles bearing brand name and identification of manufacturer or supplier.

.2 Storage and Handling Requirements: Store materials under cover, keep dry and protected against damage from weather, direct sunlight, surface contamination, corrosion, construction traffic, and other causes; stack gypsum panels flat and on sufficient spacers to prevent sagging, not in direct contact with floor surfaces.

1.8 SITE CONDITIONS

.1 Ambient Conditions: Store and install materials specified in this Section in accordance with requirements of GA-253 Manual.

.2 Mould Prevention: Transport and store materials specified in this Section in accordance with manufacturer’s written instructions and CCA 82.

Part 2 Products

2.1 MATERIALS

.1 Exterior Sheathing: Fibreglass matt faced gypsum based sheathing panels meeting requirements of ASTM C1177/C1177M, formulated specifically for exterior use in water managed building envelope systems; fire rated in accordance with CAN/ULC S102, in maximum lengths and widths practical to minimize joints in each area and to correspond with support system; and as follows:

.1 Thickness: As Indicated on Drawings

.2 Location: Exterior walls, soffits, and parapets.

.2 Fasteners: Corrosion resistant, ceramic-silicone resin coated self-drilling screws.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: Verify that substrates and other conditions affecting performance of installed sheathing are in accordance with manufacturer’s written requirements before starting work of this Section.

.1 Correct unsatisfactory conditions; installation of products specified in this Section will denote acceptance of site conditions.

3.2 PREPARATION

.1 Fire Rated Construction: Install materials forming a part of fire rated construction to meet ULC listed construction requirements submitted by Subcontractor:

.1 Install in accordance with GA-254 and manufacturer’s instructions to achieve required fire rating.

.2 Install fire rated gypsum sheathing vertically; horizontal installation does not meet testing standard unless horizontal blocking is installed behind horizontal joints.

3.3 INSTALLATION

.1 Vertical Installation: Install gypsum panels in accordance with ASTM C1280, GA-253 and manufacturer’s written instructions and as follows:

.1 Form expansion joints to account for building movements using back-to-back framing members and edge trims, and a break in gypsum panel over structural movement joints and floor slab control joints as follows:

.1 Install expansion joints incorporating continuous air and vapour membranes and with sufficient gap to allow for projected building movements.

.2 Form expansion joints to meet fire ratings required for remainder of wall or soffit construction.

.2 Install and space fasteners in gypsum panels in accordance with referenced gypsum board application standard and manufacturer's written requirements.

.3 Install fire rated and labelled gypsum board at locations indicated on Drawings; continue fire and smoke rated wall construction behind and around recessed items larger than a double gang switch box to maintain wall fire rating.

.2 Horizontal Installation: Install exterior soffit board ASTM C1280, GA-253 and manufacturer's written instructions and as follows:

.1 Install gypsum soffit board perpendicular to supports, with end joints staggered and located over supports.

.2 Install with 6 mm open gap where panels abut other construction or structural penetrations.

.3 Fasten with corrosion resistant screws.

END OF SECTION

Part 1 GENERAL

1.1 REFERENCES

.1 American National Standards Institute (ANSI)

.1 ANSI/HPVA HP-1-09, Standard for Hardwood and Decorative Plywood.

.2 Architectural Woodwork Manufacturers Association of Canada (AWMAC), Architectural Woodwork Institute (AWI) and Woodwork Institute (WI).

.1 AWI/AWMAC/WI Architectural Woodwork Standards, AWS Edition 2-2014.

.3 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-71.20-M88, Adhesive, Contact, Brushable.

.4 CSA International

.1 CSA B111-74(R2003), Wire Nails, Spikes and Staples.

.2 CSA O121-08(R2013), Douglas Fir Plywood.

.3 CSA O151-09(R2014), Canadian Softwood Plywood.

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

.1 Material Safety Data Sheets (MSDS).

.6 National Electrical Manufacturers Association (NEMA)

.1 ANSI/NEMA LD-3-05, High-Pressure Decorative Laminates (HPDL).

.7 National Hardwood Lumber Association (NHLA)

.1 Rules for the Measurement and Inspection of Hardwood and Cypress 1998.

.8 National Lumber Grades Authority (NLGA)

.1 Standard Grading Rules for Canadian Lumber 2014.

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

.1 SCAQMD Rule 1113-A2007, Architectural Coatings.

.2 SCAQMD Rule 1168-A2005, Adhesives and Sealants Applications.

.10 Sustainable Forestry Initiative (SFI).

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for architectural woodwork and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Submit two copies of WHMIS MSDS.

.3 Shop Drawings:

.1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Ontario, Canada.

.2 Indicate details of construction, profiles, jointing, fastening and other related details.

.1 Scales: profiles full size, details half full size.

.3 Indicate materials, thicknesses, finishes and hardware.

.4 Indicate locations of service outlets in casework, typical and special installation conditions, and connections, attachments, anchorage and location of exposed fastenings.

.4 Samples:

.1 Submit for review and acceptance of each unit.

.2 Samples will be returned for inclusion into work.

.3 Submit duplicate samples of plywood: sample size 300 x 300 mm.

.4 Submit duplicate samples of laminated plastic for colour selection.

.5 Submit duplicate samples of laminated plastic joints, edging, cutouts and postformed profiles.

.6 Submit duplicate samples of solid surface material: sample size 100 x 100 mm.

.7

.5 Certifications: submit AWMAC GIS certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.1 Architectural woodwork shall be manufactured and/or installed to the current AWMAC Architectural Woodwork Standards and shall be subject to an inspection at the plant and/or site by an appointed AWMAC Certified Inspector.

.2 Inspection costs shall be included in the bid price for this project. Contact your local AWMAC Chapter for details of inspection costs.

.3 Shop drawings shall be submitted to the AWMAC Chapter office for review before work commences.

.4 Work that does not meet the AWMAC Architectural Woodwork Standards, as specified, shall be replaced, reworked and/or refinished by the architectural woodwork contractor, to the approval of AWMAC, at no additional cost to the. Departmental Representative.

1.3 QUALITY ASSURANCE

.1 Lumber by grade stamp of an agency certified by Canadian Lumber Standards Accreditation Board.

.2 Plywood, particleboard, OSB and wood based composite panels to CSA and ANSI standards.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 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.

.1 Protect millwork against dampness and damage during and after delivery.

.2 Store millwork in ventilated areas, protected from extreme changes of temperature or humidity.

.3 Storage and Handling Requirements:

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

.2 Store and protect architectural woodwork from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

Part 2 PRODUCTS

2.1 MATERIALS

.1 Wood Mouldings: Provide interior millwork in accordance with AWS Section 6 for profiles and configurations required for the project and as follows:

.1 Hardwood Trim: Selected to meet AWS Custom Grade, kiln dried; species white oak finished lumber (S4S), selected for compatible grain and colour, edge grain (vertical), suitable for clear stained finish.

.2 Douglas fir plywood (DFP): to CSA O121, standard construction, FSC certified.

.3 Plywood resin to contain no added urea-formaldehyde.

.2 Industrial Particleboard: Meeting ANSI 208.1 Grade M-2 for interior use, minimum 720 kg/m³ density and Grade M-3, minimum 750 kg/m³ particleboard for shelves; clearly mark panels with grade mark in visible location; extruded particleboard having loose cores with voids will not be permitted.

.1 Particleboard to contain no added urea formaldehyde.

.3 Laminated plastic for flatwork (PL): to NEMA LD3, Grade VGL, Type HD, pattern, colour, finish as selected by Departmental Representative.

.4 Laminated plastic for postforming work (PL): to NEMA LD3, Grade VGL, Type HD, pattern, colour, finish as selected by Departmental Representative.

.5 Thermofused Melamine: to NEMA LD3 Grade VGL.

.1 High wear resistant thermofused melamine: equal or exceed 400 cycles (Minimum standard for HPL abrasion test).

.6 Solid Surfacing Sheet: Cast, nonporous, filled polymer, with through body colour meeting requirements of NEMA LD 3, and having the following nominal properties:

.1 Thickness: As shown on Drawings.

.2 Surface Burning Characteristics: in accordance with CAN/ULC S102 and as follows:

.1 Flame Spread: Maximum 25

.2 Smoke Developed: Maximum 25

.3 Density (ANSI Z124.3): Minimum 1.7g/cm^3

.7 Nails and staples: to CSA B111.

.8 Wood screws: type and size to suit application.

.9 Splines: metal.

.10 Sealant: in accordance with Section 07 92 00.

.1 Sealants: VOC limit 250 g/L maximum to SCAQMD Rule 1168.

.11 Laminated plastic adhesive:

.1 Adhesive: contact adhesive to CAN/CGSB-71.20.

.2 Adhesives: VOC limit 120 g/L maximum to SCAQMD Rule 1168 and GS-36.

.3 Clear Wood Finishes: VOC limit 550 g/L maximum to SCAQMD Rule 1113

2.2 MANUFACTURED UNITS

.1 Casework:

.1 Fabricate caseworks to AWI/AWMAC/WI AWS premium quality grade.

.2 Furring, blocking, nailing strips, grounds and rough bucks and sleepers.

.1 Board sizes: "standard" or better grade.

.2 Dimension sizes: "standard" light framing or better grade.

.3 Urea-formaldehyde free.

.3 Framing NLGA Grade No.1.

.4 Countertops, Solid Surface:

.1 Edges: Built up with chamfer and drip edge.

.2 Splash: Coved Splash where splashes are shown.

.5 Case bodies (ends, divisions and bottoms).

.1 Grade M-2 for interior use, minimum 720 kg/m³ density and Grade M-3, minimum 750 kg/m³ particleboard for countertops and shelves, thickness as indicated on Drawings.Backs:

.1 Grade M-2 for interior use, minimum 720 kg/m³ density.Interiors: Thermofused Melamine: to NEMA LD3 Grade VGL.

.8 Shelving:

.1 Grade M-3, minimum 750 kg/m³ particleboard, thickness as indicated on DrawingsEdge banding: High Pressure Decorative Laminate for HPDL Finished Surfaces; colour to match with surface finish

.10 Drawers:

.1 Fabricate drawers to AWI/AWMAC/WI Architectural Woodwork Standards premium grade supplemented as follows:

.2 Sides and Backs.

.1 Grade M-2 for interior use, minimum 720 kg/m³ density, thickness as indicated on Drawings.Bottoms:

.1 Grade M-2 for interior use, minimum 720 kg/m³ density, thickness as indicated on Drawings.Fronts:

.1 Grade M-2 for interior use, minimum 720 kg/m³ density, thickness as indicated on Drawings.Casework Doors:

.1 Grade M-2 for interior use, minimum 720 kg/m³ density, thickness as indicated on Drawings.**HARDWARE**

.1 Cabinet hinge: to ANSI/BHMA-A156.9-2015, type B81602 or type B81612.

.2 Magnetic catch: to ANSI/BHMA-A156.9-2015, type B13171, heavy duty.

.3 Cabinet pull: to ANSI/BHMA-A156.9-2015, type B32011, and CSA B651-12, finish 628, satin aluminum, 76.2 mm centres, back mounted.

.4 Adjustable shelf standard: to ANSI/BHMA- A156.9-2015, type B84061, recessed application, open shelf rest type B84091.

.5 Drawer slide set: heavy duty to ANSI/BHMA- A156.9-2015, type B05051, with zinc plate finish, progressive full extension.

.6 Draw bolts: type recommended by laminated plastic manufacturer.

.7 Pull-Out Waste Bin System:

.1 Full extension sliding waste system complete with two (2) plastic bins per unit and lids fixed to remain within cabinet when system is in open position, complete with all hardware and accessories for a functioning sliding waste bin system and as follows:

.1 Capacity: 50kg; 70L minimum.

.2 Bin Colour: Grey

.3 Dimensions: to suit cabinet dimensions shown on Drawings

2.4 FABRICATION

.1 Set nails and countersink screws apply stained wood filler to indentations, sand smooth and leave ready to receive finish.

.2 Shop install cabinet hardware for doors, shelves and drawers. Recess shelf standards unless noted otherwise.

.3 Shelving to cabinetwork to be adjustable unless otherwise noted.

.4 Provide cutouts for plumbing fixtures, inserts, appliances, outlet boxes and other fixtures.

.5 Shop assemble work for delivery to site in size easily handled and to ensure passage through building openings.

.6 Obtain governing dimensions before fabricating items which are to accommodate or abut appliances, equipment and other materials.

.7 Ensure adjacent parts of continuous laminate work match in colour and pattern.

.8 Veneer laminated plastic to core material in accordance with adhesive manufacturer's instructions. Ensure core and laminate profiles coincide to provide continuous support and bond over entire surface. Use continuous lengths up to 2400 mm. Keep joints 600 mm from sink cutouts.

.9 Form shaped profiles and bends as indicated, using postforming grade laminate to laminate manufacturer's instructions.

.10 Use straight self-edging laminate strip for flatwork to cover exposed edge of core material. Chamfer exposed edges uniformly at approximately 20 degrees. Do not mitre laminate edges.

.11 Apply laminate backing sheet to reverse side of core of plastic laminate work.

.12 Apply laminated plastic liner sheet where indicated.

.13 Solid Surface Countertops: Install using skilled personnel specializing in the type of work indicated; cut solid surface accurately to conform to shape and dimensions required with exposed surfaces true:

.1 Perform cutting and drilling not provided by supplier.

.2 Do not use impact or hammer drills; use only diamond drill bits.

.3 Carefully cut and fit edges and grind to a perfect fit in a manner that does not impair strength or appearance.

.4 Machine polish exposed edges; do not use waxes, sealers or coatings.

.5 Patching or other forms of concealment to cover defects in material or workmanship will not be permitted.

.6 Identify the rift direction on a concealed surface of each unit. Panels shall be cut generally parallel to the rift and panels shall be cut in the same direction.

2.5 FINISHING

.1 Finish in accordance with Section 09 91 23.

Part 3 EXECUTION

3.1 EXAMINATION

.1 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts are acceptable for architectural woodwork installation in accordance with manufacturer's instructions.

.1 Visually inspect substrate in presence of Departmental Representative.

.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 INSTALLATION

.1 Do architectural woodwork to AWI/AWMAC/WI Architectural Woodwork Standards.

.2 Install prefinished millwork at locations shown on drawings.

.1 Position accurately, level, plumb straight.

.3 Fasten and anchor millwork securely.

.1 Supply and install heavy duty fixture attachments for wall mounted cabinets.

.4 Use draw bolts in countertop joints.

.5 Scribe and cut as required to fit abutting walls and to fit properly into recesses and to accommodate piping, columns, fixtures, outlets or other projecting, intersecting or penetrating objects.

.6 At junction of plastic laminate counter back splash and adjacent wall finish, apply small bead of sealant in accordance with Section 07 92 00.

.7 Apply water resistant building paper over wood framing members in contact with masonry or cementitious construction.

.8 Fit hardware accurately and securely in accordance with manufacturer's written instructions.

.9 Site apply laminated plastic to units as indicated.

.1 Adhere laminated plastic over entire surface.

.2 Make corners with hairline joints.

.3 Use full sized laminate sheets.

.4 Make joints only where approved by Departmental Representative.

.5 Slightly bevel arises.

.10 For site application, offset joints in plastic laminate facing from joints in core.

.11 Install wall base to walls, anchoring securely with proper hardware:

.1 Fasten pieces together in runs to provide a rigid rail construction, true, level and properly aligned.

.2 Apply 13 mm wide x 3 mm thick medium density adhesive backed tape gasket continuous along top and bottom edge where mounted snug to wall or cabinet work to close variation gaps.

3.3 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11.

.1 Clean millwork and cabinet work inside cupboards and outside surfaces.

.2 Remove excess glue from surfaces.

.3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 20.

.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

.4 Sand smooth, fill and retouch nicks, chips and scratches; replace damaged items that cannot be repaired.

3.4 PROTECTION

.1 Protect millwork and cabinet work from damage until final inspection.

.2 Protect installed products and components from damage during construction.

.3 Repair damage to adjacent materials caused by architectural woodwork installation.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 This Section provides common design requirements relating to technical specification sections forming a part of fire and smoke rated assemblies and systems for installation by specialized Subcontractor's:

.1 Design of Rated Systems is a joint responsibility of the Departmental Representative, the Contractor, the manufacturer and installing Subcontractor, and the Authority Having Jurisdiction.

.2 Drawings indicate suggested solutions to fire and smoke rated separations, assemblies and materials using Standard Details based on generic information and time assigned materials listings listed in the Building Code for components required to meet the intent of the fire and smoke rated System

.3 Drawings do not portray complete assessment of all conditions associated with fire and smoke rated separations, assemblies and materials.

.4 Delegated design requirements of this section are included to complete the required details for the Project.

.5 Delegated design submittals are required so that the Departmental Representative can accurately and completely fulfill the requirements for the submission of schedules required by the Authorities Having Jurisdiction.

.2 This Section provides requirements for identification of fire and smoke rated assemblies common to other assemblies that reference this Section, supply and installation of identification and labelling components are the responsibility of the installing Subcontractor.

.3 It is a requirement of this Section that work relating to construction of fire and smoke rated assemblies and components is installed under the responsibility of a single source specialty firestop and smokeseal applicator or by the Contractor, or by several firestop and smokeseal applicators that are closely supervised by the Contractor in accordance with requirements forming a part of the related references included in this Section.

1.2 RELATED REQUIREMENTS

.1 Section 06 10 00 – Rough Carpentry: Fire retardant treated lumber and panels.

.2 Section 07 84 00 – Firestopping and Smokeseals: Design and labelling of openings through fire resistive assemblies, top-of-wall and building perimeter joints, mechanical and electrical penetrations, and other firestop or smokeseal components.

.3 Section 08 11 00 – Metal Doors and Frames: Labelling of fire rated doors and frames.

.4 Section 09 21 16 – Gypsum Board Assemblies: Labelling of fire and smoke rated assemblies and partitions.

.5 Division 21 – Fire Suppression: Labelling of fire suppression systems; coordination of firestop and smokeseals penetrations through other assemblies.

.6 Division 23 – Heating, Ventilating and Air Conditioning: Coordination of fire and smoke rated dampers and detection systems; labelling of dampers and detection systems; coordination of firestop and smokeseals penetrations through other assemblies.

.7 Division 28 – Electronic Safety and Security: Labelling of fire detection and alarm systems.

.8 Work of other sections having fire and smoke resistant construction or separation ratings.

1.3 DEFINITIONS

.1 Authority Having Jurisdiction: The local Building Code authority responsible for reviewing Engineered Judgements, Rated Systems and Mock-Ups (if any), and for inspecting installed Rated Systems for compliance with local codes and ordinances.

.2 Certified Fire Protection Specialist (CFPS): Person who has completed the NFPA sanctioned examination and professional accreditation, who is directly employed by the manufacturer, and who has direct experience in the preparation of Engineered Judgements.

.3 Technical Authority: as defined in the General Conditions of the Contract.

.4 Engineered Judgement: A written proposal submitted by the manufacturer to the Authority Having Jurisdiction arising from a variation in the assembly or system from that tested and labelled in their Rated Systems, and as follows:

.1 Engineered Judgements are specific to this Project and details described in the written proposal and form a part of the Submittal requirements for this Section.

.2 Engineered Judgements must be signed by a CFPS, and form a part of the delegated design submittal required by this section and Section 01 33 50.

.5 Manufacturer's Authorized Representative: A person who is directly employed by the manufacturer and who is capable of making onsite decisions relating to the installation of the manufacturers Products; this person is specifically noted as not being an employee of a distributor, agent or other supplier.

.6 Rated Systems: A system that has a specific assembly rating and design or listing number assigned to it from a Recognized Testing Authority; a single example follows, additional design listings must be provided with project solutions for fire and smoke assemblies:

.1 ULC Design No. D708 – Floor Assembly: Provides the specific requirements for concrete and reinforcing, steel deck, joint covers, spray applied fire resistive materials and ratings applicable to restrained and unrestrained assemblies, and the assembly is specific to one manufacturer's product(s) in a specific testing configuration.

.2 Assemblies or systems using materials that have not been tested as a part of a Rated System, or that are not capable of obtaining an Engineered Judgement will not be acceptable for use on this Project.

.3 Materials having only a testing label from a Recognized Testing Authority will not be acceptable for use on this Project unless they form a part of a specific Rated System.

.7 Recognized Testing Authority: An organization recognized by the Authority Having Jurisdiction as being capable of conducting testing and providing labelling for materials, assemblies and systems that include, but are not limited to, the following organizations:

.1 Underwriters Laboratories of Canada (ULC)

.2 Underwriters Laboratories Inc. (UL)

.3 Warnock Hersey (WH) and Electrical Testing Labs (ETL) Listed

.4 ETL, UL and WH labelling will only be acceptable subject to the following conditions:

.1 Fire resistance rated assemblies and materials bearing an Underwriters Laboratories Inc. (UL) or Warnock Hersey (WH) label will be acceptable for use on this project provided that the label indicates acceptance under Underwriters Laboratories of Canada (ULC) and having one of the following cUL, cULus, cWH or cWHus markings.

.2 Materials that only have UL, ULus, WH or WHus markings are not acceptable.

.5 Examples of acceptable marks from Recognized Testing Authorities:

.8 Standard Details: Details prepared by the Departmental Representative indicating an assembly based on generic materials demonstrating configuration and proposed methods for attaining the required fire rating; Standard Details may be derived from the following criteria:

.1 Details may be based on specific Rated Systems provided by a Recognized Testing Authority.

.2 Details may be based on time assigned to materials listed in the Building Code.

.3 Details are of a general nature only, sufficient to inform the bidders of the Departmental Representative's design intent, and do not portray every instance or requirement that can be represented on the Project site; the supplier of materials is responsible submitting design information for firestopping and smokeseal systems required for the Project to the Departmental Representative prior to starting work.

1.4 REFERENCE STANDARDS

.1 Intertek Group:

.1 Directory of WH Listed Building Products

.2 Directory of ETL Listed Electrical and Electronic Products

.2 International Firestop Council (IFC):

.1 Guidelines for Evaluating Firestop Systems Engineering Judgments

.3 Underwriters Laboratories of Canada (ULC):

.1 Directory of Burglar and Fire Alarm Systems and Components

.2 Directory of Building Materials

.3 Directory of Fire Protection Equipment

.4 Directory of Fire Resistance

.5 Directory of Firestop Systems and Components

.6 Directory of Heating and Ventilating Equipment, Flammable Liquids and Gases Equipment, and Marine Equipment

.4 Underwriters Laboratories Inc. (UL):

.1 UL Fire Resistive Assemblies and Systems, Certified for Canada.

1.5 ADMINISTRATIVE REQUIREMENTS

.1 Delegated Design: Design fire resistive assemblies, firestopping and smokeseals required by the Contract Documents to withstand fire ratings indicated on Drawings and in accordance with requirements of the Building Code:

.1 Provide manufacturers standard details where site conditions match standard assembly listings.

.2 Provide manufacturers Engineered Judgment, indicating acceptance by the Authority Having Jurisdiction, signed by manufacturer's CFPS designer, where assembly does not match standard assembly listing.

.3 Confirm proposed rated system materials and methods to applicable codes and ordinances of the Authority Having Jurisdiction.

.4 Additional performance requirements are listed in the referenced technical specification sections.

.2 Coordination: Subcontractor is required to notify the Contractor where their work passes through a fire separation or removes any fire resistive materials, so that the penetration or damage is filled or repaired by an acceptable installation contractor to maintain the integrity of the fire separations:

.1 Contractor is required to notify the Departmental Representative prior to penetrating any load bearing assembly that does not have a predetermined penetration location; Rated Systems do not re-establish the structural integrity of load bearing partitions or assemblies, or support live loads and traffic.

.2 Rated System can be either "built-in" (such as; integral with concrete placement) or "post-installed"; provide built-in Rated System devices prior to concrete placement or masonry installation.

.3 Coordinate construction of openings and penetrating items and verify that through Rated Systems are installed according to specified requirements.

.4 Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate penetrations through fire and smoke rated separations.

.3 Preinstallation Conference: Conduct conference at Project site in accordance with the requirements of Section 01 31 19 to discuss proposed Rated Systems supplied by the installing Subcontractor and manufacturer, modifications to the Departmental Representative's Standard Details, Engineered Judgements, placement of identification labels and coordination issues, and as follows:

.1 Attendees for meetings include the Departmental Representative, Contractor, installing Subcontractor's, Manufacturer's Authorized Representative(s), and the Departmental Representative's third party inspection agency; the Authority Having Jurisdiction can be invited as a courtesy, but it is not mandatory that they attend the meeting.

.4 Scheduling: Schedule required site visits, submission requirements and documentation procedures, review of Mock-Ups (if any) and inspection of fire and smoke rated assemblies as follows:

.1 Authority Having Jurisdiction: Notify Authority Having Jurisdiction in sufficient time to allow for inspection prior to Rated Systems being covered up or enclosed.

.2 Departmental Representatives Testing Agency: Inspection and Testing: Coordinate with Departmental Representative's third party inspection agency and incorporate any corrections or modifications required by inspection agency.

.5 Sequencing: Sequence installation of fire and smoke rated components to maintain the continuity of fire separations whether or not shown on the drawings:

.1 Fire separations may not be pierced by electrical or similar service outlets except in accordance with Building Code.

.2 Do not support non-combustible construction on combustible construction.

.3 Firestop openings in non-combustible construction that terminates at the exterior wall, the underside of floor, ceiling, or roof structures, and at floors with non-combustible materials.

.4 Do not use combustible members, fastenings, and similar items to anchor fixtures to fire separations.

.5 Firestop openings for non-combustible pipes and ducts to prevent the passage of smoke and flame.

.6 Existing fire separations must be maintained as such; any cutting must be sealed to retain the separation's integrity.

1.6 QUALITY ASSURANCE

.1 Rated Systems specified for the Project will be supplied and installed by a Subcontractor specializing in the application of specific systems as follows:

.1 Intumescent Paint: Specified in Section 09 96 46 for flame spread of structural systems – Single Source Responsibility for Project.

.2 Firestopping and Smokeseals: Specified in Section 07 84 00 for mechanical and electrical penetrations, floor and wall openings, top-of-wall seals, perimeter building seals and re-enterable cable management systems – Single Source Responsibility for Project.

.2 Subcontractors installing Rated Systems must be certified by the Manufacturer to install any named Products.

.3 Manufacturer's authorized representative (not distributor or agent) will be onsite during initial installation of Rated Systems to train Subcontractor's personnel in proper selection and installation procedures in accordance with manufacturer's written recommendations.

1.7 SUBMITTALS

.1 Submit a summary of Rated Systems proposed for use in the Project within four (4) weeks of starting work of the Contract in accordance with Section 01 33 00, and as follows:

.1 Provide summary of manufacturer's details and Engineered Judgements in a format similar to that attached to the end of this Section

.2 Attach detailed sketches and drawings, manufacturer's written installation instruction, and material safety and data sheets to the summary; fully cross referenced to the Drawings and the summary.

.3 Manufacturer's Details:

.1 Submit manufacturer's details indicating an assembly or system that matches the design intent provided by the Standard Details.

.2 Manufacturer's standard details must be signed by CFPS, and include only content that is applicable to the Work of the Project.

.3 Provide additional details as required to address additional detail conditions not covered by the Standard Details.

.4 Engineered Judgements:

.1 Manufacturer's details indicating a modification to an assembly or system required to meet the design intent provided by the Standard Details or to address a specific site condition not normally test for in the manufacturer's testing program.

.2 Engineered Judgments must include project name and Subcontractor's name who will install Rated System described in the Engineered Judgement.

.3 Engineered Judgements must be signed by a CFPS employed by the manufacturer, and who was directly responsible for preparation of the Engineered Judgement.

.4 Prepare Engineered Judgements in accordance with IFC Guidelines for Evaluating Firestop Systems Engineering Judgements.

.2 Letters of General Conformance:

.1 Provide letters of General Conformance as required by Section 01 33 50.

.2 A principal of the installing company and the Manufacturer's Authorized Representative (CFPS) jointly sign required letters instead of a professional engineer as required by Section 01 33 50.

.3 Submit additional letters of General Conformance where there are more than one Manufacturer's Authorized Representative or installing Subcontractors.

.3 Samples: Submit samples of each type of firestopping, smokeseal and accessory to the Departmental Representative prior to starting work.

1.8 MOCK-UP

.1 Provide Mock-Up in an accessible location at the Project site ready for review by the Authority Having Jurisdiction and the Departmental Representative in accordance with Section 01 45 00 – Quality Control.

.2 Mock-Up will be representative of the Rated Systems used for the Project, and be kept in a location that can be referenced during the entire construction period; Mock-Up will form the basis for acceptance of installed systems by the Authority Having Jurisdiction and the Departmental Representative.

.3 Refer to individual technical specification sections, which may provide additional requirements for Mock-Ups.

Part 2 Products

2.1 DESIGN REQUIREMENTS

.1 Fire Test Response Characteristics: Provide Rated Systems identical to those tested in assembly indicated by the Recognized Testing Authority; provide Engineered Judgements for systems that do not match the Rated Systems:

.1 Provide a label and proof of fire resistive materials used in Rated Systems issued by a Recognized Testing Authority.

.2 Refer to technical sections for specific requirements for sealing penetrations and joints of smoke and fire separations.

2.2 MATERIALS

.1 Provide Rated Systems composed of components that are compatible with each other, the substrates they are applied to, and the items (if any) penetrating the Rated System under conditions of service and application as demonstrated by the manufacturer based on testing and site experience.

.2 Provide complete components for each Rated System that are needed to properly install material forming the system; use only components specified by the manufacturer and approved by the Recognized Testing Agency for the designated fire resistance rated systems.

2.3 IDENTIFICATION MATERIALS

.1 Adhesive Labels: Nominal 75 mm high x 125 mm wide self adhering labels placed adjacent to fire and smoke rated penetration components, printed with the following information:

.1 ATTENTION: FIRE RATED PENETRATION ASSEMBLY
DO NOT MODIFY
HOUR RATING AND CLASS OF PENETRATION ASSEMBLY

.2 Name of firestopping manufacturer;

.3 Names of products used;

.4 Manufacturers standard detail number, or Engineered Judgement identifier; ULC or cULus Number;

.5 Date of installation;

.6 Name of installing Subcontractor;

.7 Contact telephone number for repair or replacement of firestopping materials.

.8 Size of Label

.9 Placement: Place self adhering labels on a permanent surface adjacent to firestopping or smokeseal installation in an inconspicuous location in fully finished areas and as follows:

.1 Acceptable locations include areas such as within concealed ceiling spaces, above cable trays, out of direct line-of-sight beside penetrations and similar locations.

.2 Confirm locations before final placement.

.10 Example:

.2 Stencil Signs: Nominal 300 mm high by 400 mm wide painted and stencilled permanent signage applied to fire walls, fire barriers and partitions, smoke barriers and partitions and other wall or floor assemblies containing protected openings and penetrations labelled with the following information:

.1 ATTENTION: FIRE RATED BARRIER – PROTECT ALL OPENINGS
HOUR RATING OF ASSEMBLY
OR (as appropriate to installation)

ATTENTION: SMOKE RATED BARRIER – PROTECT ALL OPENINGS

.2 Placement: Apply stencilled signage to wall or barrier surface at 10 metre intervals, evenly laid out across the length of the assembly at a concealed locations and as follows:

.1 Acceptable locations include areas such as above finished ceilings, or out of direct line-of-sight in finished public spaces.

.2 Acceptable exposed locations include areas such as within unoccupied spaces, mechanical and electrical rooms and similar unfinished non-public spaces.

.3 Confirm locations before final placement.

.3 Self adhering labels containing similar information and sized similarly to site stencilled signage are considered as an acceptable substitution for stencilled and painted signage.

.4 Example:

Part 3 Execution

3.1 RESPONSIBILITIES OF PARTIES INVOLVED

.1 The Departmental Representative is responsible for the following:

.1 Provide Standard Details of Rated Systems for the guidance of the Contractor, Subcontractors, and Authority Having Jurisdiction; Standard Details represent design intent only, and do not portray every condition that may arise in the construction process.

.2 Review manufacturer's submittals for conformance to design intent to comply with the Departmental Representative's requirements for completing schedules required by the Building Code.

.2 The Contractor is responsible for the following:

.1 Direct Subcontractors responsible for installation of Rated Systems to submit a summary of Rated Systems used in the project for submission to the Authority Having Jurisdiction and the Departmental Representative.

.2 Direct Subcontractors responsible for installation of Rated Systems to complete any Mock-Ups required by the technical specification sections ready for review by the Authority Having Jurisdiction and the Departmental Representative.

.3 Direct the Subcontractor to submit Letters of General Conformance to the Departmental Representative.

.4 Direct the Subcontractor to notify the Authority Having Jurisdiction to inspect installed Rated Systems.

.3 The Authority Having Jurisdiction will be responsible for the following:

.1 Review manufacturer's submittals for compliance with local codes and ordinances.

.2 Review Mock-Ups (if any) for compliance with local codes and ordinances.

.3 Review of installed Rated Systems for compliance with local codes and ordinances.

3.2 SITE REVIEW

.1 Notify Departmental Representative a minimum of seven days in advance of completion of installation of fire and smoke rated systems and firestop installations; confirm dates and times on days preceding each series of installations.

.2 Do not cover up fire and smoke rated construction or firestop systems that will become concealed behind other construction until Departmental Representative has reviewed and Authority Having Jurisdiction's building inspector have examined each installation.

.3 Cut tests may be made at random; the Departmental Representative will determine the frequency of cut tests, but will not be more than 1% of total length of firestopping and smokeseals:

.1 Make all necessary repairs and correct all deficiencies noted after completion of cut tests.

3.3 SITE QUALITY CONTROL

.1 Departmental Representative will retain a qualified third party inspection agency to conduct site review of fire and smoke rated construction to verify that fire and smoke rated assemblies, firestopping and smokeseals have been installed in accordance with governing regulations, requirements of the manufacturer and to meet acceptance criteria of the Authorities Having Jurisdiction.

.2 Third party inspection agency will be responsible for the following:

- .1 Review Contract Documents and verify Code requirements.
- .2 Attend pre--construction meetings.
- .3 Review submittals of drawings, assemblies and samples.
- .4 Review mock-ups and provide input into mock-up requirements.
- .5 Perform periodic site reviews and provide reports.
- .6 Perform thickness and density testing and provide reports.
- .7 Upon project completion provide a letter of certification indicating that code requirements have been met.

.3 Departmental Representative's provision of a third party inspection agency does not relieve Contractor of responsibility for supply and installation of conforming fire and smoke rated separations and assemblies.

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3.4 SAMPLE SUMMARY FORM

.1 The following Sample Summary Form can be used to develop the listing of Rated Systems required for the Project as noted in Item 1.7.1 above:

RATED SYSTEM SUMMARY SHEET			
Project Name:			Date:
Project Address:			
Installing Subcontractor:			Telephone:
Installer's Address:			
Submitted to:			
SPRAY APPLIED FIRE RESISTIVE MATERIALS			
Type of Assembly: Wall, Floor, Roof or Ceiling	Combustible or Non-Combustible Assembly	Rating: Time, Restraint or Unrestrained	Design or Listing Number
INTUMESCENT FIRE RESISTIVE MATERIALS			
Type of Assembly: Wall, Floor, Roof or Ceiling	Combustible or Non-Combustible Assembly	Rating: Time, Restraint or Unrestrained	Design or Listing Number

RATED SYSTEM SUMMARY SHEET	
Project Name:	Date:
Project Address:	
Installing Subcontractor:	Telephone:
Installer's Address:	
Submitted to:	

CONCRETE FIRE PENETRATIONS – HORIZONTAL OR VERTICAL (FT RATING)			
Type of Penetration	**Combustible or Non-Combustible Penetrating Material**	**FT Rating**	**Design or Listing Number**
Water Distribution			
Sprinkler Piping			
Drain Waste and Vent (DWV) Piping			
Gas Piping			
HVAC Ducts (Not requiring Dampers)			
Electrical Cables (Diameter >25 mm)			
Electrical Metallic Tubing (EMT) or Steel Conduit.			
Other Penetrations			

RATED SYSTEM SUMMARY SHEET			
Project Name:			Date:
Project Address:			
Installing Subcontractor:			Telephone:
Installer's Address:			
Submitted to:			
PENETRATIONS THROUGH FLOOR ASSEMBLIES			
Type of Penetration	Combustible or Non-Combustible Penetrating Material	F Rating	Design or Listing Number
Water Distribution			
Sprinkler Piping			
Drain Waste and Vent (DWV) Piping			
Gas Piping			
HVAC Ducts (Not requiring Dampers)			
Electrical Cables (Diameter >25 mm)			
Electrical Metallic Tubing (EMT) or Steel Conduit.			
Other Penetrations			

RATED SYSTEM SUMMARY SHEET			
Project Name:			Date:
Project Address:			
Installing Subcontractor:			Telephone:
Installer's Address:			
Submitted to:			
PENETRATIONS THROUGH WALL ASSEMBLIES			
Type of Penetration	Combustible or Non-Combustible Penetrating Material	F Rating	Design or Listing Number
Water Distribution			
Sprinkler Piping			
Drain Waste and Vent (DWV) Piping			
Gas Piping			
HVAC Ducts (Not requiring Dampers)			
Electrical Cables (Diameter >25 mm)			
Electrical Metallic Tubing (EMT) or Steel Conduit.			
Other Penetrations			
PERIMETER SEALS, TOP-OF-WALL DETAILS AND OTHER FIRESTOPPING			
Type of Penetration	Combustible or Non-Combustible Material	FT or F Rating	Design or Listing Number

RATED SYSTEM SUMMARY SHEET			
Project Name:			Date:
Project Address:			
Installing Subcontractor:			Telephone:
Installer's Address:			
Submitted to:			

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Work of this section includes, but is not limited to supply and installation of Crystalline Waterproofing applied to the surface of concrete substrates, at the following locations:

.1 Dry side of elevator pits and slabs.

1.2 REFERENCE STANDARDS

.1 American Society for Testing and Materials (ASTM):

.1 ASTM C39/C39M-16b, Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens

.2 ASTM C 267-01(2012), Standard Test Methods for Chemical Resistance of Mortars, Grouts, and Monolithic Surfacings and Polymer Concretes

.2 United States Army Corps of Engineers Specifications:

.1 COE CRD-C 48 - Standard Test Method for Water Permeability of Concrete; 1992.

1.3 ADMINISTRATIVE REQUIREMENTS

.1 Pre-Construction Meetings: Arrange a pre-construction meeting in accordance with Section 01 31 19, prior to commencement of installation of materials specified in this section. Purpose of meeting, as follows:

.1 Establish procedures to maintain required working conditions.

.2 Coordinate work of related and adjacent work.

.3 Review substrate conditions

.4 Review manufacturer’s warranty requirements

.5 Verify manufacturer's current installation requirements and recommendations match final waterproofing details required for site.

.2 Required personnel, as follows:

.1 Departmental Representative

.2 Waterproofing installer

.3 Manufacturer’s authorized representative

.4 Contractor

.5 Subcontractors responsible for work penetrating waterproofing and work adjacent to waterproofing

1.4 SUBMITTALS

.1 Provide required information in accordance with Section 01 33 00.

.2 Action Submittals: Provide the following submittals before starting any work of this Section:

.1 Product Data: Submit manufacturer's product data, with complete general and specific installation instructions, recommendations, and limitations affecting installation.

.3 Informational Submittals: Provide the following submittals during the course of the work:

.1 Certificates:

.1 Submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical requirements; and that waterproofing system and components; and drainage and protection materials are supplied by a single source manufacturer.

.2 Submit written certification that installer has current approved applicator status with waterproofing material manufacturer.

.2 Site Quality Control Submittals: Submit written report summarizing manufacturer’s observations, and indicating results of final inspection and any corrective action required for changes arising from deficiencies or site conditions.

1.5 QUALITY ASSURANCE

.1 Manufacturer Qualifications: A firm able to provide test reports showing compliance with specified performance characteristics, and able to provide on-site technical representation to advise on installation.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Delivery and Storage Requirements: Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.

.2 Storage and Handling Requirements: Store materials in a clean, dry area in accordance with manufacturer's instructions; protect materials during handling and application to prevent damage or contamination.

1.7 SITE CONDITIONS

.1 Ambient Conditions: Maintain manufacturer’s recommended surface and ambient air temperature range during installation and until materials are fully cured and as follows:

.1 Wet Weather Precautions: Cover materials when installing during precipitation to prevent streaking of finished surfaces for a minimum of 48 hours after installation.

.2 Cold Weather Precautions: Install only during rising temperature during cold weather conditions; do not install to frozen or frost covered surfaces; provide electrical heaters to protect material from freezing during and for a minimum of 48 hours after installation.

.3 Hot Weather Precautions: Provide shade and shelter to protect materials from rapid evaporation of water content during curing period using water misting or surface applied evaporation retarders recommended by manufacturer.

1.8 WARRANTY

.1 For work of this section 07 16 16, the 12 months warranty period prescribed in subsection GC3.13 of R2830D "GC3 - Execution and Control of the Work" is extended to 24 months.

Part 2 Products

2.1 MATERIALS

.1 Waterproofing Products: Provide installed products that comply with following, when tested using cured concrete samples made without admixtures, with two 1 mm thick coats of waterproofing:

.1 Penetration: At least 50 mm penetration of crystal-forming material, evidenced by scanning electron microscope photographs.

.2 Permeability: No measurable leakage through waterproofed concrete, when tested in accordance with COE CRD-C 48 at 123.4 m of head or 1200 kPa using 50 mm thick, 13.8 MPa compressive strength concrete.

.3 Chemical Resistance: No detrimental effects when tested using 27.6 MPa compressive strength concrete in accordance with ASTM C 267 using hydrochloric acid (pH of 3.5), brake fluid, transformer oil, ethylene glycol, toluene, and caustic soda as test mediums for duration of 84 days each; 14 % increase minimum in concrete compressive strength when tested in accordance with ASTM C 39/C 39M.

.4 Potable water

.2 Waterproofing: Two-coat crystalline waterproofing.

.1 First Coat: Slurry proprietary blend of Portland cement, silica sand and active chemicals, mixed with water in proportions recommended by manufacturer to achieve specified coverage with application method used.

.2 First Coat Coverage: Thickness and density as recommended by manufacturer

.3 Second Coat Coverage: Thickness and density as recommended by manufacturer

.4 Second Coat: Proprietary blend of Portland cement, silica sand and active chemicals, mixed with water in proportions recommended by manufacturer to achieve full coverage with application method used.

.3 Top-of-Slab Waterproofing: Dry shake powder application on fresh concrete; proprietary blend of Portland cement, silica sand and various active chemicals, formulated as a powder compound for dry shake application.

.4 Dry Pack Repair Compound: Dry pack consistency proprietary blend of Portland cement, silica sand and active chemicals, mixed with water in proportions recommended by manufacturer.

.5 Patching Compound: Single component, fast-setting, nonshrink, high bond strength hydraulic cement; with admixture where needed for increased bond strength to existing concrete.

.6 Slurry Coat: Slurry coat mixture; proprietary blend of Portland cement, silica sand and active chemicals, mixed with water in proportions recommended by manufacturer to achieve the specified coverage with application method used.

Part 3 Execution

3.1 EXAMINATION

.1 Verify substrate conditions, which have been previously installed under other sections, are acceptable for product installation in accordance with manufacturer’s instructions.

.2 Obtain waterproofing manufacturer's approval of substrate conditions; submit site inspection report.

.3 Do not install unless substrate and ambient air temperature are within range acceptable to waterproofing manufacturer.

3.2 NEWLY PLACED HORIZONTAL CONCRETE SURFACES

.1 Comply with manufacturer’s product data sheets, technical bulletins, and installation instructions.

.2 Apply rough wood float or broom finish.

.3 Apply dry shake powder to fresh horizontal concrete surfaces at rate recommended by manufacturer. Incorporate powder into surface during concrete finishing process.

3.3 PREPARATION OF CURED CONCRETE

.1 Prepare surfaces being treated in accordance with waterproofing manufacturer's instructions.

.2 Clean laitance, curing compounds, excess form oil, dirt film, paint, coatings or other foreign matter harmful to performance of waterproofing from surfaces of cured concrete being treated.

.3 Prepare cured surfaces if necessary to provide open capillary surface; use acid etching, sandblasting, water blasting, or other methods as recommended by manufacturer.

.4 Defects: Rout out defects, such as cracks, faulty construction joints, honeycombing, form tie holes, and other defects to sound concrete, and repair.

.1 Chip defective areas into a U-shaped slot 25 mm wide and minimum 25 mm deep.

.2 Clean slot, wet, saturate with water and remove surface water.

.3 Apply specified slurry coat to slot at rate recommended by manufacturer.

.4 Allow slurry coat to reach initial set.

.5 Fill cavity with specified dry pack repair compound.

.6 Compress tightly into cavity using pneumatic packer or hammer and blocks.

.5 Rock Pockets, Honeycombing, and Other Defective Concrete:

.1 Rout out defective areas to sound concrete.

.2 Remove loose material and saturate with water.

.3 Remove surface water and apply specified slurry coat.

.4 After slurry coat has set, but while still green, fill cavity to surface with specified patching compound.

.6 Coves: At right-angle intersections cove joint for smooth transition of waterproofed surface.

.1 Apply specified slurry coat to slot at rate recommended by manufacturer.

.2 Fill and form surfaces using specified dry pack repair compound or waterproofing material in mortar consistency while slurry coat is still green, but after slurry coat has reached initial set.

.3 Trowel into cove shape.

.7 Construction Joints: Apply sealing strips at each construction joint by filling grooves coinciding with construction joint.

.1 If grooves have not been preformed, at least 19 mm wide and minimum 25 mm deep, saw cut and chip grooves to that dimension.

.2 Apply specified slurry coat to slot at rate recommended by manufacturer.

.3 Fill and form surfaces using specified dry pack repair compound while slurry coat is still green, but after slurry coat has reached initial set.

.4 Compact tightly using pneumatic packer or hammer and block.

3.4 APPLICATION ON CURED CONCRETE

.1 Comply with manufacturer’s instructions, including product data, technical bulletins, catalogue installation instructions, and product carton instructions.

.2 Mix materials in accordance with manufacturer’s instructions.

.3 Wet concrete surfaces and saturate with clean water to ensure migration of crystalline chemicals into concrete; remove free surface water before application of waterproofing treatment.

.4 Exposed Surface Application: Apply waterproofing uniformly with semi-stiff bristle brush or spray under conditions and application rate recommended by manufacturer.

.5 Apply second coat while first coat is still green, but after reaching initial set.

.6 Use light pre-watering between coats when rapid drying conditions occur.

.7 Curing: Cure exposed waterproofing treatment using a mist fog spray of clean water after coating has hardened sufficiently not to be damaged by spray; do not use plastic sheeting laid directly on waterproofing; air circulation is required.

.1 If water curing is not possible, follow manufacturer's recommendations for curing using chemical curing agent approved by manufacturer.

.2 Avoid coating damage with spray operation.

.3 Spray treated surface 3 times a day for 2 to 3 days.

.4 In hot climates, spray treated surfaces at intervals recommended by waterproofing manufacturer.

.5 During curing period, protect treated surfaces from rainfall, ambient temperature below freezing, and puddling of water.

.6 Provide supplementary air circulation as recommended by waterproofing manufacturer.

.8 Comply with waterproofing manufacturer's recommendations for sequencing construction operations after waterproofing applications to avoid conditions detrimental to performance of waterproofing application.

3.5 SITE QUALITY CONTROL

.1 Manufacturer's Site Services: Provide manufacturer's field service consisting of product use recommendations and periodic site visit for inspection of product installation in accordance with manufacturer's instructions.

.2 Do not cover waterproofed surfaces with other construction until they have been observed by manufacturer's site representative and Departmental Representative.

3.6 CLEANING AND PROTECTION

.1 Clean spillage and overspray from adjacent surfaces using appropriate cleaning agents and procedures.

.2 Protect installed product from damage during construction; do not allow traffic on unprotected waterproofed surfaces.

END OF SECTION

Part 1 GENERAL

1.1 REFERENCES

.1 American Society for Testing and Materials International, (ASTM).

.1 ASTM C612-10, Standard Specification for Mineral Fiber Block and Board Thermal Insulation

.2 Underwriters Laboratories Canada (ULC):

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

.2 CAN/ULC S701-11, Thermal Insulation, Polystyrene, Boards and Pipe Covering

.3 CAN/ULC S702-09, Thermal Insulation, Mineral Fibre, for Buildings

.4 CAN/ULC S702.2-10, Mineral Fibre Thermal Insulation for Buildings, Part 2: Application Guidelines

.5 CAN/ULC S704-11, Thermal Insulation, Polyurethane and Polyisocyanurate Boards, Faced

.6 CAN/ULC S770-09, Determination of Long-Term Thermal Resistance of Closed-Cell Thermal Insulating Foams

.7 CAN/ULC S773-09, Thermal Insulation Terminology

1.2 SUBMITTALS

.1 Product Data:

.1 Submit manufacturer's printed product literature, specifications and data sheet in accordance with Section 01 33 00.

.2 Submit two copies of WHMIS MSDS - Material Safety Data Sheets. Indicate VOC's insulation products and adhesives.

.2 Manufacturer's Instructions:

.1 Submit manufacturer's installation instructions.

.3 Sustainable Design Submittals:

.1 LEED Canada-NC Submittals: in accordance with Section 01 35 21.

.2 MR Credit 4 – Recycled Content:

.1 Content: Total value of building materials must contain a minimum weighted average of 20% of post consumer + ½ pre-consumer recycled content; preference will be given to materials that provide a positive contribution towards the total recycle content for the project over materials that provide less of a contribution.

1.3 QUALITY ASSURANCE

.1 Test Reports: certified test reports showing compliance with specified performance characteristics and physical properties.

.2 Certificates: product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

.3 Pre-Installation Meetings: conduct pre-installation meeting to verify project requirements, manufacturer's installation instructions and manufacturer's warranty requirements.

1.4 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 74 20.

.2 Remove from site and dispose of packaging materials at appropriate recycling facilities.

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

Part 2 PRODUCTS

2.1 INSULATION

.1 Wall Insulation: Fibrous Mineral Wall Insulation: Unfaced, preformed rigid fibrous mineral slag board insulation manufactured in accordance with CAN/ULC S702, Type 1, thermal resistance not less than RSI 0.76/25 mm; rated non-combustible in accordance with CAN/ULC S114 and having a flame spread rating of 5 or less in accordance with CAN/ULC S102; nominal 70 kg/m³:

.1 Thickness: As indicated

.2 Edges: Square

2.2 ADHESIVE

.1 Adhesive (for polystyrene): to CGSB 71-GP-24.

2.3 ACCESSORIES

.1 Insulation clips: impale type, perforated 50 x 50 mm cold rolled carbon steel 0.8 mm thick, adhesive back, spindle of 2.5 mm diameter annealed steel, length to suit insulation, 25 mm diameter washers of self locking type.

Part 3 EXECUTION

3.1 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.

3.2 EXAMINATION

.1 Examine substrates and immediately inform Departmental Representative in writing of defects.

.2 Prior to commencement of work ensure:

.1 Substrates are firm, straight, smooth, dry, free of snow, ice or frost, and clean of dust and debris.

3.3 WORKMANSHIP

.1 Install insulation after building substrate materials are dry.

.2 Maintain continuous thermal insulation, vapour barrier and air tightness for building spaces and elements, and as follows:

.1 Saw cut and trim insulation neatly to fit spaces; fill voids with edges of insulation, cut to fit tightly to surrounding insulation boards to maintain a continuous thermal barrier to the building.

.2 Butt edges and ends tight.

.3 Fit insulation tight against mechanical, electrical and other items protruding through the plane of insulation.

.4 Use insulation free of broken edges.

.5 Apply single layer of insulation to produce thickness indicated, unless multiple layers are otherwise specifically shown or required to make up total thickness.

.6 Fit insulation firmly against substrate using mechanical fasteners spaced in accordance with manufacturers recommended spacing and pattern; in addition, adhere insulation to uneven substrate surfaces and provide additional fasteners to eliminate air spaces between insulation and substrate.

.7 Mechanically fasten insulation boards 50 mm in from edges at 300 mm centres.

.3 Do not enclose insulation until it has been inspected and approved by Departmental Representative.

3.4 EXAMINATION

.1 Examine substrates and immediately inform Departmental Representative in writing of defects.

.2 Prior to commencement of work ensure:

.1 Substrates are firm, straight, smooth, dry, free of snow, ice or frost, and clean of dust and debris.

3.5 CLEANING

.1 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

END OF SECTION

Part 1 GENERAL

1.1 SUMMARY

.1 This Section includes requirements for supply and installation of a spray polyurethane foam air and vapour seal system, and other components to bridge and seal the following air leakage pathways and gaps between; but not limited to, the following

- .1 Preparation of substrates required for proper adhesion of foamed-in-place insulation materials to adjacent surfaces required for a continuous thermal, air and vapour barrier.
- .2 Installation of flexible transition strip membranes at openings, across expansion joints; openings at piping, conduit, duct and similar penetrations, and other through wall flashings prior to placement of foamed-in-place insulation.
- .3 Connections of the walls to the roof air seal
- .4 Openings and penetrations
- .5 Piping, conduit, duct and similar penetrations
- .6 All other air leakage pathways in the building envelope

1.2 RELATED REQUIREMENTS

.1 Section 07 92 00 – Joint Sealers: Joint sealant materials and installation.

1.3 REFERENCES

.1 American Society for Testing and Materials (ASTM):

- .1 ASTM E1677-05, Standard Specification for an Air Seal (AR) Material or System for Low-Rise Framed Building Walls
- .2 ASTM E2357-11, Standard Test Method for Determining Air Leakage of Air Barrier Assemblies

.2 Canada Green Building Council (CaGBC)

- .1 LEED Canada-NC 2009.

.3 Canadian Urethane Foam Contractors Association Inc. (CUFCA)

.4 Green Seal (GS)

- .1 GS-11-2013, Standard for Paints and Coatings.

.5 South Coast Air Quality Management District (SCAQMD)

- .1 SCAQMD Rule 1113-16, Architectural Coatings.

.6 Canadian Construction Materials Centre (CCMC):

.1 Listing of Acceptable Spray Polyurethane Foam Insulation Manufacturers

.7 Underwriters Laboratories Canada (ULC):

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

.2 CAN/ULC S124-06, Standard Method of Test for the Evaluation of Protective Coverings for Foamed Plastic

.3 CAN/ULC S127-07, Standard Corner Wall Method of Test for Flammability Characteristics of Non-Melting Foam Plastic Building Materials

.4 CAN/ULC S705.1-15, Standard for Thermal Insulation-Spray Applied Rigid Polyurethane Foam, Medium Density-Material-Specification including amendments

.5 CAN/ULC S705.2-05, Standard for Thermal Insulation-Spray Applied Rigid Polyurethane Foam, Medium Density-Material-Application

.6 CAN/ULC S770-15, Standard Test Method for Determination of Long-Term Thermal Resistance of Closed-Cell Thermal Insulating Foams

1.4 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00.

.2 Action Submittals:

.1 Product Data:

.1 Submit manufacturer's printed product literature and data sheets for polyurethane foam sprayed insulation and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Submit manufacturer's printed instructions for evaluating, preparing, and treating substrate, temperature and other limitations of installation conditions, technical data, tested physical and performance properties, and materials used in final construction.

.3 Submit 2 copies of WHMIS MSDS in accordance with Section 01 35 29.

.2 Test Reports:

.1 Submit certified test reports for insulation from approved independent testing laboratories, indicating compliance with specifications for specified performance characteristics and physical properties.

.2 Submit test reports in accordance with CAN/ULC-S101 for fire endurance and CAN/ULC-S102 for surface burning characteristics.

.3 Informational Submittals: Provide the following submittals during the course of the work:

.1 Site Quality Control Submittals: Submit SPF Quality Assurance Program (QAP) documentation and reports in accordance with requirements listed in this Section at completion of work.

.2 Sustainable Design Submittals:

.1 LEED Canada submittals: in accordance with Section 01 35 21.

.2 Construction Waste Management:

.1 Submit project Waste Management Plan highlighting recycling and salvage requirements.

.2 Submit calculations on end-of-project recycling rates, salvage rates, and landfill rates demonstrating that 75% of construction wastes were recycled or salvaged.

.3 Recycled Content:

.1 Submit listing of recycled content products used, including details of required percentages or recycled content materials and products, showing their costs and percentages of post-consumer and post-industrial content, and total cost of materials for project.

.4 Regional Materials: submit evidence that project incorporates required percentage 20 % of regional materials and products, showing their cost, distance from project to furthest site of extraction or manufacture, and total cost of materials for project.

1.5 QUALITY ASSURANCE

.1 Certifications: Provide proof of the following during the course of the Work:

.1 Quality Assurance Program: Arrange for onsite inspections and testing, documentation and reporting in accordance with CUFCA SPF Quality Assurance Program (QAP) as mandated by CAN/ULC S705.2.

.2 Additional QA Agencies: Other Quality Assurance Agencies may be acceptable to the Departmental Representative provided that information indicating equivalency to CUFCA SPF QAP is provide before starting work of this Section.

.2 Qualifications:

.1 Manufacturer: Obtain foamed-in-place insulation materials from a single manufacturer regularly engaged in manufacturing the products specified in this Section and that manufacturer’s material conforming to the requirements of CAN/ULC S705.1.

.2 Installers: Use companies having trained and certified installers in accordance with CAN/ULC S705.2 and by the foamed-in-place insulation manufacturer.

.3 Health and Safety Requirements: worker protection:

.1 Protect workers as recommended by CAN/ULC-S705.2 and manufacturer's recommendations:

.2 Workers must not eat, drink or smoke while applying foam insulation.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 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: Store materials in their original undamaged packages in a clean, dry, protected location and within temperature range required by air and vapour seal manufacturer, and as follows:

.1 Protect stored materials from direct sunlight.

.2 Avoid spillage; immediately notify Departmental Representative if spillage occurs and start clean up procedures; clean spills and leave area as it was prior to spill.

.3 Replace defective or damaged materials with new.

.4 Develop Construction Waste Management Plan related to Work of this Section and in accordance with Section 01 35 21.

.5 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding and packaging materials as specified in Construction Waste Management Plan in accordance with Section 01 74 20 and Section 01 35 21.

1.7 SITE CONDITIONS

.1 Ventilate area in accordance with Section 01 51 00.

.2 Ventilate area to receive insulation by introducing fresh air and exhausting air continuously during and 24 hours after application to maintain non-toxic, unpolluted, safe working conditions.

.3 Provide temporary enclosures to prevent spray and noxious vapours from contaminating air beyond application area.

.4 Protect adjacent surfaces and equipment from damage by overspray, fall-out, and dusting of insulation materials.

.5 Apply insulation only when surfaces and ambient temperatures are within manufacturers' prescribed limits.

Part 2 PRODUCTS

2.1 MATERIALS

.1 Spray Applied Polyurethane Foam Insulation (SPFI): Two component, polyurethane resin and polyol, closed cell foamed-in-place insulation containing recycled materials in accordance with CAN/ULC S705.1, Type 2 and having the following minimum properties:

.1 Vapour Permeance: Less than 60 ng/P•s•m^2 qualifying as a vapour retarder in applied thicknesses of 50 mm and greater.

.2 Air Leakage Rate: Maximum 0.02 L/s•m^2 at 75 Pa

.3 Long Term Thermal Resistance: Nominal RSI 2.1/50 mm in accordance with ULC S770

.4 Density: Nominal 35 kg/m^3 ±10% by weight.

.5 Closed Cell Content: Minimum 95% in accordance with ASTM D2856

.6 Ozone Depletion Potential: Zero

.7 Global Warming Potential: Low

.8 Volatile Organic Compounds: Zero

.2 Primer: Manufacturer’s recommended primer specific to steel and aluminum surfaces subject to forming oils or grease such as steel studs, girts, and plastic piping materials.

.3 Accessories: Manufacturer’s recommended materials required for a complete and functioning vapour resistant, and air barrier.

Part 3 EXECUTION

3.1 EXAMINATION

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

.1 Protection of Existing Conditions: Mask and cover adjacent areas; protect other surfaces from overspray and as follows:

.1 Verify that any required foam stop or back up materials are in place to prevent over spray and achieve complete seal.

.2 Seal off existing ventilation equipment; install temporary ducting and fans to remove exhaust fumes; provide for make-up air.

.3 Erect barriers, isolate area and post warning signs to advise non-protected personnel to avoid the spray area.

.2 Surface Preparation: Clean, prepare, and treat substrate in accordance with CAN/ULC S705.2, manufacturer's written instructions, and as follows:

.1 Provide clean, dust free, and dry substrate ready for installation of air and vapour seal.

.2 Clean and prime metal and plastic surfaces to remove grease and oil that have potential to impair bond of foamed-in-place materials to substrates in accordance with manufacturer’s written requirements.

.3 Prime other substrates appropriate to the materials that foamed-in-place foam is being bonded to when recommended by manufacturer.

.4 Apply foamed-in-place materials in layers to achieve required bond to transition membranes and to prevent membrane damage arising from exothermic heating; allow for drying time between coats; protect self adhered membranes in accordance with manufacturer’s written requirements.

.5 Prepare, treat, and seal vertical and horizontal surfaces at terminations and penetrations through air and vapour seal and at protrusions according to air and vapour seal manufacturer's written instructions.

3.3 APPLICATION

.1 Apply insulation to clean surfaces in accordance with CAN/ULC-S705.2 and manufacturer's printed instructions.

.2 Use primer where recommended by manufacturer.

.3 Apply sprayed foam insulation in thickness as indicated.

.1 Apply foamed-in-place materials in layers to achieve required bond to transition membranes and to prevent membrane damage arising from exothermic heating; allow for drying time between coats; protect self adhered membranes in accordance with manufacturer’s written requirements.

.2 Prepare, treat, and seal vertical and horizontal surfaces at terminations and penetrations through air and vapour seal and at protrusions according to air and vapour seal manufacturer's written instructions.

.4 Application – Building Perimeter Air Seal: Fill juncture of external walls and roofs with continuous gusset shaped seal extending minimum 150 mm horizontally and vertically from line of juncture and protect with thermal barrier, and at the following additional locations:

.1 All joints in perimeter roof to wall joints along perimeter.

.2 Other locations indicated on drawings.

.5 Application – Protrusions through Building Air and Vapour Seals: Install foamed-in-place air and vapour barrier around protrusions through exterior building envelope to achieve and maintain continuity of air/vapour seal and as follows:

.1 Install inside structural metal studs at parapets.

.2 Other locations indicated on drawings.

.3 Apply to interior (warm side) of structural elements to provide an insulation barrier where structural elements are continuous from interior to exterior of building envelope.

.6 Allow materials to cure; do not cover up materials until full curing has taken place and Departmental Representative has reviewed and accepted the installation.

3.4 SITE QUALITY CONTROL

.1 Manufacturers Quality Assurance Program: Perform manufacturer’s SPF QAP inspections and testing using recognized inspection agency and submit written reports and testing information; include costs for QAP as a part of the work of this Section.

.2 Site Testing: Notify Departmental Representative when foamed-in-place insulation installations are ready for inspection prior to concealing or enclosing materials specified in this Section:

.1 Arrange for inspections required by CAN/ULC S705.2 and include costs for third party testing as a part of the cost for the project.

.2 Prepare daily reports required by CAN/ULC S705.2 and submit to Departmental Representative as described in this Section, and to SPF QAP as required by the Quality Assurance Program.

.3 Repair foamed-in-place insulation as required to ensure compliance building envelope requirements, and as directed by inspection agency.

.4 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.

3.5 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11.

.1 Remove insulation material spilled during installation and leave work area ready for application of wall board.

.3 Waste Management: separate waste materials for recycling in accordance with Section 01 35 21.

.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 American Society for Testing of Materials:

.1 ASTM D146-04 (2012)e1, Standard Test Methods for Sampling and Testing Bitumen-Saturated Felts and Woven Fabrics for Roofing and Waterproofing

.2 ASTM D412-06ae2, Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers—Tension

.3 ASTM E96/E96M-10, Standard Test Methods for Water Vapor Transmission of Materials

.4 ASTM E283-04 (2012), Standard Test Method for Determining the Rate of Air Leakage through Exterior Windows, Curtain Walls, and Doors under Specified Pressure Differences across the Specimen

.5 ASTM E2178-11, Standard Test Method for Air Permeance of Building Materials

.6 ASTM E2357-11, Standard Test Method for Determining Air Leakage of Air Barrier Assemblies

.2 Canadian General Standards Board:

.1 CAN/CGSB 37-GP-56M, Membrane, Modified, Bituminous, Prefabricated, and Reinforced for Roofing

1.2 ADMINISTRATIVE REQUIREMENTS

.1 Coordination: Coordinate interface of membranes specified in this Section with adjacent systems to ensure continuity of system and that junctions between various components are effectively sealed; verify with manufacturers and installers for installation procedures of materials incorporated into air and vapour membrane elements including membranes, transitions, coatings and sealants and continuity with roofing membrane.

1.3 ACTION AND INFORMATION SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00.

.2 Product Data:

.1 Provide two copies of most recent technical air and vapour membrane components data sheets describing materials' physical properties and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Manufacturer's Installation Instructions: indicate special precautions required for seaming the membrane.

.4 Manufacturer's field report: in accordance with Section 01 45 00.

1.4 QUALITY ASSURANCE

.1 Qualifications: Provide proof of qualifications when requested by Departmental Representative:

.1 Manufacturer: Obtain air and vapour membrane materials through one source from a single manufacturer or using materials from a secondary source that are acceptable to the manufacturer.

.2 Installer: Use an installation company that is acceptable to the manufacturer, using workers who are trained and approved by the membrane manufacturer having experience with projects of similar complexity and area.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Delivery and Acceptance Requirements: Deliver materials to job site in original unopened packages, clearly marked with manufacturer's name, material brand name and description of contents.

.2 Storage and Handling Requirements: Protect membrane materials before, during and after installation in accordance with manufacturer’s requirements for weight, temperature, heat and flame, and humidity; store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by membrane manufacturer.

1.6 SITE CONDITIONS

.1 Ambient Conditions: Apply air and vapour membrane to substrate surfaces that are within manufacturer’s installation temperature threshold range accounting for wind cooling and apparent temperature when actual temperature is approaching manufacturer’s minimum temperature threshold.

Part 2 Products

2.1 PERFORMANCE REQUIREMENTS

.1 Provide materials and installations that meet the following material and assembly performance ratings, and as follows:

.1 Material Performance: Provide materials having an air permeance rating not exceeding 0.02 l/sec-m^2 measured at 75 Pa pressure differential in accordance with ASTM E2178; and having a vapour permeance rating not exceeding 3.5 g/sec-m^2 in accordance with ASTM E96.

.2 Assembly Performance: Install materials and accessories to provide a continuous air and vapour membrane assembly having an air leakage rate not exceeding 0.20 l/sec-m^2 measured at 75 Pa pressure differential in accordance with ASTM E2357; that will perform as the primary drainage plane flashed to direct condensation or water penetration to the exterior; that will accommodate movement of building materials and building expansion and contraction; and that has appropriate accessory materials to account for changes in substrate, transitions and other perimeter conditions.

.3 Low Temperature Performance: Modify acceptable material listings and provide manufacturer’s low temperature or ultra-low temperature membrane products when installation conditions are scheduled to occur at or below installation temperature range of specified materials.

2.2 AIR AND VAPOUR MEMBRANE ASSEMBLY

.1 Primers and Undercoats: Manufacturer’s recommended primer or surface conditioner to improve bond between membranes to substrates.

.2 Self Adhering Membrane: Self adhering SBS modified bitumen reinforced membrane; having low temperature formulation appropriate for installation requirements; tested in accordance with ASTM E96 and ASTM E2178, and having the following nominal properties:

.1 Low Temperature Flexibility:Less than -20°C

.2 Nominal Thickness:1.5 mm

.3 Through Wall Flashing Membranes: Self adhering SBS modified bitumen reinforced membrane with cross-linked polyethylene skins, specifically manufactured for use as through wall flashing or dampproofing course; and having the following nominal properties:

.1 Service Temperature Range:-40°C to +80°C

.2 Thickness:1.0 mm

2.3 ACCESSORIES

.1 Waterproofing Mastic: Manufacturer's recommended trowel applied waterproofing mastic containing compatible modified bitumen, fibres and mineral fillers.

.2 Panel Sheathing Tape: Manufacturer's recommended self adhering tape compatible with liquid applied air and vapour membranes specified in this Section.

.3 Roof-to-Wall Transition Membranes: Manufacturer's recommended reinforced self adhesive, compatible with roofing air and vapour membranes and wall materials specified in this Section.

.4 Opening Transition Membranes: Manufacturer's recommended reinforced, self adhesive membrane compatible with adjacent materials, and air and vapour membranes specified in this Section.

.5 Through Wall Membranes: Manufacturer's recommended reinforced self adhesive, compatible with air and vapour membrane and that will not become plastic and extrude onto finished surfaces when exposed to high wall temperatures.

Part 3 Execution

3.1 EXAMINATION

.1 Examine conditions of substrates and other conditions affecting this Section before starting work; notify other related trades and verify that substrates are complete and ready for installation of products specified in this Section.

3.2 PREPARATION

.1 Prepare surfaces in accordance with manufacturer's written requirements for type of substrate; free from voids, spalled areas, loose aggregates or sharp points; clean surfaces to remove contaminants that could affect bond such as grease or wax, dust, dirt and debris and as follows:

.1 Exterior Gypsum Sheathing Panels: Verify that boards are sufficiently stabilized with corners and edges fastened with appropriate screws; pre-treat board joints with reinforced self adhesive tape or fibreglass mesh tape; fill gaps wider than 6 mm with mastic or sealant and allow sufficient time to fully cure before applying tape and liquid applied membrane.

.2 Adjacent Materials: Treat construction joints and install flashings as recommended by manufacturer.

.2 Apply primer to substrates when required by manufacturer at rate recommended by manufacturer; cover primed substrates on same day, reapply primer when work cannot be completed on the same day.

3.3 INSTALLATION

.1 Install air and vapour membranes in accordance with manufacturer's written requirements, using appropriate equipment and skilled workers and as follows:

.1 Holes and Tears: Repair holes and tears with compatible membrane materials; overlap affected surface area by a minimum of 100 mm and seal edges of repair with manufacturer's recommended mastic material.

.2 Transition Membranes: Connect air and vapour membranes to adjacent assemblies having pre-installed transition membranes at openings and other assemblies; install transition membranes where required to maintain continuity of building envelope.

.3 Corner Details and Protrusions: Cover inside corners and protrusions, centred and installed in direct contact with the substrate with no voids under the membrane strip; reinforce outside corners by double lapping or stripping as required by membrane manufacturer.

.4 Through Wall and Flexible Flashings: Install flexible membranes where required to maintain flow direction to divert water away from face of building envelope.

.2 Separate air and vapour membranes from incompatible materials, and provide manufacturer's recommended transition materials required to maintain continuity of building envelope.

.3 Inspect membrane installation at end of each day of work and before installation of insulation; seal upper edge of membrane with mastic at end of day's work when precipitation is anticipated or when work is expected to be delayed or interrupted by more than one day.

3.4 SITE QUALITY CONTROL

.1 Allow access for inspection and testing of installed air and vapour membranes, and repair of deficiencies before placement of insulation materials.

.2 Manufacturer's Site Services: Arrange for air and vapour membrane manufacturer's technical personnel to review building envelope during installation as follows:

.1 Provide training and supervision of personnel who will install membrane systems and coordinate other subcontractors affected by work of this Section

.2 Provide frequent visits during the progress of the work to assure quality and competence of membrane installation in accordance with manufacturer's instructions

.3 Verify surface conditions prior to installation to

.4 Verify that workmanship requirements are being met during installation and to provide technical assistance and installation guidance as necessary to ensure a complete and continuous membrane assembly

.5 Verify that installation meets requirements of manufacturer's warranty after completion of membrane system

.6 Submit written report of site activities, directions for correction of installed membranes, detailing and any special installation requirements resulting from site conditions different than manufacturer's standard details

.3 Non-Conforming Work: Repair or replace non-conforming work at no additional expense to the Project.

3.5 CLOSEOUT ACTIVITIES

.1 Protection: Protect membrane as recommended by manufacturer from effects of long term exposure where membrane is open to the environment for prolonged time periods using opaque plastic sheets or tarpaulins; protect membrane from penetrations and damage by successive components of the Work; assign payment for repairs to responsible parties; make repairs in accordance with manufacturer's written instructions using original installers.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 05 31 00 – Steel Decking

.2 Section 07 62 00 – Sheet Metal Flashing and Trim

.3 Section 07 92 00 – Joint Sealants

1.2 DESCRIPTION

.1 Pre-finished, pre-formed metal contoured roofing.

1.3 PERFORMANCE REQUIREMENTS

.1 Design and construct roof so that completed installation will not leak.

.2 Maximum deflection not to exceed 1/180 under system own weight plus snow load and buildup, wind and suction loads acting normal to the plane in accordance with the Building Code Climatic Data, wind load 1:30 years.

.3 Provide movement of components without causing buckling, failure of joint seals, undue stress on fasteners when subject to seasoned temperature range, from -40°C to 50°C, and preceding noted wind and suction loads.

.4 Include expansion joints to accommodate movement in wall system and between wall system and building structure, where these movements are caused by deflection of building structure. Accommodate these movements, without permanent distortion, damage to infills, racking of joints, breakage of seals, or water penetration.

.5 Provide for positive drainage to the exterior of all water entering or condensation occurring within the system.

1.4 REFERENCE STANDARDS

.1 American Society for Testing and Materials (ASTM):

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

.2 Canadian Sheet Steel Building Institute (CSSBI):

.1 CSSBI Technical Bulletin No. 20M-99, Sheet Steel Cladding for Architectural and Industrial Applications

.3 Canadian Standards Association (CSA):

.1 CSA W47.1-09, Certification of Companies for Fusion Welding of Steel

1.5 SUBMITTALS

.1 Provide required information in accordance with Section 01 33 00 – Submittal Procedures.

.2 Submit a sample section of preformed contoured metal panel, minimum size 450 mm x 450 mm, showing preformed corner, vertical joint for horizontal surface.

.3 Submit a sample of contoured metal panel, in the selected colour on actual metal base.

.4 Submit shop drawings showing assembly and installation details, method of sealing and flashing, building connection attachments, and provision for thermal movement. Arrangement of structural liner including thickness, type and welding requirements. Each drawing submitted shall bear the signature and stamp of a qualified professional engineer registered in the Province of Work.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Cover prefinished components to protect surface finishes from damage and deterioration.

.2 Store components off the ground to prevent twisting, bending or delamination. Slope to shed moisture.

Part 2 Products

2.1 MATERIALS

.1 Zinc Galvanized Sheet Steel Panels: Tension levelled, Commercial Steel (CS) designation, Type A, Grade 230 (33) in accordance with ASTM A653/A653M and as follows:

.1 Thickness: Minimum 0.76 mm base metal thickness, or thicker as required to meet design loads.

.2 Galvanizing Designation: Z275 (G90) applied evenly to both sides.

.3 Profile: Corrugated profile as indicated on Drawings.

.4 Surface Texture: Smooth

.5 Finish: Prefinished colour selected from manufacturer’s standard range using Silicone Modified Polyester coating.

.6 Colour: As selected by Departmental Representative from manufacturer’s complete range.

.2 Z Bars: 1.2 mm thick minimum galvanized steel.

.3 Flashing, Trim and Enclosures: Steel core thickness and finish as for metal panels.

.4 Fastenings: Manufacturer's standard to suit design loads and application. Finish all exposed fasteners to match metal panels.

.5 Sealant: In accordance with Section 07 92 00, type as recommended by manufacturer for specific end use, colour to match panels.

.6 Auxiliary Levelling Surface: Preservative treated plywood, Douglas Fir to CSA O121, G1S good one side, pressure treated with CCA to CAN/CSA-O80.9, minimum retention 4.0 kg/m3 by assay.

.1 Preservative: Chromated copper arsenate (CCA) to AWPA P5 as amended by CAN/CSA-O80-Series.

.7 Sheet Membrane Roof Underlayment (Water Membrane) (Air / Vapour Barrier): Cold-applied, self adhering, smooth surface roof underlayment sheet, minimum 1.02 mm thick, maximum permeance 0.05 perms, consisting of glass fibre mat reinforcing and SBS modified asphalt, with release paper backing; provide primer when recommended by manufacturer.

2.2 ACCESSORY MATERIALS

.1 Provide components required for complete metal roofing system assembly including trim, copings, fasciae, corner units, ridge closures, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items; match material and finish of metal roofing system.

.2 Fasteners: Self tapping screws, bolts, nuts, self locking rivets and bolts, end welded studs, and other suitable fasteners designed to withstand design loads, and as follows:

.1 Provide exposed fasteners with heads matching color of metal roofing system by means of plastic caps or factory applied coating.

.3 Bituminous Coating: Cold applied asphalt mastic, SSPC-Paint 12, compounded for 0.4 mm dry film thickness per coat; inert type non-corrosive compound free of asbestos fibres, sulphur components, and other deleterious impurities.

.4 Flashing, Roof Curbs, Gutters and Downspouts, and Trim: Prefinished flashing materials to match roofing materials in accordance with Section 07 62 00.

Part 3 Execution

3.1 PREPARATION

.1 Install auxiliary levelling substrate boards over steel deck; attach with mechanical fasteners into top flutes of steel to prevent wind uplift.

.2 Install flashings and other sheet metal in accordance with requirements specified in Section 07 62 00.

.3 Install fasciae and copings in accordance with requirements specified in Section 07 62 00.

.4 Install eave angles, furring, and other miscellaneous roof system support members and anchorage in accordance with metal roofing system manufacturer's written recommendations.

3.2 ICE AND WATER SHIELD INSTALLATION

.1 Install self adhering sheet ice and water shield, wrinkle free, on roof sheathing under metal roofing system.

.2 Apply primer if required by manufacturer and install in accordance with temperature restrictions of ice and water shield manufacturer; use primer rather than nails for installing ice and water shield at low temperatures.

.3 Apply over entire roof in shingle fashion to shed water, with end laps of not less than 150 mm staggered 600 mm between courses and as follows:

.1 Overlap side edges not less than 90 mm.

.2 Extend ice and water shield into gutter trough.

.3 Roll laps with roller.

.4 Cover ice and water shield within 14 days.

.4 Install flashings to cover ice and water shield in accordance with requirements specified in Section 07 62 00.

.5 Apply slip sheet over ice and water shield before installing metal roofing system.

3.3 METAL ROOFING INSTALLATION

.1 Install metal roofing system in accordance with manufacturer's written instructions and as modified by this Section; consistent with weatherproof and waterproof installation requirements.

.2 Install exterior metal panels to structural support by mechanical fasteners.

.3 Install preformed corners and end enclosures, caulked and sealed to arrest direct weather penetration.

.4 Ensure panels aligned vertically, horizontally and contoured as indicated.

3.4 TOLERANCES

.1 Maintain following installation tolerances:

.1 Maximum variation from plane or location shown on reviewed shop drawings: 10 mm/m of length and up to 20 mm/100 m maximum.

.2 Maximum offset from true alignment between two adjacent members abutting end to end, in line: 0.75 mm.

3.5 ADJUSTING AND CLEANING

.1 Remove all excess materials, debris and equipment at completion.

.2 Clean all panels clean and free of all grime and dirt.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 This Section includes requirements for supply and installation of the following panel systems:

.1 Profiled steel panels forming a part of an exterior wall system with a system of girts, flashings and trims using prefinished sheet materials to match Manufactured Metal Panel Roofing specified in Section 07 41 00.

.2 Provide specified system with labour, materials, and equipment required to fabricate and erect panels including cutting and penetrations, accessories, flashings, trims and closures necessary for a complete installation.

1.2 RELATED REQUIREMENTS

.1 Section 04 81 00 – Unit Masonry Assemblies

.2 Section 07 41 00 – Manufactured Metal Panel Roofing

.3 Section 07 62 00 – Sheet Metal Flashing and Trim: Metal flashing and trim not part of this Work.

.4 Section 07 92 00 – Joint Sealants: Site applied sealants

1.3 REFERENCE STANDARDS

.1 American Architectural Manufacturers Association (AAMA):

.1 AAMA 605.2, Voluntary Specification for High Performance Coatings on Architectural Panels and Extrusions

.2 American Society for Testing and Materials (ASTM):

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

.2 ASTM A755/A755M-04a, Standard Specification for Steel Sheet, Metallic Coated by the Hot-Dip Process and Prepainted by the Coil-Coating Process for Exterior Exposed Building Products

.3 Canadian Sheet Steel Building Institute (CSSBI):

.1 CSSBI 20M-99, Standard for Sheet Steel Panels for Architectural, Industrial and Commercial Building Applications

.2 CSSBI S8-2007, Quality and Performance Specification for Prefinished Sheet Steel Used for Building Products

.4 Canadian Standards Association (CSA):

.1 CSA CAN/CSA S16-09, Limit States Design of Steel Structures

.2 CSA S136-12, North American Specification for the Design of Cold-Formed Steel Structural Members and Commentary

.5 Canadian General Standards Board (CGSB):

.1 CGSB 1.108-M89, Bituminous Solvent Type Paint

1.4 SUBMITTALS

.1 Provide required information in accordance with Section 01 33 00 – Submittal Procedures.

.2 Action Submittals: Provide the following submittals before starting any work of this Section:

.1 Product Data: Submit manufacturer's product data, standard details, certified product test results, and general recommendations, as applicable to materials and finishes for each component and for total panel assemblies.

.2 Shop Drawings:

.1 Submit shop drawings indicating layouts of panels, details of corner conditions, joints, panel profiles, supports, anchorages, trim, flashings, closures, and special details, distinguishing between factory and site assembled work.

.2 Include structural analysis data signed and sealed by a professional engineer responsible for their preparation of shop drawings for installed products indicated to comply with design loadings listed in 2.1 below.

.3 Samples: Submit samples of materials as follows:

.1 Provide manufacturer's colour charts or chips showing the full range of colours, textures, and patterns available for wall panels with factory applied finishes for initial selection.

.2 Provide sample panels 300 mm long x actual panel width in specified profile, style, colour, and texture including clips, caps, battens, fasteners, closures, and other exposed panel accessories for verification and acceptance by the Departmental Representative.

1.5 PROJECT CLOSEOUT SUBMISSIONS

.1 Operation and Maintenance Data: Submit manufacturer’s written instructions for repair and cleaning procedures, include name of original installer and contact information in accordance with Section 01 78 23.

.2 Record Documentation: Submit as constructed information in accordance with Section 01 78 39.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Delivery and Acceptance Requirements:

.1 Package materials for protection against damage during transportation or handling.

.2 Deliver materials so they will not be damaged or deformed.

.2 Storage and Handling Requirements:

.1 Exercise care in unloading, storing, and erecting wall system to prevent bending, warping, twisting, and surface damage.

.2 Stack materials on platforms or pallets, covered with tarpaulins or other suitable weather tight and ventilated covering, maintaining wall system in a dry condition.

.3 Do not store materials in contact with other materials that might cause staining, denting, or other surface damage.

1.7 SITE CONDITIONS

.1 Site Measurements: Verify dimensions including structural members and openings in substrates by site measurements before fabrication and indicate measurements on shop drawings where metal wall panels are indicated to fit between or around other construction; coordinate fabrication schedule with construction progress to avoid delaying the Work.

.2 Established Dimensions: Where site measurements cannot be made without delaying the Work, either establish opening dimensions and proceed with fabricating wall system without site measurements or allow for trimming panel units on site, coordinate wall construction to ensure actual locations of structural members and to ensure opening dimensions correspond to established dimensions.

Part 2 Products

2.1 PERFORMANCE CRITERIA

.1 Calculate live load deflections in accordance with CSSBI 20M, as modified by the requirements of this Section.

.2 Provide for movement of components without causing buckling, failure of joint seals, undue stress on fasteners when subject to seasonal temperature range from -40°C to +50°C, and wind loads noted in **Error! Reference source not found.**.

.3 Provide for positive drainage to the exterior of all water entering or condensation occurring within the system.

2.2 PANELS MATERIALS

.1 Zinc Galvanized Sheet Steel Panels: Tension levelled, Commercial Steel (CS) designation, Type A, Grade 230 (33) in accordance with ASTM A653/A653M and as follows:

.1 Thickness: Minimum 0.76 mm base metal thickness, or thicker as required to meet design loads.

.2 Galvanizing Designation: Z275 (G90) applied evenly to both sides.

.3 Metal Panels:

.1 Profile: Corrugated to match profile of Manufactured Metal Panel Roofing as specified in Section 07 41 00.

.2 Surface Texture: Smooth

.3 Finish: Prefinished to match finish listed for Steel Standing Seam Metal Roofing System as specified in Section 07 41 00.

2.3 SYSTEM COMPONENTS

.1 Girts: Fabricated from minimum 1.21 mm base metal thickness galvanized steel to ASTM A653/A653M, Grade 230 with Z275 (G90) coating; finish material visible after assembly of wall system to match panels.

.2 Isolation Tape: Manufacturers standard material for separating dissimilar metals from direct contact.

.3 Flashing, Trim and Enclosure: Core material, thickness, and finish to match panels material.

.4 Fasteners: Non-corrosive fasteners as recommend by panel manufacturer, and as follows:

.1 Attachment panel system to primary panel structural supports using manufacturer’s recommended fasteners; finish all exposed fasteners to match metal panels.

.5 Closure Strips: Closed cell, self extinguishing, expanded, cellular, rubber or cross linked, polyolefin foam flexible closure strips, cut or pre-moulded to match configuration of panels to maintain weather tight construction.

.6 Sealing Tape: Pressure-sensitive, 100% solids, polyisobutylene compound sealing tape with release paper backing; permanently elastic, non-sag, non-toxic, non-staining.

.7 Sealant: One-part elastomeric polyurethane, polysulphide, or silicone rubber sealant as recommended by panel manufacturer in accordance with Section 07 92 00, type as recommended by manufacturer for specific end use, colour to match panels where exposed.

.8 Accessories: Provide components required for a complete wall panels assembly including trim, copings, fasciae, mullions, sills, corner units, clips, seam covers, flashings, louvers, sealants, gaskets, fillers, closure strips, and similar items; to match materials and finishes of panels.

.9 Bituminous Coating: Cold-applied asphalt mastic, in accordance with CGSB 1.108, compounded for 0.40 mm dry film thickness per coat with inert type non-corrosive compound free of asbestos fibres, sulphur components, and other deleterious impurities.

2.4 FABRICATION

.1 Fabricate and finish panels, and accessories at the factory to greatest extent possible using manufacturer's standard procedures and processes, and conforming to indicated profiles and with dimensional and structural requirements.

.2 Fabricate panels true, plumb and square, with no oil-canning or deformity that detracts from aesthetic appearance.

.3 Apply bituminous coating or other permanent separation materials on concealed panel surfaces where panels will be in direct contact with substrate materials that are not compatible or could result in corrosion or deterioration of either materials or finishes.

Part 3 Execution

3.1 EXAMINATION

.1 Obtain dimensions from project site before fabricating wall system.

.2 Examine substrates and conditions for conditions affecting performance of metal panel walls and correct unsatisfactory conditions, or notify Contractor for correction of conditions not controlled by this Section.

.3 Do not proceed with wall panel installation until unsatisfactory conditions have been corrected.

.4 Inspect wall system and components before installation and verify that there is no shipping damage.

.5 Do not install damaged panels; repair or replace as required for smooth and consistent finished appearance.

3.2 PREPARATION

.1 Coordinate metal wall system installation with rain drainage work; flashing; trim; and construction of soffits, roofing, parapets, walls, and other adjoining work to provide a leak-proof, secure, and non-corrosive installation.

.2 Promptly remove protective film, if any, from exposed surfaces of metal panels. Strip with care to avoid damage to finish.

.3 Install girts, angles, and other secondary structural panel support members and anchorage according to reviewed shop drawings and manufacturer’s written instructions.

3.3 PANEL INSTALLATION

.1 Comply with panel manufacturer's written instructions and recommendations for installation, as applicable to project conditions and supporting substrates.

.2 Anchor wall system and other components of the work securely in place, with provisions for thermal and structural movement, and as follows:

.1 Site cutting exterior panels by torch is not permitted.

.2 Install panels with manufacturer’s standard fasteners.

.3 Locate and space exposed fasteners in true vertical and horizontal alignment. Use proper tools to obtain controlled, uniform compression for positive seal without rupture of neoprene washer.

.3 Install accessories as required for a complete wall panel assembly including trim, copings, fasciae, mullions, sills, corner units, clips, seam covers, flashings, louvers, sealants, gaskets, fillers, closure strips, and similar items.

.4 Joint Sealers: Install gaskets, joint fillers, and sealants where indicated and where required for weatherproof performance of wall panel assemblies of types indicated or, if not otherwise indicated, types recommended by panel manufacturer and as follows:

.1 Install weather seal to prevent air and moisture penetration.

.2 Flash and seal panels at ends and intersections with other materials with rubber, neoprene, or other closures to exclude weather.

.3 Seal panel end laps with a bead of tape or sealant, full width of panel.

.4 Seal side joints where recommended by panel manufacturer.

.5 Prepare joints and apply sealants to comply with requirements of Section 07 92 00.

.5 Wall panels: Apply elastomeric sealant continuously between metal base channel (sill angle) and concrete, as required for waterproofing in accordance with sealant manufacturer's written instructions, and as follows:

.1 Fasten flashings and trim around openings and similar elements with self-tapping screws.

.2 Install screw fasteners with power tools having controlled torque adjusted to compress neoprene washer tightly without damage to washer, screw threads, or panels.

.3 Install screws in predrilled holes.

.4 Provide weatherproof escutcheons for pipe and conduit penetrating exterior walls.

.6 Separate dissimilar metals by painting each metal surface in area of contact with a bituminous coating or by other permanent separation as recommended by manufacturers of dissimilar metals.

.7 Remove temporary protective coverings and strippable films, if any, as soon as each panel is installed.

.8 Installation Tolerances: Shim and align panel system within installed tolerance of 6 mm in 6100 mm on level, plumb, and location lines as indicated, and within 3 mm offset of adjoining faces and of alignment of matching profiles.

3.4 SITE QUALITY CONTROL

.1 Manufacturer’s representative, Contractor and Departmental Representative shall carry out final inspection and approval of completed Work.

.2 Deficiencies will be noted in accordance with Section 01 77 00 – Closeout Procedures, and corrections made before acceptance of Declaration for Substantial Performance.

3.5 NON-CONFORMING WORK:

.1 Damaged Units: Replace panels and other components of the Work that have been damaged or have deteriorated beyond successful repair by finish touch-up or similar minor repair procedures.

3.6 CLEANING AND PROTECTION

.1 Cleaning: On completion of panel installation, clean finished surfaces following instructions of panels manufacturer and maintain in a clean condition during construction.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 This Section includes requirements for supply and installation of a unitized ceramic panel system forming part of the building envelope including but not limited to:

.1 Aluminum vertical framing.

.2 Extruded solid ceramic panels.

.3 Thermally broken clip system

.4 Sheathing membrane

.5 Anchors, fasteners, flashings, weatherseals, cover plates and formed metal trim through and at the perimeter of the panel system and other accessories required for a complete installation.

1.2 RELATED REQUIREMENTS

.1 Section 05 41 00 – Structural Metal Stud Framing

.2 Section 06 16 43 – Gypsum Sheathing: Fiberglass matt faced gypsum based sheathing.

.3 Section 07 21 13 – Board Insulation

.4 Section 07 25 13 – Air and Vapour Membranes

.5 Section 07 62 00 – Sheet Metal Flashing and Trim

1.3 DEFINITIONS

.1 Delegated Design Professional Engineer: The professional engineer hired or contracted to the fabricator or manufacturer to design specialty elements, produce delegated design submittals and shop drawings to meet the requirements of the Project; who is registered in the province of the Work; and who is not the Departmental Representative.

1.4 REFERENCE STANDARDS

.1 Specification American Society for Testing and Materials (ASTM):

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

.2 ASTM B209-10, Standard Specification for Aluminum and Aluminum Alloy Sheet and Plate

.3 ASTM B211-12e1, Standard Specification for Aluminum and Aluminum Alloy Rolled or Cold Finished Bar, Rod, and Wire

.4 ASTM B221-12, Standard for Aluminum and Aluminum Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes

.5 ASTM C1166-06(2011), Standard Test Method for Flame Propagation of Dense and Cellular Elastomeric Gaskets and Accessories

.6 ASTM D395-03(2008), Standard Test Methods for Rubber Property Compression Set

.7 ASTM D412-06ae2, Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers Tension

.8 ASTM D624-00(2012), Standard Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers

.9 ASTM D746-07, Standard Test Method for Brittleness Temperature of Plastics and Elastomers by Impact

.10 ASTM D1149-07(2012), Standard Test Methods for Rubber Deterioration Cracking in an Ozone Controlled Environment

.11 ASTM D2240-05(2010), Standard Test Method for Rubber Property Durometer Hardness

.2 Underwriter Laboratories of Canada (ULC):

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

.2 CAN/ULC-S114-05, Standard Method of Test for Determination of Non-combustibility in Building Materials

.3 CAN/ULC-S134-92, Fire Test for Exterior Wall Assemblies

.4 CAN/ULC-S135-04, Standard Test Method for the Determination of Combustibility Parameters of Building Materials Using an Oxygen Consumption Calorimeter (Cone Calorimeter), Includes Amendment 1

.3 Canadian Construction Materials Centre (CCMC):

.1 CCMC 13549-R, Technical Guide 07 193 Sheathing Membrane - Breather Type

1.5 ADMINISTRATIVE REQUIREMENTS

.1 Coordination: Coordinate installation of air and vapour retarder membranes and insulation with installation of work of this Section, confirm acceptable substrate and fastening requirements for work of this Section supplied and installed by other Sections.

.2 Pre-Construction Meetings: Conduct preinstallation meeting in accordance with Section 01 31 19 – Project Meetings attended by Contractor, Subcontractor, manufacturer’s representative, Departmental Representative and other parties affected by work of this Section to verify project requirements, substrate conditions, manufacturer‘s recommended installation instructions and manufacturer‘s warranty requirements.

1.6 SUBMITTALS

.1 Provide required information in accordance with Section 01 33 00 – Submittal Procedures.

.2 Action Submittals: Provide the following submittals before starting any work of this Section:

.1 Product Data: Submit manufacturer’s standard product data clearly indicating materials used and methods of installation.

.2 Shop Drawings: Submit shop drawings indicating attachment methods, joinery, accommodation of thermal movement, edge conditions, panel joints and reveals, fixture locations, anchorages, accessories, finish colours, patterns and textures; prepare detail drawings at a minimum 1:2 scale and elevations at a minimum 1:100 scale.

.3 Samples:

.1 Samples for Initial Selection: Manufacturer's colour charts or chips showing the full range of colors, textures, and patterns available for wall panels with factory applied finishes.

.4 Samples for Verification:

.1 Panels: Submit two (2) -300 mm x 300 mm samples of selected colour before ordering material.

.2 Accessories: Submit one (1) sample of clips, caps, battens, fasteners, closures, and other exposed panel accessories used in the final panel assembly.

.3 Informational Submittals: Provide the following submittals when requested by the Departmental Representative:

.1 Certificates: Submit qualification statement or certificate stating that fabricator and installer are approved by manufacturer and have the necessary tools, equipment and expertise to undertake work specified in this Section.

.2 Source Quality Control Submittals: Submit product test reports indicating compliance of manufactured wall panel assemblies and materials with performance and other requirements based on comprehensive testing of current products.

.3 Site Quality Control Submittals: Submit written inspection report indicating compliance with manufacturers requirements for installation and system requirements.

.4 Sustainable Design Submittals: Coordinate project sustainable design requirements with Section 01 35 21 LEED - Requirements.

1.7 PROJECT CLOSEOUT SUBMISSIONS

.1 Operation and Maintenance Data: Submit manufacturer’s written instructions for procedures, include name of original installer and contact information in accordance with Section 01 78 00 – Closeout Submittals.

1.8 QUALITY ASSURANCE

.1 Regulatory Requirements: Use only materials for non-combustible construction meeting flame and smoke developed criteria required by the Authority Having Jurisdiction and the referenced standards.

.2 Qualifications:

.1 Manufacturer: Obtain materials from a single manufacturer having technical support personnel that can provide technical review to panel fabricator to address specific installation requirements.

.2 Fabricator: Use fabricator having shop and equipment required to factory fabricate panels to shapes and configurations indicated, having experience with projects of similar complexity and extent, and certified by manufacturer.

.3 Delegated Design Professional Engineer: Retain a professional engineer, registered in the province of the Work, to design fabrication and erection of the Work of this Section in accordance with applicable Building Code and Contract Documents requirements including; but not limited to, the following:

.1 Seal and signature to shop drawings and design submittals

.2 Site review and certification of installed components

1.9 MOCK-UPS

.1 Provide required Mock-Up in accordance with Section 01 45 00 – Quality Control.

.2 Construct mock-up for each form of construction and finish required to verify selections made under sample submittals and to demonstrate aesthetic effects and qualities of materials and execution before installing wall panels.

.3 Build mock-up using exposed and concealed materials indicated for the completed Work, and as follows:

.1 Locate mock-up in the location and of the size indicated or, if not indicated, as directed by Departmental Representative.

.2 Notify Departmental Representative 7 days in advance of the dates and times when mock-up will be constructed.

.3 Demonstrate the proposed range of aesthetic effects and workmanship.

.4 Obtain Departmental Representative's acceptance of mock-up before proceeding with construction of wall panels.

.5 Maintain mock-up during construction in an undisturbed condition as a standard for judging the completed Work.

.6 Accepted mock-up in an undisturbed condition at the time of Substantial Performance may form a part of the completed Work.

1.10 DELIVERY, STORAGE AND HANDLING

.1 Delivery and Acceptance Requirements: Schedule delivery of products specified in this section to avoid delaying the Work; deliver materials in manufacturer’s original, unopened, undamaged containers with identification labels intact.

.2 Storage and Handling Requirements:

.1 Store materials in unopened packaging until ready for installation

.2 Store materials in a covered area, away from water, on a flat, level surface with adequate support to prevent sagging and in accordance with manufacturer’s instructions.

.3 Store materials in their final environment a minimum three (3) to four (4) days before installation with packaging removed and components stacked with spacers between each piece.

.4 Protect materials during handling in accordance with manufacturer’s instructions.

1.11 SITE CONDITIONS

.1 Site Measurements: Verify dimensions by site measurements before fabrication and indicate measurements on shop drawings where ceramic wall panels are indicated to fit between or around other construction; coordinate fabrication schedule with construction progress to avoid delaying the Work.

.2 Established Dimensions: Establish dimensions and proceed with fabricating ceramic wall panels without site measurements where site measurements cannot be made without delaying the Work; coordinate construction to ensure that actual site dimensions correspond to established dimensions; allow for trimming and fitting.

Part 2 Products

2.1 PERFORMANCE REQUIREMENTS

.1 General Performance: Assemblies shall comply with performance requirements without failure due to defects in manufacture, fabrication, installation, or other defects in construction.

.2 Delegated Design: Ceramic wall panel system, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

.3 Structural Performance: Provide Ceramic Facade assembly capable of withstanding the effects of the following loads and stresses within limits and under conditions indicated, based on testing according to ASTM E 330.

.1 Wind Loads: Uniform pressure of 40 psf inward and outward wind pressures.

.2 Deflection Limits: Ceramic Facade assemblies shall provide L/180 maximum deflection required by the panel manufacturer.

.3 Condensation: Panels shall accommodate positive drainage for moisture entering or condensation occurring within panel system.

.4 Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

.1 Temperature Change (Range): -29°C to 82°C ambient; 82°C material surfaces.

.5 Design to accommodate, by means of control joints, movement in wall system and between wall system and building structure, caused by structural movements, without permanent distortion, damage to in fills or racking of joints.

2.2 EXTERIOR PANELS

.1 Ceramic Panels: Vacuum-extruded solid panels produced from double dried fine powdered clay, through colour, complete with rear ribs for reinforcement and mounting, manufactured as follows:

.1 Mounting Configuration: Prepare panels for non-exposed fastener installation

.2 Panel Thickness: 22 mm

.3 Panel Profile:

.1 Type 1: Smooth Surface, 250 mm x 1000 mm

.2 Type 2: Grooved Surface, 250 mm x 1000 mm

.3 Type 3: Striped Surface, 250 mm x 1000 mm

.4 Dimension Tolerances:

.1 Length: ±1 mm

.2 Height: ±2 mm

.3 Evenness: ±2 mm

.4 Top edge bending: Max 0.25%

.5 Butt edge bending: Max 0.25%

.6 Squareness: Max 2 mm in 1000mm

.5 Physical Characteristics:

.1 Density: 2,250 kg/m³

.2 Water absorption: <6% weight

.6 Finish:

.1 Inside surface: Natural

.2 Outside surface: Manufacturer's standard anti-graffiti coating

.3 Colour: As selected by the Departmental Representative from manufacturer's complete product line.

2.3 SYSTEM BACK UP MATERIALS

.1 Vertical Girt Framing:

.1 Manufacturer's standard vertically oriented and vented girt and rail system, complete with support hangers allowing panel to clip into attachment rail.

.2 Aluminum Sub-Framing Materials:

.1 Aluminum extrusions, mill finish meeting requirements for ASTM B221 alloy 6063-T6 in shapes and sizes selected by fabricator as required to suit design loading and wall configuration.

.2 Aluminum Trim and Accessory Materials: Aluminum sheet or plate, anodized finish meeting requirements for ASTM B209 alloy 6063-T6 in configurations and sizes selected by fabricator as required to suit details.

.3 Thermally improved cladding support system: Panel manufacturer's standard adjustable thermally broken supporting girt system as follows:

.1 Closure Protection/Vent Screen: Manufacturer's recommended material comprised of compressible open-cell U/V stabilised polyether polyurethane foam or other screening material that provides the following:

.1 Air Flow: Minimum of 50% free area, thickness to fill ventilation cavity between rear of cladding panels and insulation, inserted at top, bottom, edges and perimeters of penetrations.

.2 Opening Size: Sized to minimize infiltration of air, water, dust and insects into the cavity space, and allowing drainage of water accumulating within ventilation cavity.

.2 Fasteners: Stainless steel fasteners designed to reduce thermal conductivity and that accommodate thermal expansion and contraction without transferring excessive stress to cladding panels.

.3 Structural Thermal Break Spacer: Fibre reinforced thermoset plastic, structural thermal break, washers and bushings, custom sized to match structural bearing locations and as follows:

.1 Loading Pressure: Nominal 300 N/mm^2

.2 Compressive Modulus: Nominal 10,000 N/mm^2

.3 Shear Strength: Nominal 110 N/mm^2

.4 Thermal Conductivity: Maximum USI-Value 0.20 W/m^2-°K

.4 Thermal Breaks and Separation Strips: EPDM rubber or cork strips as standard to thermally improved cladding support system, and to maintain performance required for thermal improvement indicated above.

.5 Supporting Substructure and Girts: Manufacturer's standard system of substructure and girts, thickness based on structural support requirements of thermally improved cladding support system and as follows:

.1 Steel Girts: Fabricate from galvanized zinc coated steel meeting requirements of ASTM A653 having Grade A, Z275 Coating

.2 Finish: Black finished where visible through open joints of cladding system; bare metal in concealed locations.

.3 Drainage and Air Circulation: Perforate or notch horizontal components to allow for drainage and airflow.

.4 Girt locations as determined thermally improved cladding support manufacturer to align with modular panel fasteners spacing based on panel load data.

.4 Sheathing Membrane: Triple layer, spun bonded polypropylene, breathable membrane with a nominal weight of 120 g/m², water vapour transmission of 150 perms minimum, as per ASTM E96; Colour: Black.

.1 Seam Tape: 25mm double sided tape, 0.76 mm thick, to seal vertical and horizontal seams between layers of sheathing membrane.

.5 Air/Vapour Membrane: Bituminous sheet membrane as specified in Section 07 25 13.

.6 Insulation: Semi-rigid fibrous board insulation as specified in Section 07 21 13.

.1 Insulation Fasteners: Corrosion resistant, galvanized bugle head screws with 38 mm diameter washer, 25 mm minimum penetration into framing.

2.4 ACCESSORIES:

.1 Manufacturer's recommended materials required for complete installation including but not limited to the following:

.2 Joint Inserts: Aluminum joint trim, black finish, located between each horizontally adjacent panel, allowing for panel alignment and uniform joint dimension, in configurations and sizes as shown in Drawings.

.3 Corner Trims: Manufacturer's standard extruded aluminum corner trim, in configurations and sizes as shown in Drawings.

.4 Continuous bird and vent screen located at top and bottom of panel system, where opening is minimum 25mm wide, with minimum 50% free air flow, manufactured from perforated aluminum, painted black.

.5 Flashings: Prefinished flashings, colour to match panel colours as specified in Section 07 62 00.

2.5 FABRICATION

.1 Fabricate wall panels and components to obtain profiles and details indicated on drawings and as indicated in shop drawings.

.2 Fabricate components at factory to the greatest extent possible using best shop practices as required by panel manufacturer.

.3 Fabricate components to match quality and installation of acceptable mock-up specified above.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: Verify building surfaces are smooth, clean and dry, and free from defects before beginning of installation of products specified in this Section:

.1 Notify Departmental Representative of conditions not acceptable for installation of system.

.2 Installation of products specified in this Section will denote acceptance of site conditions.

.2 Inspect all panels and components prior to installation and verify that there is no shipping damage; do not install damaged panels, repair or replace as required for smooth and consistent finished appearance.

3.2 PREPARATION

.1 Prepare surfaces using methods recommended by manufacturer for this scope of Work.

.2 Protect metal surfaces in contact with concrete, masonry mortar, plaster or other cementitious surface with isolation coating.

3.3 INSTALLATION

.1 Install air/vapour retarder membrane in accordance with Section 07 25 13.

.2 Install board insulation in accordance with Section 07 12 13.

.3 Install sub-framing in accordance with manufacturer’s instructions; provide additional framing as may be required to conform to specified performance requirements. Install girts maximum 610 mm centres.

.4 Install sub-framing attached to structural support or wall framing, using manufacturer’s recommended non-exposed fasteners; apply bituminous paint or tape between the dissimilar metals or concrete and aluminum sub-framing materials to isolate against corrosion.

.5 Install insulation between sub-framing members to maintain continuous thermal barrier using disk type fasteners spaced at nominal 300 mm vertical on centre spaced evenly from edges of insulation, and at nominal 400 mm horizontal on centre, aligning with wall framing.

.6 Install fasteners into wall framing; do not remove fastener where fastener does not penetrate framing; removal of fastener will damage integrity of air/vapour membrane, realign fastener location and install new fastener in close proximity to original fastener so that it penetrates wall framing.

.7 Install flashings in accordance with Section 07 62 00 to divert all moisture and condensation to exterior; trim and flash around doors, louvers, windows and other openings.

.8 Install panels in accordance with manufacturer’s instructions; align vertically and horizontally, and flush between adjacent panels to within tolerances indicated; with weep holes and drainage channels free of dirt and sealants that could impede the function of the rain screen assembly.

.9 Tolerances:

.1 Panel Dimensions: Allow for site adjustment and thermal movement.

.2 Panel Surfaces: Free of scratches or marks caused during fabrication and installation.

.3 Installation to allow for thermal expansion of the panel. Provide a minimum of 10mm space between top and bottom of each panel.

3.4 CLOSEOUT ACTIVITIES

.1 Repair or Replacement:

.1 Remove and replace panels that are damaged and cannot be repaired; coordinate with Contractor for responsibility of repairs not caused by work of this Section.

.2 Touch-up damaged finishes with manufacturer's recommended touch-up paint; touch-up painting will only be permitted where damaged finishes are visible in final installation.

.2 Cleaning:

.1 Remove strippable film coating or masking as soon as possible after surrounding material is installed.

.2 Remove excess materials, debris, and equipment at completion.

.3 Clean all panels clean and free of all grime and dirt.

3.5 PROTECTION

.1 Protect installed materials and finish surfaces from damage by other subcontractors for the duration of construction.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 This Section includes requirements for an aluminum composite panel assembly and forming an integrated rain screen assembly vented horizontally and vertically including; but not limited to, the following:

.1 Exterior Panel Cladding: Anchorages, shims, furring, fasteners, girts, flashings and adapters, insulation and air/vapour barrier, and closures.

.2 Accessory Cladding: Parapets, column covers, soffits, sills, borders and fillers integral to the panel system and required for a complete assembly.

1.2 REFERENCE STANDARDS

.1 American Architectural Manufacturer's Association (AAMA):

.1 AAMA 508-05, Voluntary Test Method and Specification for Pressure Equalized Rain Screen Wall Cladding Systems

.2 AAMA 620-02, Voluntary Specifications for High Performance Organic Coatings on Coil Coated Architectural Aluminum Substrates

.2 American National Standards Institute (ANSI):

.1 ANSI H35.1-2009, Standard Alloy and Temper Designation Systems for Aluminum

.3 American Society for Testing of Materials (ASTM):

.1 ASTM A653/A653M-09, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process

.2 ASTM B209-07, Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate

.3 ASTM C393/C393M-06 Standard Test Method for Flexural Properties of Sandwich Constructions by Beam Flexure

.4 Canadian General Standards Board (CGSB):

.1 CGSB 1.108-M89, Bituminous Solvent Type Paint

.2 Underwriters Laboratories Canada (ULC):

.1 CAN/ULC S102-07, Method of Test for Surface Burning Characteristics of Building Materials and Assemblies

.2 CAN4 S114-05, Test for Determination of Non-Combustibility in Building Materials

.3 CAN/ULC S134-92 (R1998), Standard Method of Fire Test of Exterior Wall Assemblies

1.3 ADMINISTRATIVE REQUIREMENTS

.1 Coordination: Coordinate work of this Section with work of other sections that may have items supported by or built into aluminum composite panel assemblies including; but not limited to, supports and connectors to structure, doors and windows, building signage, mechanical and electrical penetrations, erection tolerances and as follows:

.1 Flashings for Other Work of the Contract: Coordinate work of this section with requirements of Section 07 62 00 for supply of prefinished sheet metal flashing materials to other Sections of the Work with installation by other Sections of the Work as follows:

.1 Supply prefinished sheet metal flashings required for the project in sheet metal thickness and colour specified in this Section.

.2 Provide prefinished sheet metal flashings tension levelled and guillotine sheared to length ready for brake forming, fabrication and installation.

.2 Pre-Construction Meetings: Include required participants and an outline agenda for meeting in accordance with Section 01 31 19 – Project Meetings and as follows:

.1 Meeting Time: Arrange meeting before starting work k this Section to discuss expectations for fit and finish of aluminum composite panel assemblies, quality of workmanship for installation of air and vapour retarders and transitions, continuity of insulation and relationship of wall system to adjacent components.

.2 Participants: Arrange for attendance by Contractor for this Section; Subcontractors of affected components of the Work, manufacturer's representative and Departmental Representative.

1.4 SUBMITTALS

.1 Provide required information in accordance with Section 01 33 00 – Submittal Procedures.

.2 Action Submittals: Provide the following submittals before starting any work of this Section:

.1 Shop Drawings: Submit shop drawings indicating attachment methods, joinery, sealing methods and accommodation of thermal movement, drawing at a minimum half full size.

.2 Samples for Verification: Submit the following samples:

.1 Panels: Submit two (2)-75 mm x 125 mm chip for custom colour approval before ordering material.

.2 Accessories: Submit one (1) sample of clips, caps, battens, fasteners, closures, and other exposed panel accessories used in the final panel assembly.

.3 Informational Submittals: Provide the following submittals when requested by the Departmental Representative:

.1 Certificates: Submit qualification statement or certificate stating that fabricator and installer are approved by manufacturer and have the necessary tools, equipment and expertise to undertake work specified in this Section; include lists of completed projects with project names and addresses, indicating range of experience.

.2 Source Quality Control Submittals: Submit product test reports indicating compliance of manufactured wall panel assemblies and materials with performance and other requirements based on comprehensive testing of current products.

.3 Site Quality Control Submittals: Submit written inspection report indicating compliance with manufacturers requirements for installation and system requirements.

.4 Submit authorized documentation stating conformation to CAN/ULC S102, S114, and S134.

1.5 QUALITY ASSURANCE

.1 Regulatory Requirements: Provide panels that are listed and labelled in accordance with CAN/ULC S102, S114 and S134 for fire endurance and flame spread testing.

.2 Qualifications: Provide proof of qualifications when requested by Departmental Representative:

.1 Professional Engineer: Retain a professional engineer, registered in the province of the Work, to design fabrication and erection of the Work of this Section in accordance with applicable Building Code and Contract Documents requirements including; but not limited to, the following:

.1 Seal and signature to shop drawings and design submittals

.2 Site review and certification of installed components

.2 Manufacturer’s Engineering Recommendations: Perform composite wall panel work in accordance with written recommendations from panel manufacturer.

.3 Verify panel thickness based on maximum deflections provided in this Section and to suit building location and configuration.

1.6 DELIVERY, STORAGE, AND HANDLING

.1 Delivery and Acceptance Requirements: Deliver panels and other components so they will not be damaged or deformed; package panels for protection against damage during transportation or handling.

.2 Storage and Handling Requirements: Handling panels with care during unloading, storing, and erection to prevent bending, warping, twisting, and surface damage:

.1 Stack materials on platforms or pallets, covered with tarpaulins or other suitable weather tight and ventilated covering

.2 Store panels in dry location

.3 Do not store panels in contact with other materials that might cause staining, denting, or other surface damage

1.7 SITE CONDITIONS

.1 Site Measurements: Verify locations of structural members and opening dimensions by site measurements before fabrication and indicate measurements on shop drawings for aluminum composite panel assemblies that are indicated to fit other construction; coordinate fabrication schedule with construction progress to avoid delaying the Work.

.2 Established Dimensions: Establish dimensions and proceed with fabricating wall panel assemblies without site measurements where site measurements cannot be made without delaying the Work; coordinate construction to ensure that actual site dimensions correspond to established dimensions; allow for trimming and fitting.

Part 2 Products

2.1 PERFORMANCE REQUIREMENTS

.1 System Description: Plans, elevations, details, characteristics, and other requirements indicated are based upon materials and details provided by one manufacturer that forms part of this Section and as follows:

.1 Responsibility: Professional engineer is responsible for designing composite wall panel assembly, composite panel thickness and connections based on design loads, and verifying that installation meets requirements of the Authority Having Jurisdiction.

.2 Provide a rear ventilated rain screen system in accordance with good design practices as established by Canada Mortgage and Housing Corporation for curtain wall assemblies.

.3 Provide a system that has no visible fasteners, telegraphing or fastening on the exposed panel faces or other components that detract from a neat and flat finished appearance.

.4 Provide a system that does not place restraints on panel that could result in compressive skin stresses, and that will maintain a flat appearance regardless of temperature change.

.2 Design fabricated wall panel assemblies to meet or exceed the following minimum requirements:

.1 Wind Load: Determine wind loads using post disaster importance factors listed in the Building Code for deflection and strength, modified by the appropriate exposure, gust and pressure (internal and external) factors in accordance with Building Code structural commentaries

.2 Deflection Limitation: Maximum deflection of perimeter not to exceed L/175 or 19 mm; whichever is less, under system weight plus wind load (positive and negative) loads acting normal to plane of wall under 1 in 50 year sustained wind loading, and as follows:

.1 Maximum deflection criteria apply to horizontal plane of system, width and length, as well as vertical deflection.

.2 Include adequate stiffeners and fasteners are included to prevent excessive deflection.

.3 Thermal Movement: Design system that allows for thermal movements without buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects resulting from the following maximum change in ambient and surface temperatures:

.1 Base design calculation on surface temperatures of materials due to both solar heat gain and night time sky heat loss.

.4 Building Movement: Include provisions to accommodate movement in composite panel system and between composite panel system and building structure where these movements are caused by deflection of building structure.

.5 Drainage: Provide for positive drainage to the exterior of all water entering or condensation occurring within the system in accordance with NRC Rain Screen Principles.

2.2 COMPOSITE ALUMINUM BUILDING PANEL MATERIALS

.1 Aluminum Composite Panel: Two sheets of prefinished AA3000 Series aluminum sandwiching a fire rated composite core, formed in a continuous process with no glues or adhesives between dissimilar materials, and as follows:

.1 Total composite thickness: 4 mm

.2 Core: Non-combustible in accordance with ASTM D1929, CAN/ULC S102, CAN/ULC S114, and CAN/ULC S134

.3 Face Sheets: Nominal 0.50 mm thick

.4 Finish: Prefinished using manufacturer's standard 2 coat for MP-1 and manufacturer's standard 3 coat for MP-2, thermo-cured system composed of specially formulated inhibitive primer, fluoropolymer colour coat, and clear alkyl ether resin; coil coated with Polyvinylidene Fluoride (PVDF) or Fluoro Ethylene – Alkyl Vinyl Ether (FEVE) resin in accordance with AAMA 2605 coating thicknesses.

.1 Colour: to match Alpolic #439z456M Fluropon 9721 Metallic and selected by Departmental Representative from manufacturer's standard range

2.3 SYSTEM BACK-UP MATERIALS

.1 Panel Support System: Thermally Isolated ‘Z’ Girt System complete with continuous horizontal track and as follows:

.1 Z-Girts designed to accommodate insulation depth and allow full thermal expansion and contraction of sheet; cold-rolled, commercial grade structural quality sheet steel (SS), minimum 1.519mm base metal thickness; zinc-coated to ASTM A653/A653M, coating designation Z275.

.2 Proprietary system designed and tested to reduce thermal bridging through the exterior wall assembly from the structural metal stud framing to the Z-Girts retaining at least 75% of the calculated wall insulation value to be retained for the ‘true insulating value’.

.2 Isolation Tape: Manufacturers standard material for separating dissimilar metals from direct contact.

.3 Air/Vapour Retarder: Membrane as specified in Section 07 25 13.

.4 Insulation: As specified in Section 07 21 13.

.5 Insulation Fastenings: Corrosion resistant, galvanized bugle head screws with 38 mm diameter washer, 25 mm minimum penetration into framing.

2.4 ACCESSORIES

.1 Extrusions: Formed aluminum members, sheet, and plate in accordance with ASTM B209 and manufacturers written recommendations and as follows:

.1 Perimeter Extrusions: Alloy: AA-6063-T5, mill finish where non-exposed; to match panels when exposed.

.2 Stiffeners: Alloy: AA-6063-T5, mill finish

.2 Panel Stiffeners: Structurally fastened or restrained at ends, secured to rear face of composite panel with silicone or double sided high bond isolating tape to prevent weather staining and frost lines to the face of the panel as recommend by panel manufacturer; size stiffeners to maintain panel flatness to specified tolerances; material as recommended by panel manufacturer.

.3 Sealants and Gaskets: Panel system components as recommended by panel manufacturer to meet performance requirements.

.4 System Sealants: Sealants within the panel system, type as recommended by manufacturer, colour to match panel finish.

.5 Flashings: Fabricate flashing from 0.75 mm minimum thickness aluminum sheet, coloured to match panel where exposed to view; provide lap strip under flashing at butted conditions, with lapped surfaces sealed in a full bed of non-hardening sealant.

.6 Fasteners: Non-corrosive fasteners as recommend by panel manufacturer, and as follows:

.1 Attachment panel system to primary panel structural supports using manufacturer's recommended concealed fasteners.

.2 Use concealed fasteners for typical joinery.

.3 Obtain Departmental Representative's acceptance where exposed fasteners are required in isolated conditions; Departmental Representative will permit a limited number of exposed fasteners obscured within panel joinery using stainless steel fastenings, or in the face of panels using colour matched fastenings.

2.5 FABRICATION

.1 Fabricate composite wall panels and components to obtain profiles and details indicated on drawings and as indicated in shop drawings.

.2 Fabricate components at factory to the greatest extent possible using best shop practices as required by panel manufacturer.

.3 Fabricate components to match quality and installation of reviewed mock-up specified above.

Part 3 Execution

3.1 PREPARATION AND EXAMINATION

.1 Obtain dimensions from job site before fabricating panels.

.2 Verify that building surfaces are smooth, clean and dry, and free from defects detrimental to the installation of the system.

.3 Notify Contractor of conditions not acceptable for installation of system, start of work will indicate acceptance of substrate conditions.

.4 Inspect all panels and components prior to installation and verify that there is no shipping damage; do not install damaged panels, repair or replace as required for smooth and consistent finished appearance.

3.2 INSTALLATION

.1 Install air/vapour retarder membrane in accordance with Section 07 25 13.

.2 Install board insulation in accordance with Section 07 21 13.

.3 Install girts in accordance with manufacturer's instructions. Provide additional metal framing as may be required to conform to Performance Requirements.

.4 Install girts attached to structural support or wall framing, using recommended fasteners.

.5 Install additional stiffeners from grade to 1200mm, or closest panel joint to 1200mm.

.6 Install insulation between girts forming tight to following applied girt to maintain continuous thermal barrier. Install insulation with disk type fasteners spaced at 305 mm vertical o/c spaced evenly from edges of insulation, and at 406 mm horizontal o/c.

.7 Install fasteners into wall framing; do not remove fastener where fastener does not penetrate framing; removal of fastener will damage integrity of air/vapour membrane, realign fastener location and install new fastener in close proximity to original fastener so that it penetrates wall framing.

.8 Install flashings to divert all moisture and condensation to exterior. Trim and flash around doors, louvers, and windows.

.9 Install exterior metal cladding to structural support by hidden mechanical fasteners.

.10 Apply bituminous paint or caulking tape to insulate between the dissimilar materials and aluminum materials. Factory applied protective paint or G-90 galvanized steel is considered adequate insulation.

.11 Install pre-formed corners and end enclosures, sealed to arrest direct weather penetration.

.12 Install panels are aligned vertically and horizontally, and flush between adjacent panels to within tolerances indicated; with weep holes and drainage channels free of dirt and sealants that could impede the function of the rain screen assembly.

.13 Assemble and secure wall system so stresses on sealants are within manufacturers' recommended limits.

.14 Tolerances:

.1 Panel Dimensions: Allow for site adjustment and thermal movement.

.2 Panel Fabrication: Fabricate panels under controlled shop conditions to the greatest extent possible; site fabrication will only be permitted where minor adjustments are required to account for substrate variations that could not be identified during the preparation of shop drawings.

.3 Panel Lines, Breaks and Curves: Form changes in direction sharp, smooth, and free of warps or buckles.

.4 Panel Surfaces: Free of scratches or marks caused during fabrication and installation.

.5 Panel Bow: Maximum 0.8% of any 1830 mm panel overall dimension in width or length.

.6 Panel Flatness: Maximum 3 mm in 1525 mm deviation from panel flatness non-cumulative; no oil canning.

.7 Panel Joints: Maximum 1 mm lippage between any 2 adjacent panels not attached with same fastener; 0 mm lippage where 2 adjacent panels share the same fastener.

3.3 SITE QUALITY CONTROL

.1 Perform final inspection of completed work shall carried out by the manufacturer's representative; prepare a written report and submit to Departmental Representative certifying that installation meets manufacturers requirements and detailing for systems described in this Section.

.2 Perform final inspection with Departmental Representative, Contractor and Subcontractor, present; provide a minimum of 72 hours notice so that all parties can confirm their attendance.

3.4 TOUCH-UP AND CLEANING

.1 Remove and replace panels that are damaged and cannot be repaired; coordinate with Contractor for responsibility of repairs not caused by work of this Section.

.2 Remove strippable film coating or masking as soon as possible after surrounding material is installed.

.3 Remove excess materials, debris, and equipment at completion.

.4 Clean all panels clean and free of all grime and dirt.

.5 Touch-up damaged finishes with manufacturer’s recommended touch-up paint.

END OF SECTION

Part 1 GENERAL

1.1 RELATED REQUIREMENTS

.1 Section 03 52 16 – Lightweight Insulation Concrete: Lightweight insulating concrete forming the substrate for roof membrane specified in this Section.

.2 Section 06 10 00 –Rough Carpentry: Wood blocking and curbs required for roof construction.

.3 Section 07 62 00 – Sheet Metal Flashing and Trim.

.4 Section 07 71 00 – Roofing Specialties: Prefabricated roof penetrations.

1.2 REFERENCES

.1 ASTM International Inc.

.1 ASTM D4601/D4601M -04 (2012)e1, Standard Specification for Asphalt-Coated Glass Fiber Base Sheet Used in Roofing.

.2 ASTM D5147/D5147M-14, Standard Test Methods for Sampling and Testing Modified Bituminous Sheet Material.

.3 ASTM C726-12, Standard Specification for Mineral Fiber Roof Insulation Board.

.2 Canadian General Standards Board (CGSB)

.1 CGSB 37-GP-9Ma-83, Primer, Asphalt, Unfilled, for Asphalt Roofing, Dampproofing and Waterproofing.

.2 CGSB 37-GP-56M-80(1985), Membrane, Modified, Bituminous, Prefabricated, and Reinforced for Roofing.

.3 Canada Green Building Council (CaGBC)

.1 LEED Canada For New Construction and Major Renovations 2009.

.4 Canadian Roofing Contractors Association (CRCA)

.1 CRCA Roofing Specifications Manual-2011.

.5 Canadian Standards Association (CSA International)

.1 CAN/CSA-A123.4-04(R2013), Asphalt for Constructing Built-Up Roof Coverings and Waterproofing Systems.

.2 CSA O121-08(R2013), Douglas Fir Plywood.

.3 CSA O151-09(R2013), Canadian Softwood Plywood.

.4 CAN/ULC-S702-14, Thermal Insulation, Mineral Fibre, for Buildings.

.6 Factory Mutual Global (FM):

.1 FM 4454 Approval Standard for Lightweight Insulating Concrete Roof Deck.

.2 FM 4470 Approval Standard for Class 1 Roof Covers.

.3 Property Loss Prevention Data Sheets:

.1 1-28 Design Wind Loads and 1-28R Roof Systems.

.2 1-29 Roof Deck Securement and Above Deck Roof Components and 1-29R Roof Systems.

.3 1-49, Perimeter Flashing.

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

.1 Material Safety Data Sheets (MSDS).

.8 Underwriters Laboratories' of Canada (ULC)

.1 CAN/ULC S107-10, Standard Methods of Fire Tests of Roof Coverings

1.3 ADMINISTRATIVE REQUIREMENTS

.1 Convene pre-installation meeting 3 weeks prior to beginning roofing Work, with roofing contractor’s representative, Contractor, roofing inspector and Departmental Representative in accordance with Section 01 31 19.

.1 Coordinate the meeting to coincide with the pre-installation conference in Section 03 52 16.

.2 The purpose of this meeting is to review installation conditions particular to this project and review materials specified in this section.

.3 Agenda to cover but not limited to the following:

.1 Verify project requirements.

.2 Review installation and substrate conditions.

.3 Co-ordination with other Sections including Section 03 52 16.

.4 Review manufacturer's installation instructions and warranty requirements.

.4 The Contractor will complete the minutes and prepare a report for this meeting.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00.

.2 Product Data:

.1 Provide two copies of most recent technical roofing components data sheets describing materials' physical properties and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Provide two copies of WHMIS MSDS, and indicate VOC content for:

.1 Asphalt.

.3 Shop drawings:

.1 Submit membrane manufacturer's standard details that will be used for this project, indicate changes that must be made to make the details project specific for review by the Departmental Representative.

.4 Sustainable Design Submittals:

.1 LEED Submittals: in accordance with Section 01 35 21.

.5 Informational Submittals: Submit the following submittals to the Departmental Representative:

.1 Provide a wind uplift pressure calculations established by the Building Code using Building Code 1/50 year wind pressures for location of installation.

.2 Certificates:

.1 Submit confirmation that roofing materials is compatible with lightweight insulting concrete in accordance with Section 03 52 16.

.2 Manufacturer's Certificate: certify that products meet or exceed specified requirements.

.3 Test and Evaluation Reports: submit laboratory test reports certifying compliance of bitumen membrane with specification requirements.

.4 Manufacturer's Installation Instructions: indicate special precautions required for seaming the membrane.

.5 Manufacturer's field report: in accordance with Section 01 45 00.

.6 Reports: indicate procedures followed, ambient temperatures and wind velocity during application.

1.5 QUALITY ASSURANCE

.1 Regulatory Requirements: Perform roofing and sheet metal work in accordance with the roofing manufacturer's written recommendations using materials that meet the requirements of CAN/ULC - S107 Class C fire resistance rating and wind uplift loads calculated in accordance with Section 4.1.7 of the Building Code; submit proof that roofing materials meet required performance to the Departmental Representative.

.2 Sustainability Standards Certification:

.1 LEED® SS Credit 7.2 – Heat Island Effect – Roof: Submit manufacturer's product information indicating that roofing materials meet a minimum SRI of 78 required by LEED®;.

.3 Installation Requirements: FM Global listing below is used as a guide document only, roofing system is not required to meet FM Global approval requirements, as follows:

.1 Install roofing system in accordance with requirements of FM Global 1-60 Windstorm Resistance Classification; submit proof that roofing system installation meets or exceeds these minimum requirements.

1.6 FIRE PROTECTION

.1 Fire Extinguishers:

.1 Maintain one stored pressure rechargeable type with hose and shut-off nozzle,

.2 ULC labelled for A, B and C class protection.

.3 Size 9 kg on roof per torch applicator, within 6 m of torch applicator.

.2 Maintain fire watch for 1 hour after each day's roofing operations cease.

1.7 DELIVERY, STORAGE, AND HANDLING

.1 Deliver, store and handle materials in accordance with manufacturer's written instructions and Section 01 61 00.

.2 Storage and Handling Requirements:

.1 Safety: comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of asphalt, sealing compounds, primers and caulking materials.

.2 Provide and maintain dry, off-ground weatherproof storage.

.3 Store rolls of membrane in upright position with salvage edge up.

.4 Remove only in quantities required for same day use.

.5 Place plywood runways over completed Work to enable movement of material and other traffic.

.6 Store sealants at not less than + 5 degrees C.

.3 Packaging Waste Management:

.1 Separate waste materials for reuse and recycling in accordance with Section 01 74 20.

.2 Remove from site and dispose of packaging materials at appropriate recycling facilities.

.3 Collect and separate for disposal paper, plastic, polystyrene, corrugated cardboard, packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.

.4 Place materials defined as hazardous or toxic in designated containers.

.5 Handle and dispose of hazardous materials in accordance with the CEPA, TDGA, Regional and Municipal regulations.

.6 Unused sealant material must not be disposed of into sewer system, into streams, lakes, onto ground or in other location where it will pose health or environmental hazard.

.7 Divert unused joint sealing material from landfill to official hazardous material collections site approved by Departmental Representative.

.8 Empty plastic joint sealer containers are not recyclable. Do not dispose of empty containers with plastic materials destined for recycling.

.9 Fold up metal banding, flatten, and place in designated area for recycling.

1.8 FIELD CONDITIONS

.1 Ambient Conditions

.1 Do not install roofing when temperature remains below -18°C for torch application.

.2 Minimum temperature for solvent-based adhesive is -5 degrees C.

.2 Install roofing on dry deck, free of snow and ice, use only dry materials and apply only during weather that will not introduce moisture into roofing system.

Part 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

.1 Provide Products that are compatible with one another under site conditions, as demonstrated by roofing manufacturer.

.2 Compatibility between components of roofing system and substrate is essential. Provide written declaration to Departmental Representative stating that roofing materials and components, as assembled in system are compatible with the lightweight insulated concrete system specified in Section 03 53 16.

.3 Provide a prefabricated membrane in accordance with CAN/CGSB 37-GP-56M.

.4 Provide a vapour retarder membrane that possesses waterproofing capability that with only the modified bitumen vapour retarder in place, can waterproof the building for prolonged periods of time without detriment to the watertight integrity of the entire roof system.

.5 Provide a membrane roofing system that resists corner, perimeter and field-of-roof uplift pressure criteria established by the Building Code using Building Code 1/50 year wind pressures for location of installation and;

.1 Install roofing system in accordance with requirements of FM Global Windstorm Resistance Classification standard using factored uplift pressures from procedure in 2.1.4 above.

.6 Provide watertight roofing system capable of resisting thermally induced movement and exposure to weather.

2.2 ROOFING SYSTEM

.1 Consist of waterproof vapour retarder, mechanical fastened vented base sheet, torch adhered base sheet, torch adhered cap sheet membrane and accessories.

2.3 MEMBRANE

.1 Vapour retarder:

.1 Roofing membrane with non-woven polyester or glass mat reinforcement and elastomeric bitumen, both sides covered with thermofusible plastic film in accordance with CGSB 37-GP-56M type 2, class C, grade 1.

.1 Base sheet:

.1 Type: Torch Adhered.

.2 Components:

.1 Reinforcement: Non-woven polyester or glass mat.

.2 Elastomeric bitumen: Mix of selected bitumen and SBS polymer.

.3 Mark top face with lines to ensure proper roll alignment.

.3 Characteristics:

.1 Cold bending at minimum -25°C: No cracking

.2 Softening point: ≥110°C

.3 Static puncture resistance (N): ≥300

.4 Reinforcing weight: 180 g/m²

.5 Membrane thickness: minimum 2 mm

.2 Vapour retarder continuity strip: Self -adhesive roof membranes as specified in 2.3.4 below.

.1 Primer: Manufacturer's recommended elastomeric bitumen or synthetic rubber blend, volatile solvents, adhesive enhancing additives and resins used to prime substrate to enhance the adhesion of self-adhesive membranes suitable for application temperatures

.2 Ventilated base sheet membrane:

.1 Roofing manufacturer's recommended membrane for mechanically fasten with specified lightweight insulated concrete fastener.

.2 Glass mat reinforcement coated with oxidized bitumen or fibrous glass mat impregnated and coated with oxidized asphalt.

.3 Type: Mechanical fastened.

.4 Top and bottom surfaces: Sanded/sanded

.5 Vented base sheet membrane properties: In accordance with ASTM D5147 or ASTM D4601, Type II.

.1 Membrane thickness: minimum 1 mm

.2 Breaking strength (longitudinal/transversal): minimum 11 / 8.5 kN/ m.

.3 Ultimate elongation (longitudinal/transversal): 4 / 4%.

.6 Fasteners: Recommended by lightweight insulated concrete manufacturer; meeting FM 4470 for wind uplift and corrosion resistance requirement.

.3 Base sheet membrane:

.1 Roofing membrane with non-woven polyester reinforcement and elastomeric bitumen, both sides covered with thermofusible plastic film in accordance with CGSB 37-GP-56M type 2, class C, grade 1.

.1 Type: Torch Adhered.

.2 Components:

.1 Reinforcement: Non-woven polyester.

.2 Elastomeric bitumen: Mix of selected bitumen and SBS polymer.

.3 Mark top face with lines to ensure proper roll alignment.

.3 Characteristics:

.1 Cold bending at minimum -25°C: No cracking

.2 Softening point: ≥110°C

.3 Static puncture resistance (N): ≥300

.4 Reinforcing weight: 180 g/m²

.5 Membrane thickness: minimum 3 mm

.4 Base sheet flashing (stripping):

.1 Self-adhesive roofing membrane with non-woven polyester reinforcement and glass grid elastomeric bitumen, upper surface covered with thermofusible plastic film, underside self-adhesive in accordance with CGSB 37-GP-56M type 1A, class C, grade 1.

.1 Type: Self-adhesive.

.2 Components:

.1 Reinforcement: Non-woven polyester.

.2 Elastomeric bitumen: Mix of selected bitumen and SBS polymer.

.3 Mark top face with lines to ensure proper roll alignment.

.3 Characteristics:

.1 Cold bending at minimum -25°C: No cracking

.2 Softening point: ≥110°C

.3 Static puncture resistance (N): ≥300

.4 Reinforcing weight: 160 g/m²

.5 Membrane thickness: minimum 2.5 mm

.2 Primer: Manufacturer's recommended elastomeric bitumen or synthetic rubber blend, volatile solvents, adhesive enhancing additives and resins used to prime substrate to enhance the adhesion of self-adhesive membranes suitable for application temperatures

.5 Cap sheet membrane and cap sheet flashing:

.1 Roofing membrane with non-woven polyester and glass reinforcement and elastomeric bitumen with flame retarding agent. Top face protected by high albedo surface granules, underside covered with a thermofusible plastic film, in accordance with CGSB 37 GP 56M type 1, class A, grade 2.

.2 Type: Torch adhered.

.3 Components:

.1 Reinforcement: Non-woven polyester and glass.

.2 Elastomeric bitumen: Mix of selected bitumen and SBS polymer.

.3 Protection: Coloured granules – white; minimum SRI value of 78.

.4 Characteristics:

.1 Cold bending at minimum -25°C: No cracking

.2 Softening point: ≥110°C

.3 Reinforcing weight: minimum 250 g/m²

.4 Membrane thickness: minimum 3.6 mm

2.4 LIQUID FLASHING

.1 One component, cold fluid-applied reinforced resinous waterproofing membrane with polyester reinforcing fleece, consisting of base coat, top coat and finish coat; recommended by Manufacturer.

.1 Auxiliary Materials: Materials required for a complete and functioning waterproof membrane system and as follows:

.1 Primer: Manufacturer's standard, factory formulated polyurethane or epoxy primer.

.2 Reinforcing Strip: Manufacturer's recommended fibreglass mesh or polyester fabric.

.3 Joint Sealant: Multi-component polyurethane sealant, compatible with waterproofing; and as recommended by manufacturer for substrate and joint conditions.

2.5 WALKWAY MEMBRANE

.1 Walkway membrane:

.1 Roofing membrane with non-woven polyester reinforcement and elastomeric bitumen with flame retarding agent. Top face protected by coloured granules, underside covered with a thermofusible plastic film, in accordance with CGSB 37 GP 56M type 1, class A, grade 2.

.2 Type: Torch adhered.

.3 Components:

.1 Reinforcement: Non-woven polyester

.2 Elastomeric bitumen: Mix of selected bitumen and SBS polymer.

.3 Protection: Coloured granules – Colour to be different from field membrane as selected by Departmental Representative.

.4 Characteristics:

.1 Cold bending at minimum -25°C: No cracking

.2 Softening point: ≥110°C

.3 Reinforcing weight: minimum 250 g/m²

.4 Membrane thickness: minimum 5.0 mm

.5 Primer: Manufacturer’s recommended elastomeric bitumen or synthetic rubber blend, volatile solvents, adhesive enhancing additives and resins used to prime roof cap sheet.

2.6 CARPENTRY

.1 Refer to Section 06 10 00.

2.7 CANT STRIPS

.1 Rigid mineral wool insulation board meeting the requirements of CAN/ULC-S702 and ASTM C726 and;

.1 Minimum 170 kg/m3 density.

.2 Fabricate from laminated rigid mineral wool material, to measure 140 mm on slope.

2.8 ROOF SPECIALTIES

.1 In accordance with Section 07 71 00.

2.9 SHEET METAL FLASHING AND TRIM

.1 Refer to Section 07 62 00.

Part 3 EXECUTION

3.1 QUALITY OF WORK

.1 Do examination, preparation and roofing Work in accordance with Roofing Manufacturer's Specification Manual, CRCA Roofing Specification Manual, particularly for fire safety precautions, compliance with local fire insurance requirements and local building codes.

.2 The interface of the walls and roof assemblies will be fitted with durable rigid material providing connection point for continuity of air barrier.

.3 Assembly, component and material connections will be made in consideration of appropriate design loads.

3.2 EXAMINATION OF ROOF DECKS

.1 Verification of Conditions:

.1 Inspect with Departmental Representative deck conditions including parapets, construction joints, roof drains, plumbing vents and ventilation outlets to determine readiness to proceed.

.2 Evaluation and Assessment:

.1 Prior to beginning of work ensure:

.1 Decks are firm, straight, smooth, dry, free of snow, ice or frost, and swept clean of dust and debris. Do not use calcium or salt for ice or snow removal.

.2 Curbs have been built.

.3 Roof drains have been installed at proper elevations relative to finished roof surface.

.4 Plywood and lumber nailer plates have been installed to deck, walls and parapets as indicated.

.3 Do not install roofing materials during rain or snowfall.

3.3 PREPARATION

.1 Ensure roof drains have been installed at proper elevations relative to finished roof surface and allow for sufficient drainage of the roof surface.

.2 Prior to application of vapour retarder, examine deck, and ensure any defect of level or construction is correct before proceeding with the work.

3.4 PROTECTION OF IN-PLACE CONDITIONS

.1 Cover walls, walks, slopped roofs and adjacent work where materials hoisted or used.

.2 Use warning signs and barriers. Maintain in good order until completion of Work.

.3 Clean off drips and smears of bituminous material immediately.

.4 Dispose of rain water off roof and away from face of building until roof drains or hoppers installed and connected.

.5 Protect roof from traffic and damage. Comply with precautions deemed necessary by Departmental Representative.

.6 At end of each day's work or when stoppage occurs due to inclement weather, provide protection for completed Work and materials out of storage.

.7 Metal connectors and decking will be treated with rust proofing or galvanization.

3.5 VAPOUR RETARDER

.1 Install a continuous layer of modified bitumen base sheet flashing over prepared substrate.

.2 The substrate to be clean, dry, and free of dust, grease, or other contaminants.

.3 Install vapour retarder on the same day as the primer application and meeting field conditions

.4 Install torch adhesive type vapour retarder in field and self-adhering type at flashing.

.5 Field sheet installation:

.1 In accordance with manufacturer’s recommendation.

.2 Starting at low point of roof, perpendicular to slope, unroll base sheet, align and re-roll from both ends.

.3 Unroll and torch base sheet onto substrate taking care not to burn membrane or its reinforcement or substrate.

.4 Lap sheets 75 mm minimum for side and 150 mm minimum for end laps.

.5 Application to be free of blisters, wrinkles and fish-mouths.

.6 Self-adhering modified bitumen flashing installation:

.1 Prime substrate to receive self-adhering base sheet flashing with manufacturer recommended primer and with recommended rate.

.2 Ensure complete coverage of the primer to both prepared substrates and to the filed sheet membrane prior to placement of the membrane flashing.

.7 Install membrane gusset reinforcement at all inside and outside corners.

.8 New vapour retarder to act as a temporary roof membrane providing complete, continuous waterproofing to the roof prior to the wet installation of the lightweight insulated concrete.

.9 Ensure temporary roof membrane is watertight and has sufficient temporary drainage prior to lightweight insulated concrete installation.

.10 Water damage caused to building and its contents by roof leaks after this stage will be rectified at no expense.

3.6 (EXPOSED) CONVENTIONAL MEMBRANE ROOFING (CMR) APPLICATION

.1 Ventilated base sheet membrane application:

.1 Lay the specified base sheet over the entire area to be roofed, lapping sides 75 mm and ends 150 mm.

.2 Use the specified fasteners as recommended by the lightweight insulated concrete manufacturer, and mechanically fasten each sheet.

.3 Attach base sheet mechanically in conformance with the roofing manufacturer recommendations for wind uplift criteria for building type, height and geographic location.

.4 Adhere base sheet flashings onto substrate in 1 metre wide strips.

.5 Lap flashing base sheet to membrane base sheet minimum 150 mm and seal.

.2 Base sheet application:

.1 Starting at low point of roof, perpendicular to slope, unroll base sheet, align and reroll from both ends.

.2 Unroll and torch base sheet onto substrate taking care not to burn membrane or its reinforcement or substrate.

.3 Lap sheets 75 mm minimum for side and 150 mm minimum for end laps.

.4 Application to be free of blisters, wrinkles and fishmouths.

.3 Cap sheet application:

.1 Starting at low point on roof, perpendicular to slope, unroll cap sheet, align and reroll from both ends.

.2 Unroll and torch cap sheet onto base sheet taking care not to burn membrane or its reinforcement.

.3 Lap sheets 75 mm minimum for side laps and 150 mm minimum for end laps. Offset joints in cap sheet 300 mm minimum from those in base sheet. Seal laps by torch welding.

.4 Application to be free of blisters, fishmouths and wrinkles.

.5 Do membrane application in accordance with manufacturer's recommendations.

.4 Membrane flashings:

.1 Complete installation of flashing base sheet stripping prior to installing membrane cap sheet.

.2 Adhere base sheet onto substrate in 1 metre wide strips.

.3 Torch cap sheet onto substrate in 1 metre wide strips.

.4 Lap flashing base sheet to membrane base sheet minimum 150 mm and seal.

.5 Lap flashing cap sheet to membrane cap sheet 250 mm minimum and torch weld.

.6 Provide 75 mm minimum side lap and seal.

.7 Properly secure flashings to their support, without sags, blisters, fishmouths or wrinkles.

.8 Do work in accordance with manufacturer's recommendations and Section 07 62 00.

.5 Roof penetrations:

.1 Install roof penetration flashings and seal to membrane in accordance with manufacturer's recommendations and details and Section 07 71 00.

.6 Liquid flashings:

.1 At junctions where installation of membrane flashings is not possible, install new liquid flashing.

.2 Install liquid flashings in conformance with various roofing details illustrated in the manufacturer’s installation manual and as submitted for review as noted above.

.3 Preparation of Steel/Aluminum Substrates:

.1 Grind to generate a “white-metal” surface and remove loose particles.

.2 Extend preparation area beyond the termination of the roofing/flashing system.

.3 Do not use cleanser/solvent after grinding.

.4 Notch steel surfaces to provide a rust-stop.

.4 Preparation of Wood/Plywood Flashing Substrates to receive resin:

.1 Tape the joints between plywood or wood panels using the specified tape and prime wood/plywood surfaces to receive the specified flashing system with compatible primer.

.2 Allow primer to set prior to the flashing system application.

.7 End lap and side lap sealing:

.1 Overlap rolls of membrane at potential moisture infiltration area.

.8 Voids sealing:

.1 Prior to installation, cut off the corner of the salvage edge covered by the next roll of material.

.9 Seams:

.1 Check seams during work with a round nosed trowel.

.2 Repair found deficiencies before installing the covering layer or leaving the roof area at the end of the day.

.10 Reinforcement:

.1 Required at corners, vents and drains, mechanical units, and gravel stops.

3.7 ROOF RELIEF VENT:

.1 Install in accordance with Section 07 71 00.

.2 Install a minimum 1 vent for every 93 sq.metres of roof area and in accordance with Manufacturer’s recommendation and requirements of Section 03 52 16.

3.8 CANTS

.1 Install mineral wool fibre cants over base sheet.

.2 Apply hot bitumen to receiving surface and embed cant firmly by hand.

.3 Angle cut cants to fit tightly on back and bottom where roof to wall angle varies from 90 degrees.

3.9 WALKWAYS

.1 Install walkway membrane in accordance with manufacturer's instructions and as indicated.

.1 Apply primer to cap sheet membrane and torch apply, ensuring selvage edge is removed.

3.10 SHEET METAL FLASHING AND TRIM

.1 Complete flashing work using specified materials described on plans and details, and as described in Section 07 62 00.

.2 Installation:

.1 Install in accordance with Section 07 62 00.

.2 Caulk sheet metal joints and junctions with other materials.

.3 Install appropriate flashing, cap sheet, counter flashing, casings and other accessories to vents, pipes and other ducts to ensure perfect sealing.

3.11 FIELD QUALITY CONTROL

.1 Require site attendance of roofing materials manufacturer's representative during installation of Work.

.1 Submit Manufacturer's field reports.

.2 Fastener Pull Test:

.1 Conduct a ventilated base ply fastener pull test by roofing materials manufacturer’s representative or approved roofing contractor, 3 days following the application of the lightweight insulating concrete to ensure a minimum 18kg withdrawal resistance per fastener.

.2 Number and locations of tests to be as directed by Departmental Representative

.3 Submit Manufacturer's test reports.

.4 Repair or replace insulated concrete system as directed by Departmental Representative.

.3 Inspections:

.1 Membrane core test:

.1 Conduct a membrane core test, number and locations of tests to be as directed by Departmental Representative.

.2 Membrane and membrane flashing adhesion test:

.1 Conduct a membrane adhesion test, number and locations of tests to be as directed by Departmental Representative.

.3 Repair or replace membrane, or air and vapour retarder system as directed Departmental Representative.

3.12 CLEANING

.1 Remove bituminous markings from finished surfaces.

.2 In areas where finished surfaces are soiled caused by work of this section, consult manufacturer of surfaces for cleaning advice and complying with their recommended instructions.

.3 Repair or replace defaced or disfigured finishes caused by work of this section.

.4 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 20.

.1 Place materials defined as hazardous or toxic in designated containers.

.2 Clearly label location of salvaged material's storage areas and provide barriers and security devices.

.3 Ensure emptied containers are sealed and stored safely.

.4 Unused adhesive, sealant materials must not be disposed of into sewer system, into streams, lakes, onto ground or in other location where it will pose health or environmental hazard.

.5 Dispose of unused adhesive material at official hazardous material collections site approved by Departmental Representative.

.6 Dispose of unused sealant material at official hazardous material collections site approved by Departmental Representative.

.7 Dispose of unused asphalt material at official hazardous material collections site approved by Departmental Representative.

END OF SECTION

Part 1 GENERAL

1.1 RELATED REQUIREMENTS

.1 Section 06 10 00 – Rough Carpentry: Wood blocking and framing required for roof flashings.

.2 Section 07 52 00 – Modified Bituminous Membrane Roofing: Flashing and roofing accessories installed integral with roofing membrane as part of roofing system work.

.3 Section 07 71 00 – Roofing Specialties: Vents, and other pre-manufactured roof accessory units.

1.2 REFERENCES

.1 American Society for Testing and Materials International (ASTM)

.1 ASTM A653/A653M-15e1, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

.2 ASTM C1087-00(2011), Standard Test Method for Determining Compatibility of Liquid-Applied Sealants with Accessories Used in Structural Glazing Systems.

.3 ASTM C1248-08(2012), Standard Test Method for Staining of Porous Substrate by Joint Sealants.

.4 ASTM C920-14a, Standard Specification for Elastomeric Joint Sealants

.5 ASTM D523-14, Standard Test Method for Specular Gloss.

.6 ASTM D822/D822M-13, Standard Practice for Filtered Open-Flame Carbon-Arc Exposures of Paint and Related Coatings.

.2 Canadian Roofing Contractors Association (CRCA)

.1 Roofing Specifications Manual 2012.

.3 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-51.32-M77, Sheathing, Membrane, Breather Type.

.4 Canadian Standards Association (CSA International)

.1 CSA A123.3-05(R2015), Asphalt Saturated Organic Roofing Felt.

.2 CSA B111-1974(R2003), Wire Nails, Spikes and Staples.

.5 Factory Mutual Global (FM):

.1 Property Loss Prevention Data Sheets:

.1 1-28 Design Wind Loads and 1-28R Roof Systems

.2 1-29 Roof Deck Securement and Above Deck Roof Components and 1-29R Roof Systems

.3 1-49, Perimeter Flashing

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

.1 Material Safety Data Sheets (MSDS).

1.3 SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00.

.2 Product Data:

.1 Submit manufacturer's printed product literature for sheet metal flashing systems materials, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Submit two copies WHMIS MSDS - Material Safety Data Sheets.

.3 Shop Drawings:

.1 Shop Drawings: Submit shop drawings showing layout, profiles, methods of joining, and anchorage details.

.4 Samples:

.1 Submit 150 x 150 mm samples of each type of sheet metal material, finishes and colours.

.5 Quality assurance submittals: submit following in accordance with Section 01 45 00.

.1 Manufacturer's Instructions: submit manufacturer's installation instructions and special handling criteria, installation sequence, and cleaning procedures.

.2 Manufacturer's Field Reports: submit to manufacturer's written reports within 3 days of review, verifying compliance of Work, as described in PART 3, FIELD QUALITY CONTROL.

1.4 QUALITY ASSURANCE

.1 Pre-Installation Meetings: convene pre-installation meeting two weeks prior to beginning on-site installation, with Departmental Representative 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.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00.

.2 Waste Management and Disposal:

.1 Separate waste materials for reuse and recycling in accordance with Section 01 74 20.

Part 2 PRODUCTS

2.1 SHEET METAL MATERIALS

.1 Zinc coated steel sheet: Commercial quality to ASTM A653/A653M, with Z275 designation zinc coating and the following:

.1 Base Flashing, exposed trim, equipment support flashing, and roof penetration flashing: Minimum 0.76 mm thickness.

.2 Copings: Minimum 0.91mm thick.

.3 Drip Edges: Minimum 0.61 mm thick.

2.2 PREFINISHED STEEL SHEET

.1 Prefinished steel with factory applied polyvinylidene fluoride.

.1 Class F1S.

.2 Colour as selected by Departmental Representative from manufacturer's standard range.

.3 Specular gloss: 30 units +/- in accordance with ASTM D523.

.4 Coating thickness: not less than 22 micrometres.

.5 Resistance to accelerated weathering for chalk rating of 8, colour fade 5 units or less and erosion rate less than 20% to ASTM D822/D822M as follows:

.1 Outdoor exposure period 2500 hours.

.2 Humidity resistance exposure period 5000 hours.

2.3 THROUGH WALL FLASHING AND UNDERLAYMENT MEMBRANES

.1 Self adhering SBS modified bitumen high temperature reinforced membrane with cross-linked polyethylene skins, specifically manufactured for use as through wall flashing and having the following nominal properties:

.1 Service Temperature Range: -40°C to +80°C

.2 Thickness: Minimum 1.0 mm

.2 Primers and Undercoats: Manufacturer’s recommended primer or surface conditioner to improve bond between membranes to substrates.

2.4 SEALANT

.1 Performance Requirements:

.1 Provide elastomeric joint sealants that establish and maintain watertight and airtight continuous joint seals without staining or deteriorating joint substrates.

.2 Provide elastomeric joint sealants that have been tested in accordance with ASTM C1248 where elastomeric sealants are required for non-staining to porous substrate applications and that are manufactured by a Manufacturers capable of providing a non-stain Warranty as specified.

.3 Provide joint sealants that are compatible with one another, and with adjacent materials, as demonstrated by sealant manufacturer using ASTM C1087 testing and related experience.

.2 Do not use sealant that emits strong odours, contains toxic chemicals or is not certified as mould resistant in air handling units.

.3 When low toxicity sealants are not possible, confine usage to areas which offgas to exterior, are contained behind air barriers, or are applied several months before occupancy to maximize offgas time.

.4 Where sealants are qualified with primers use only these primers.

.5 Sealant material designations

.1 Silicone Sealant:

.1 Exterior Weatherproofing Sealant: Silicone based, single component, low modulus, neutral cure, Shore A Hardness 15-25, conforming to CAN/CGSB-19.13-M, Classification C-1-40-B-N and C-1-25-B-N, and ASTM C920, Type S, Grade NS, Class 50, use NT, M, G, A and O, Custom Colour as selected by Departmental Representative and with the following properties;

.1 Non-staining in accordance with ASTM C1248

.2 Low dirt pick-up

.2 Colours of exposed joint sealants will be selected by the Departmental Representative from manufacturer's complete range to match adjacent finish materials.

2.5 ACCESSORIES

.1 Isolation coating: alkali resistant bituminous paint.

.2 Plastic cement: to CAN/CGSB-37.5.

.3 Underlay for metal flashing: No. 15 perforated asphalt felt to CSA A123.3.

.4 Cleats: of same material, and temper as sheet metal, minimum 50 mm wide. Thickness same as sheet metal being secured.

.5 Fasteners: of same material as sheet metal, to CSA B111, ring thread flat head roofing nails of length and thickness suitable for metal flashing application.

.6 Washers: of same material as sheet metal, 1 mm thick with rubber packings.

.7 Touch-up paint: as recommended by prefinished material manufacturer.

2.6 FABRICATION

.1 Fabricate metal flashings and other sheet metal work in accordance with applicable FM G Data Sheet 1-49 details and requirements.

.1 Sheet metal work will conform to details, with plumb profiles free from deformities or defects that may hinder appearance.

.2 Form pieces in 2400 mm maximum lengths.

.1 Make allowance for expansion at joints.

.3 Hem exposed edges on underside 12 mm.

.1 Mitre and seal corners with sealant.

.4 Form sections square, true and accurate to size, free from distortion and other defects detrimental to appearance or performance.

.5 Apply isolation coating to metal surfaces to be embedded in concrete or mortar.

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 sheet metal work in accordance with FM G Data Sheet 1-49 and in accordance with reviewed shop drawings.

.2 Provide continuous hook strips and perimeter securement in accordance with FM G Data Sheet 1-49

.3 Use concealed fastenings except where approved before installation.

.4 Provide underlay under sheet metal.

.1 Secure in place and lap joints 100 mm.

.5 Through Wall Flashings: Install flexible membranes where required to maintain flow direction to divert water away from face of building envelope.

.6 Counterflash bituminous flashings at intersections of roof with vertical surfaces and curbs.

.7 Lock end joints and caulk with sealant.

3.3 FIELD QUALITY CONTROL

.1 Inspections:

.1 Inspection and testing of roofing application will be carried out by testing laboratory designated by Departmental Representative.

.2 Repair or replace membrane, or air and vapour retarder system as directed by the Departmental Representative.

3.4 CLEANING

.1 Proceed in accordance with Section 01 74 11.

.2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

.3 Leave work areas clean, free from grease, finger marks and stains.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 03 52 16 – Lightweight Insulating Concrete

.2 Section 07 52 00 – Modified Bituminous Membrane Roofing

.3 Division 22 - Plumbing

1.2 REFERENCE STANDARDS

.1 American Society for Testing and Materials (ASTM):

.1 ASTM A666-15, Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar

.2 ASTM B209-14, Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate

.3 ASTM B221-14, Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes

.4 ASTM B272-12 - Standard Specification for Copper Flat Products with Finished (Rolled or Drawn) Edges (Flat Wire and Strip).

.5 ASTM B370-12 - Standard Specification for Copper Sheet and Strip for Building Construction.

.6 ASTM C1029-15, Standard Specification for Spray-Applied Rigid Cellular Polyurethane Thermal Insulation

.2 Canadian Standards Association (CSA):

.1 CSA-B79-08 (R2013) - Commercial and residential drains and cleanouts.

.3 Canadian Roofing Contractors' Association (CRCA):

.1 Roofing Specification Manual - Modified Bituminous Membranes Section

1.3 SUBMITTALS

.1 Provide required information in accordance with Section 01 33 00 – Submittal Procedures.

.2 Submit manufacturer’s descriptive literature for each product, including sections and details indicating descriptive installation instructions.

.3 Manufacturers Reports:

.1 Submit manufacturer's field reports.

Part 2 Products

2.1 MANUFACTURED UNITS

.1 Manufactured roofing accessories from spun aluminum with cast aluminum accessories, or stainless steel and complete with removable cap where applicable.

.2 Units have foamed in place closed cell urethane foam insulation sprayed into the unit.

.3 Premanufactured unit heights to be custom height to provide min 200 mm projection above roof membrane.

.4 Prime flanges with rubberized primer.

.5 Types:

.1 Relief vent:

.1 Manufacturer recommended alloy aluminum vent with integral deck flange, and factory designed insert accessory to vent moisture vapour accumulating in the roofing and lightweight insulating concrete system.

.2 Alloy aluminum thickness: Minimum 1.5mm.

.3 Unit designed with perimeter vent holes, and insert accessory filler with half perforated holes.

.4 Provide flanges in accordance with manufacturer’s recommendation.

.2 Tall cone or “B” vent:

.1 Consists of flashing sleeves with integral deck flange, matching two piece collar, pressure grommet seal.

.3 Split flashing for round penetration:

.1 Split flashing sleeve with integral deck flange and vented cap fitted with a pressure grommet seal.

.2 Continuous seals are located at the split junctures of the sleeve and deck flange.

.3 Use clips to lock the friction-fit flashing sections together.

.4 Conduit and gas line penetrations:

.1 Flexible conduit flashing consist of a “gooseneck” shape flange, end cap seal and base seal.

.5 Roof supports:

.1 Epoxy primed, 115 mm Ø hollow steel support and 200 mm x 200 mm mounting plate, mounting hardware adjustable height galvanized steel cap and steel plate designed to receive roof top mounted equipment.

.2 Insulated spun aluminum flashing.

2.2 FABRICATION

.1 Fabricate, assemble and erect manufactured materials in accordance with manufacturer's published specifications for specific types of functions required; manufacturer's specifications are considered to form part of this Section.

.2 Fabricate assemblies complete in every respect, square, true to size and details, and free from distortion, twist or other defects that could affect strength, operation or appearance.

Part 3 Execution

3.1 EXAMINATION

.1 Report in writing defects in adjacent work and other unsatisfactory site conditions that could affect work of this Section.

.2 Verify site dimensions.

.3 Commencement of work will imply acceptance of prepared work.

3.2 INSTALLATION

.1 Install in accordance with the manufacturer's written instructions and the contract documents, plumb, true, level and rigid.

.2 Isolate aluminum surfaces from adjacent concrete materials and other metals and in conjunction with membrane roofing installation.

3.3 ADJUSTING

.1 Verify that manufactured units are installed in accordance with specifications and details, and will function as intended.

.2 Adjust any items where necessary to ensure proper operation.

3.4 FIELD QUALITY CONTROL

.1 Manufacturer's Field Services:

.1 Require site attendance of manufactured units manufacturer's representative during installation of Work.

.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.

.2 Inspections:

.1 Inspection and testing of manufactured unit installations will be carried out by testing laboratory designated by Departmental Representative.

.2 Repair or replace manufactured units, roof membrane, or air and vapour retarder system as directed by the Departmental Representative.

3.5 CLEANING

.1 Clean manufactured units using materials and methods approved by manufacturer.

.2 Do not use cleaners or techniques that could impair performance of the roofing system.

END OF SECTION

Part 1 GENERAL

1.1 REFERENCES

.1 Canada Green Building Council (CaGBC)

.1 LEED Canada For New Construction and Major Renovations 2009.

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

.1 Material Safety Data Sheets (MSDS).

.3 Underwriter's Laboratories of Canada (ULC)

.1 CAN/ULC-S101-14, Standard Methods of for Fire Endurance Tests of Building Construction and Materials.

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

.3 CAN/ULC-S115-11(R2016), Standard Method of Fire Tests of Firestop Systems.

1.2 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 Continuity of Fire Separations: NBC 2015, Division B, Parts 3.1.8 and 3.1.9.1, 9.10.9):

.1 Wall, partition or floor assemblies required to be a fire separation shall be: constructed as a continuous element; have a fire resistance rating; have openings protected by a closure; and have penetrations sealed by a firestop.

1.3 SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00.

.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.

.3 Shop Drawings:

.1 Submit shop drawings to show location, 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 Sustainable Design Submittals:

.1 LEED Canada-NC Submittals: in accordance with Section 01 35 21.

.2 IEQ Credit 4.1 – Low-Emitting Materials, Sealants and Primers:

.1 Content: Use fire stopping sealants and primers that meet or are less than VOC Limits by referenced standards of LEED® Canada.

.2 Compliance Requirements: Provide information for each site applied sealant used within the building envelope (interior side of weatherproofing system) indicating VOC Limit in grams per litre (g/L) meeting or less than limits listed in accordance with SCAQMD Rule 1168.

.6 Quality assurance submittals: submit following in accordance with Section 01 45 00.

.1 Test reports: in accordance with CAN/ULC-S101 for fire endurance and CAN/ULC-S102 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, cleaning procedures.

.4 Manufacturer's Field Reports: submit to manufacturer's written reports within 3 days of review, verifying compliance of Work, as described in PART 3 - FIELD QUALITY CONTROL.

1.4 QUALITY ASSURANCE

.1 Qualifications:

.1 All fire stopping material shall be from one manufacturer.

.2 All fire stopping installation work for entire project shall be by a single contractor experienced in firestopping. Individual disciplines shall NOT fire stop their own work.

.2 Pre-Installation Meetings: convene pre-installation meeting one week prior to beginning work of this Section, with contractor's representative and Departmental Representative in accordance with Section 01 31 19 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.

.3 Site Meetings: as part of Manufacturer's Services described in PART 3 - FIELD QUALITY CONTROL, schedule site visits, to review Work, at stages listed.

.1 After delivery and storage of products, and when preparatory Work is complete, but before installation begins.

.2 Twice during progress of Work at 25% and 60% complete.

.3 Upon completion of Work, after cleaning is carried out.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Packing, shipping, handling and unloading:

.1 Deliver, store and handle materials in accordance with Section 01 61 00.

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

.3 Deliver materials to the site in undamaged condition and in original unopened containers, marked to indicate brand name, manufacturer, ULC 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:

.1 Separate waste materials for reuse and recycling in accordance with Section 01 74 20.

Part 2 PRODUCTS

2.1 SUSTAINABLE REQUIREMENTS

.1 Materials and products in accordance with Section 01 35 21.

.2 Do verification requirements in accordance with Section 01 35 21.

2.2 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 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 Fire stopping and smoke seals at openings intended for ease of re-entry such as cables: elastomeric seal.

.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.

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 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 without interruption to vapour barrier.

.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 Remove excess compound promptly as work progresses and upon completion.

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.

.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.

.2 Manufacturer's Field Services:

.1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in PART 1 - SUBMITTALS.

.2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.

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

3.6 CLEANING

.1 Proceed in accordance with Section 01 74 11.

.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 Edge of floor slabs at curtain wall.

.3 Top of fire-resistance rated masonry and gypsum board partitions.

.4 Intersection of fire-resistance rated masonry and gypsum board partitions.

.5 Control and sway joints in fire-resistance rated masonry and gypsum board partitions and walls.

.6 Penetrations through fire-resistance rated floor slabs, ceilings and roofs.

.7 Openings and sleeves installed for future use through fire separations.

.8 Around mechanical and electrical assemblies penetrating fire separations.

.9 Rigid ducts: greater than 129 cm^2: 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

Part 1 GENERAL

1.1 SECTION INCLUDES

.1 Materials, preparation and application for sealants.

.2 Text to complete other various Sections containing sealant specifications.

1.2 REFERENCES

.1 American Society for Testing and Materials International, (ASTM)

.1 ASTM C919-12, Standard Practice for Use of Sealants in Acoustical Applications.

.2 ASTM C920-14a, Standard Specification for Elastomeric Joint Sealants.

.2 Canada Green Building Council (CaGBC)

.1 LEED Canada For New Construction and Major Renovations 2009.

.3 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-19.13-M87, Sealing Compound, One-component, Elastomeric, Chemical Curing.

.2 CAN/CGSB-19.17-M90, One-Component Acrylic Emulsion Base Sealing Compound.

.3 CAN/CGSB-19.24-M90, Multi-component, Chemical Curing Sealing Compound.

.4 Department of Justice Canada (Jus)

.1 Canadian Environmental Protection Act, 1999 (CEPA).

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

.1 Material Safety Data Sheets (MSDS).

.6 Transport Canada (TC)

.1 Transportation of Dangerous Goods Act, 1992 (TDGA).

1.3 SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00.

.2 Manufacturer's product data: Submit manufacturer’s printed product data to describe:

.1 Sealant compound.

.2 Primers.

.3 Sealing compound, each type, including compatibility when different sealants are in contact with each other.

.3 Samples: Submit duplicate samples of each type of material and colour.

.1 Submit cured samples of exposed sealants for each color where required to match adjacent material.

.4 Sustainable Design Submittals:

.1 LEED Canada-NC Submittals: in accordance with Section 01 35 21.

.2 IEQ Credit 4.1 – Low-Emitting Materials, Sealants and Primers:

.1 Content: Use sealants and primers that meet or are less than VOC Limits by referenced standards of LEED® Canada.

.2 Compliance Requirements: Provide information for each site applied sealant or primer used within the building envelope (interior side of weatherproofing system) indicating VOC Limit in grams per litre (g/L) meeting or less than limits listed in accordance with SCAQMD Rule 1168.

.5 Manufacturer's Installation Instructions: Instructions to include installation instructions for each product used.

1.4 DELIVERY, STORAGE, AND HANDLING

.1 Deliver, handle, store and protect materials in accordance with Section 01 61 00.

.2 Deliver and store materials in original wrappings and containers with manufacturer's seals and labels, intact. Protect from freezing, moisture, water and contact with ground or floor.

1.5 WASTE MANAGEMENT AND DISPOSAL

.1 Separate waste materials for reuse and recycling in accordance with Section 01 74 20.

.2 Remove from site and dispose of packaging materials at appropriate recycling facilities.

.3 Collect and separate for disposal paper, plastic, polystyrene, corrugated cardboard, packaging material in appropriate on-site bins for recycling.

.4 Place materials defined as hazardous or toxic in designated containers.

.5 Handle and dispose of hazardous materials in accordance with the CEPA, TDGA, Regional and Municipal regulations.

.6 Unused sealant material must not be disposed of into sewer system, into streams, lakes, onto ground or in other location where it will pose health or environmental hazard.

.7 Divert unused joint sealing material from landfill to official hazardous material collections site approved by Departmental Representative.

.8 Empty plastic joint sealer containers are not recyclable. Do not dispose of empty containers with plastic materials destined for recycling.

.9 Fold up metal banding, flatten, and place in designated area for recycling.

1.6 PROJECT CONDITIONS

.1 Environmental Limitations:

.1 Do not proceed with installation of joint sealants under following conditions:

.1 When ambient and substrate temperature conditions are outside limits permitted by joint sealant manufacturer or are below 4.4°C.

.2 When joint substrates are wet.

.2 Joint-Width Conditions:

.1 Do not proceed with installation of joint sealants where joint widths are less than those allowed by joint sealant manufacturer for applications indicated.

.3 Joint-Substrate Conditions:

.1 Do not proceed with installation of joint sealants until 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 Labour Canada.

.2 Conform to manufacturer's recommended temperatures, relative humidity, and substrate moisture content for application and curing of sealants including special conditions governing use.

.3 Ventilate area of work as directed by Departmental Representative by use of approved portable supply and exhaust fans.

Part 2 PRODUCTS

2.1 SEALANT MATERIALS

.1 Do not use sealant that emits strong odours, contains toxic chemicals or is not certified as mould resistant in air handling units.

.1 When low toxicity sealants are not possible, confine usage to areas which offgas to exterior, are contained behind air barriers, or are applied several months before occupancy to maximize offgas time.

.2 Where sealants are qualified with primers use only these primers.

2.2 SEALANT MATERIAL DESIGNATIONS

.1 Polyurethane:

.1 Type S-1: One component, non-sag, for general construction, Shore A Hardness 15+, conforming to CAN/CGSB-19.13, Type 2, MCG-2-25-A-N and ASTM C920, Type S, Grade NS, Class 25, Use NT, M, and A, colour to be selected by Departmental Representative from manufacturer’s standard range.

.2 Silicone:

.1 Type S-2: Mould and mildew resistant, Shore A Hardness 15-25, one component conforming to CAN/CGSB-19.13 and ASTM C920, primerless, Type S, Grade NS, Class 25, use NT, G, and A, SWRI validated.

.3 Acrylic Latex:

.1 Type S-4: One part acrylic latex, Shore A Hardness 20, conforming to CAN/CGSB-19.17 and ASTM 834.

.4 Acoustical Sealant:

.1 Type S-5: Non-skinning, non-hardening, single component synthetic rubber sealant, conforming to ASTM C919, primerless, Type S, Grade NS, Class 25, SWRI validated.

.5 Multi-Component:

.1 Type S-6: Saw cut sealant, multi-component, self levelling, conforming to ASTM D2240.

.2 Type S-7: Two part multi-component sealant; chemical curing, non sag, exterior wall sealant, Shore A Hardness 20-35, conforming to CAN/CGSB 19.24 M, Type 2, Class B, and ASTM C920, Type S, Grade NS, Class 25, use NT, M, and A.

.6 Preformed Compressible and Non-Compressible back-up materials.

.1 Polyethylene, Urethane, Neoprene or Vinyl Foam.

.1 Extruded open or 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/m^3 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.

2.3 SEALANT SELECTION

.1 Where no specified type of sealant is shown or specified choose one of the sealants specified in this Section applicable to that intended application, and consistent with manufacturer's recommendations.

.2 Perimeters of exterior openings where frames meet exterior facade of building (i.e. brick, block, precast masonry): Sealant Type S-7.

.3 Seal interior perimeters of exterior openings as detailed on drawings: Sealant type: S-4.

.4 Interior control and expansion joints in floor surfaces: Sealant Type S-6.

.5 Perimeters of interior frames, as detailed and itemized: Sealant Type S-4.

.6 Perimeter of bath fixtures (e.g. sinks, tubs, urinals, stools, waterclosets, basins, vanities): Sealant Type S-2.

.7 Exposed interior control joints in drywall: Sealant Type S-1.

2.4 JOINT CLEANER

.1 Non-corrosive and non-staining type, compatible with joint forming materials and sealant recommended by sealant manufacturer.

.2 Primer: as recommended by manufacturer.

Part 3 EXECUTION

3.1 PROTECTION

.1 Protect installed Work of other trades from staining or contamination.

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 Cleanup.

.1 Clean adjacent surfaces immediately and leave Work neat and clean.

.2 Remove excess and droppings, using recommended cleaners as work progresses.

.3 Remove masking tape after initial set of sealant.

END OF SECTION

Part 1 GENERAL

1.1 REFERENCES

.1 American Society for Testing and Materials International (ASTM)

.1 ASTM E330/E330M-14, Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.

.2 ASTM E413-10, Classifications for Rating Sound Insulation.

.3 ASTM A653/A653M-15e1, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

.2 Canada Green Building Council (CaGBC)

.1 LEED Canada For New Construction and Major Renovations 2009.

.3 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-1.181-99, Ready-Mixed Organic Zinc-Rich Coating.

.2 CGSB 41-GP-19Ma-84, Rigid Vinyl Extrusions for Windows and Doors.

.4 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).

.5 Canadian Steel Door Manufacturers' Association (CSDMA)

.1 CSDMA, Recommended Specifications for Commercial Steel Doors and Frames, 2006.

.2 CSDMA, Selection and Usage Guide for Commercial Steel Door and Frame Products, 2009.

.6 National Fire Protection Association (NFPA)

.1 NFPA 80-2016, Standard for Fire Doors and Other Opening Protectives.

.2 NFPA 252-2012, Standard Methods of Fire Tests of Door Assemblies.

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

.1 SCAQMD Rule 1113-16, Architectural Coatings.

.2 SCAQMD Rule 1168-16, Adhesives and Sealants Applications.

.8 Underwriters' Laboratories of Canada (ULC)

.1 CAN/ULC-S104-10, Standard Method for Fire Tests of Door Assemblies.

.2 CAN/ULC-S105-09, Standard Specification for Fire Door Frames Meeting the Performance Required by CAN/ULC-S104.

1.2 SYSTEM DESCRIPTION

.1 Design Requirements:

.1 Design exterior frame assembly to accommodate to expansion and contraction when subjected to minimum and maximum surface temperature of -35 degrees C to 35 degrees C.

.2 Maximum deflection for exterior steel entrance screens under wind load of 1.2 kPa not to exceed 1/175th of span.

.3 Steel fire rated doors and frames: labelled and listed by an organization accredited by Standards Council of Canada in conformance with CAN/ULC-S104 for ratings specified or indicated.

.4 Provide fire labelled frames for openings requiring fire protection ratings. Test products in conformance with CAN/ULC-S104, ASTM E152 or NFPA 252 and listed by nationally recognized agency having factory inspection services.

1.3 SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00.

.2 Provide product data: in accordance with Section 01 33 00.

.3 Provide shop drawings: in accordance with Section 01 33 00.

.1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Ontario, Canada.

.2 Indicate each type of door, material, steel core thicknesses, mortises, reinforcements, location of exposed fasteners, openings, glazed, arrangement of hardware and fire rating and finishes.

.3 Indicate each type frame material, core thickness, reinforcements, glazing stops, location of anchors and exposed fastenings and reinforcing fire rating finishes.

.4 Include schedule identifying each unit, with door marks and numbers relating to numbering on drawings and door schedule.

.4 Sustainable Design Submittals:

.1 LEED Submittals: in accordance with Section 01 35 21.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00.

.2 Waste Management and Disposal:

.1 Separate waste materials for reuse and recycling in accordance with Section 01 74 11.

Part 2 PRODUCTS

2.1 MATERIALS

.1 Hot dipped galvanized steel sheet: to ASTM A653/A653M, ZF75, minimum base steel thickness in accordance with CSDMA Table 1 - Thickness for Component Parts, minimum 30% recycled content.

.2 Reinforcement channel: to CSA G40.20/G40.21, Type 44W, coating designation to ASTM A653/A653M, ZF75, minimum 30% recycled content.

2.2 DOOR CORE MATERIALS

.1 Honeycomb construction:

.1 Structural small cell, 24.5 mm maximum kraft paper 'honeycomb', weight: 36.3 kg per ream minimum, density: 16.5 kg/m^3 minimum sanded to required thickness.

2.3 ADHESIVES

.1 Honeycomb cores and steel components: heat resistant, spray grade, resin reinforced neoprene/rubber (polychloroprene) based, low viscosity, contact cement.

.2 Lock-seam doors: fire resistant, resin reinforced polychloroprene, high viscosity, sealant/adhesive.

2.4 PRIMER

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

.1 Maximum VOC limit 50 g/L to GC-03.

2.5 PAINT

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

.1 Maximum VOC emission level 50 g/L to GS-11.

2.6 ACCESSORIES

.1 Door silencers: single stud rubber/neoprene type.

.2 Top and bottom caps: rigid polyvinylchloride extrusion conforming to CGSB 41-GP-19Ma.

.3 Fabricate glazing stops as formed channel, minimum 16 mm height, accurately fitted, butted at corners and fastened to frame sections with counter-sunk oval head sheet metal screws.

.4 Door bottom seal: As specified in Section 08 71 11.

.5 Metallic paste filler: to manufacturer's standard.

.6 Fire labels: metal riveted.

.7 Sealant: As specified in Section 07 92 00.

.8 Glazing: As specified in Section 08 80 50.

.9 Make provisions for glazing as indicated and provide necessary glazing stops.

.1 Provide removable stainless steel glazing beads for use with glazing tapes and compounds and secured with countersunk stainless steel screws.

.2 Design exterior glazing stops to be tamperproof.

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 Exterior frames: 1.6 mm thermally broken type construction.

.4 Interior frames: 1.6 mm welded type construction.

.5 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.

.6 Protect mortised cutouts with steel guard boxes.

.7 Prepare frame for door silencers, 3 for single door, 2 at head for double door.

.8 Manufacturer's nameplates on frames and screens are not permitted.

.9 Conceal fastenings except where exposed fastenings are indicated.

.10 Provide factory-applied touch up primer at areas where zinc coating has been removed during fabrication.

.11 Insulate 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 in 2 temporary jamb spreaders per frame to maintain proper alignment during shipment.

2.10 DOOR FABRICATION GENERAL

.1 Doors: swing type, flush, with provision for glass and/or louvre openings as indicated.

.2 Exterior doors: honeycomb construction. Interior doors: honeycomb construction.

.3 Fabricate doors with longitudinal edges locked seam. Seams: visible.

.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 CAN/ULC-S104 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.

2.11 DOORS: HONEYCOMB CORE CONSTRUCTION

.1 Form face sheets for exterior doors from 2.0 mm sheet steel with honeycomb polystyrene core laminated under pressure to face sheets.

.2 Form face sheets for interior doors from 1.6 mm sheet steel with honeycomb core laminated under pressure to face sheets.

2.12 THERMALLY BROKEN DOORS AND FRAMES

.1 Fabricate thermally broken doors by using insulated core and separating exterior parts from interior parts with continuous interlocking thermal break.

.2 Thermal break: rigid polyvinylchloride extrusion conforming to CGSB 41-GP-19Ma.

.3 Fabricate thermally broken frames separating exterior parts form interior parts with continuous interlocking thermal break.

.4 Apply insulation.

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 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 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.

.4 Make allowances for deflection of structure to ensure structural loads are not transmitted to frames.

.5 Caulk perimeter of frames between frame and adjacent material.

.6 Maintain continuity of air barrier and vapour retarder where required.

3.4 DOOR INSTALLATION

.1 Install doors and hardware in accordance with hardware templates and manufacturer's instructions and Section 08 71 00.

.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, noncombustible sill, and thresholds: 13 mm.

.3 Adjust operable parts for correct function.

.4 Install louvres.

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.

3.6 GLAZING

.1 Install glazing for doors and frames in accordance with Section 08 80 50.

END OF SECTION

Part 1 GENERAL

1.1 SUMMARY

.1 This section includes requirements for flush wood doors including the following:

.1 Solid core doors with wood veneer finished faces.

.2 Factory finishing flush wood doors.

.3 Factory fitting flush wood doors to frames and factory machining for hardware.

1.2 REFERENCES

.1 American National Standards Institute (ANSI) / Hardwood Plywood & Veneer Association (HPVA):

.1 ANSI/HPVA HP-1-2009, American National Standard for Hardwood and Decorative Plywood.

.2 Architectural Woodwork Institute/Architectural Woodwork Manufacturers Association of Canada/ Woodwork Institute (AWI/AWMAC/WI):

.1 AWI/AWMAC/WI Architectural Woodwork Standards, AWS Edition 2-2014.

.3 Canadian Standards Association (CSA International).

.1 CAN/CSA-O132.2 Series-90(R2003), Wood Flush Doors.

.2 CSA Certification Program for Windows and Doors 00.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Product Data:

.1 Submit manufacturer's printed product literature, specifications and data sheet in accordance with Section 01 33 00.

.2 Submit two copies of WHMIS MSDS - Material Safety Data Sheets. Indicate VOC's:

.1 For caulking materials during application and curing.

.2 For door materials and adhesives.

.2 Shop Drawings:

.1 Submit shop drawings in accordance with Section 01 33 00.

.2 Indicate door types and sizes, core construction, transom panel construction and cutouts.

1.4 SAMPLES

.1 Submit samples in accordance with Section 01 33 00.

.2 Submit one 300 x 300 mm corner sample of each type wood door.

.3 Show door construction, core, glazing detail and faces.

.4 Manufacturer's Instructions:

.1 Submit manufacturer's installation instructions.

1.5 QUALITY ASSURANCE

.1 Test Reports: certified test reports showing compliance with specified performance characteristics and physical properties.

.2 Certificates: product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

1.6 DELIVERY, STORAGE, AND HANDLING

.1 Storage and Protection:

.1 Protect doors from dampness. Arrange for delivery after work causing abnormal humidity has been completed.

.2 Store doors in well ventilated room, off floor, in accordance with manufacturer's recommendations.

.3 Protect doors from scratches, handling marks and other damage. Crate doors.

.4 Store doors away from direct sunlight.

1.7 WASTE MANAGEMENT AND DISPOSAL

.1 Remove from site and dispose of packaging materials at appropriate recycling facilities.

.2 Dispose of corrugated cardboard, polystyrene and plastic packaging material in appropriate on-site bin for recycling in accordance with site waste management program.

.3 Unused or damaged glazing materials are not recyclable and must not be diverted to municipal recycling programs.

.4 Divert unused adhesive material from landfill to official hazardous material collections site approved by Departmental Representative.

.5 Do not dispose of unused paint materials into sewer systems, into lakes, streams, onto ground or in locations where it will pose health or environmental hazard.

Part 2 PRODUCTS

2.1 WOOD FLUSH DOORS

.1 Solid core: to CAN/CSA-O132.2.1.

.1 Construction:

.1 Solid particleboard core: stile and rail frame bonded to particleboard core with wood lock blocks, 5-ply construction.

.2 Face Panels:

.1 Hardwood; veneer grades: Grade I (Premium), maple species.

.3 Blocking: Hardwood lum ber, kiln dried to an average moisture content of between 6% and 12% maximum at time of manufacture, sized and located as required to eliminate through bolting hardware.

.4 Adhesive: Type II (water resistant) for interior doors.

2.2 GLAZING

.1 Glass: As indicated in Section 08 80 50 Glazing.

2.3 FABRICATION

.1 Vertical edge strips to match face veneer.

.2 Prepare doors for glazing. Provide glazing stops with mitred corners.

.3 Bevel vertical edges of single acting doors 3 mm in 50 mm on lock side and 1.5 mm in 50 mm on hinge side.

.4 Radius vertical edges of double acting doors to 60 mm radius.

.5 Machine doors to accept recessed hardware; locate hardware in accordance with requirements listed in Section 08 71 00 and templates provided by hardware supplier.

.6 Coordinate with hardware mortises in metal frames to verify dimensions and alignment before machining.

.7 Openings: no cut-outs permitted within 125 mm of sides and top of door or 250 mm from bottom of door.

2.4 FACTORY FINISHING

.1 Complete fabrication of doors before applying factory finishes including, but not limited to fitting doors for openings and machining for recessed hardware.

.2 Factory finish all four edges, edges of cut outs, and mortises the same as for faces, except that stains and fillers may be omitted on bottom edges, edges of cut outs, and mortises.

.3 Steam out deep scratches and ease sharp edges by sanding before starting factory finishing; block sand using 150/180 grit in direction of grain on all surfaces to remove handling marks and fingerprints.

.4 Perform filling, sanding and finishing in horizontal position wherever possible.

.5 Do not use water based primers, stains or combination stain sealers as they raise natural wood grain and may cause veneer splitting and highlighting of veneer joints.

.6 Transparent Finish:

.1 Grade: Premium

.2 Finish: TR-4 Conversion Varnish finish designation from AWMAC Manual.

.3 Staining: As selected by Departmental Representative from manufacturer's full range.

.4 Effect: Open-grain finish

.5 Sheen: Semi-gloss.

Part 3 EXECUTION

3.1 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.

3.2 INSTALLATION

.1 Unwrap and protect doors in accordance with CAN/CSA-O132.2 Series, Appendix A.

.2 Install doors and hardware in accordance with manufacturer's printed instructions and CAN/CSA-O132.2 Series, Appendix A.

.3 Trim doors as required for proper fit and function; refinish all cut or planed surfaces immediately to match factory finish.

.4 Do not impair structural strength of door by the application of hardware, cutting and altering the door for lights, louvres or other special details.

.5 Install glazing in accordance with Section 08 80 50.

.6 Install stops ready to receive finish.

.7 Adjust hardware for correct function.

3.3 ADJUSTMENT

.1 Re-adjust doors and hardware just prior to completion of building to function freely and properly.

3.4 CLEANING

.1 Perform cleaning as soon as possible after installation to remove construction and accumulated environmental dirt.

.2 Remove traces of primer, caulking; clean doors and frames.

.3 Clean glass and glazing materials with approved non-abrasive cleaner.

.4 On completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 This Section includes requirements for supply and installation of the following:

.1 Non-rated wall access doors and frames

.2 Fire rated wall access doors and frames

.3 Non-rated Ceiling access doors and frames

.4 Fire rated ceiling access doors and frames

1.2 RELATED REQUIREMENTS

.1 Section 09 21 16 – Gypsum Board Assemblies: Rated and non-rated access panels in walls and ceilings.

.2 Section 09 21 16.23 – Gypsum Board Shaft Wall Assemblies: Rated access panels in shaft wall assemblies.

.3 Division 22 – Plumbing: Shut-off and control valves for heating and plumbing systems; clean-outs for drainage systems.

.4 Division 23 – Heating, Ventilating and Air Conditioning: Duct accessories for heating and air-conditioning duct access doors.

.5 Division 26 – Electrical: Transformers and access doors for points and other electrical accessories.

1.3 REFERENCE STANDARDS

.1 American Society for Testing and Materials (ASTM):

.1 ASTM A568/A568M-13ae1, Standard Specification for Steel, Sheet, Carbon, Structural, and High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, General Requirements for

.2 ASTM A591/A591M-98, Standard Specification for Steel Sheet, Electrolytic Zinc-Coated, for Light Coating Weight (Mass) Applications

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

.4 ASTM A780-09, Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings

.5 ASTM A1008/A1008M-13, Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable

.6 ASTM B221-13, Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes

.7 ASTM C36/C36M-03, Standard Specification for Gypsum Wallboard

.2 National Fire Protection Agency (NFPA):

.1 NFPA 80, Standard for Fire Doors and Fire Windows

.3 International Organization for Standardization (ISO):

.1 ISO 14021:1999, Environmental labels and declarations -- Self-declared environmental claims (Type II environmental labelling)

.4 Underwriters Laboratories of Canada (ULC):

.1 CAN4-S104-1980 (R1985), Fire Tests of Door Assemblies

.5 Underwriters' Laboratories (UL), Standards for Safety acceptable to the Standards Council of Canada (SCC)

1.4 ADMINISTRATION REQUIREMENTS

.1 Coordination: Determine specific locations and sizes for access doors needed to gain access to concealed equipment, and indicate on schedule specified below, and as follows:

.1 Coordinate locations of all access panels in gypsum board ceilings with Departmental Representative for size and location prior to installation, making every effort to locate outside of gypsum board ceilings.

.2 Coordinate acceptable locations and sizes with Architectural Reflected Ceiling Plans; no access panels are allowed in public corridors or feature ceilings.

.3 Coordinate closely with mechanical and electrical sections for size and locations of access panels in walls and ceilings; provide access doors and panels required for project.

1.5 SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00.

.2 Action Submittals: Provide the following submittals before starting any work of this Section:

.1 Product Data: Provide product data for each type of door and frame indicated, including construction details relative to materials, individual components and profiles, finishes, and fire ratings (if required) for access doors and frames.

.2 Shop Drawings: Provide coordination drawings and reflected ceiling plans drawn to scale and coordinating penetrations and ceiling-mounted items with concealed framing, suspension systems, piping, ductwork, and other construction. Show the following:

.1 Method of attaching door frames to surrounding construction.

.2 Ceiling mounted items including access doors and frames, lighting fixtures, diffusers, grilles, speakers, sprinklers, and special trim.

.3 Samples: Provide complete door and frame schedule, including types, general locations, sizes, construction details, latching or locking provisions, and other data pertinent to installation.

1.6 QUALITY ASSURANCE

.1 Regulatory Requirements: Provide fire rated access doors and frames in accordance with NFPA 80 or ULC S104, and labelled and listed by UL, ULC or ITS/Warnock Hersey, or another testing and inspecting agency acceptable to Authority Having Jurisdiction and Section 07 05 53.

Part 2 Products

2.1 NON-RATED ARCHITECTURAL ACCESS PANELS

.1 Flush doors and trimless frames, fabricated as follows:

.1 Aluminum Extrusions: ASTM B221, Alloy 6063-T6.

.2 Door: Extruded aluminum frame with gypsum board inlay and structural nylon corner elements:

.1 Gypsum Board: to ASTM C36, 13 mm and 16 mm thickness to match adjacent construction.

.2 Size: Square sized to suit access requirements if not indicated on Drawings.

.3 Latch: Concealed touch latch

.4 Hinge: Concealed, two point pin hinge, non-corroding, allowing door to open 120° and allowing door to be removed.

.5 Edge Bead: Recessed extruded aluminum frame edge bead providing surface that can be finished to adjacent gypsum board.

.6 Accessories: Fibreglass reinforced nylon, zinc plated screws, stainless steel springs and retaining wire to manufacturer’s standard.

.7 Finish: Aluminum frames, gypsum board, nylon and aluminum cam latch to receive the same finish and paint as the surrounding surface.

2.2 FIRE RATED ACCESS PANELS IN GYPSUM BOARD

.1 Flush, fire rated access doors and trimless frames, fabricated from zinc coated steel sheet, and as follows:

.1 Cold-Rolled Steel Sheets: ASTM A1008/A1008M, Commercial Steel (CS), or ASTM A1008/A1008M, Drawing Steel (DS), Type B; stretcher-levelled standard of flatness; with minimum thickness indicated representing specified nominal thickness according to ASTM A568/A568M.

.2 Galvanizing: Electrolytic zinc-coated steel sheet, complying with ASTM A591/A591M, Class C coating or ASTM A653/A653M Z180 (G60) mill phosphatized zinc coating, at fabricator's option.

.3 Door: Flush panel, minimum thickness of 0.95 mm.

.4 Latch: Self-latching bolt operated by standard screwdriver with interior release.

.5 Hinge: Concealed, two point pin hinge, non-corroding, allowing door to open 120° and allowing door to be removed.

.6 Automatic Closer: Spring type.

.2 Edge Beads: Edge trim formed from 0.80 mm nominal thickness zinc coated steel sheet formed to receive joint compound and in size to suit thickness of gypsum board.

.3 Door Frame: Minimum 1.6 mm thick sheet metal with gypsum board bead.

2.3 FIRE RATED ACCESS PANELS IN MASONRY OR CONCRETE

.1 Flush, fire rated access doors and trimless frames, fabricated from zinc coated steel sheet, and as follows:

.1 Cold-Rolled Steel Sheets: ASTM A1008/A1008M, Commercial Steel (CS), or ASTM A1008/A1008M, Drawing Steel (DS), Type B; stretcher-levelled standard of flatness; with minimum thickness indicated representing specified nominal thickness according to ASTM A568/A568M.

.2 Galvanizing: Electrolytic zinc-coated steel sheet, complying with ASTM A591/A591M, Class C coating or ASTM A653/A653M Z180 (G60) mill phosphatized zinc coating, at fabricator's option.

.3 Door: Flush panel, minimum thickness of 0.95 mm.

.4 Latch: Self-latching bolt operated by standard screwdriver with interior release.

.5 Hinge: Concealed, two point pin hinge, non-corroding, allowing door to open 120° and allowing door to be removed.

.6 Automatic Closer: Spring type.

.7 Edge Trim: All purpose exposed flange formed from 1.98 mm nominal thickness zinc coated steel sheet.

.8 Door Frame: Minimum 1.6 mm thick sheet metal with gypsum board bead.

2.4 FABRICATION

.1 Provide access door assemblies manufactured as integral units ready for installation.

.2 Provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness for metal surfaces exposed to view in the completed Work.

.3 Grind exposed welds smooth and flush with adjacent surfaces. Furnish attachment devices and fasteners of type required to secure access panels to types of supports indicated.

.4 Latching Mechanisms: Supply number required to hold doors in flush, smooth plane when closed based on size of door or panel opening.

.5 Apply manufacturer's standard protective coating on aluminum that will come in contact with concrete after fabrication.

2.5 FINISHES

.1 Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

.2 Finish metal fabrications after assembly.

.3 Aluminum Finishes:

.1 Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

.2 As-Fabricated Finish: AA-M10 Mechanical Finish: as fabricated, unspecified (mill finish).

.4 Steel Finishes:

.1 Surface Preparation: Clean surfaces with non-petroleum solvent so surfaces are free of oil and other contaminants. For galvanized surfaces, apply, after cleaning, a conversion coating suited to the organic coating to be applied over it. For zinc coated surfaces, clean welds, mechanical connections, and abraded areas, and apply galvanizing repair paint specified below to comply with ASTM A780.

.2 Factory Priming for Site Painted Finish: Apply shop primer immediately after cleaning and pre-treating, as follows:

.1 Shop Primer for Ferrous Metal: Fast-curing, lead- and chromate free, universal modified alkyd primer selected for good resistance to normal atmospheric corrosion, compatibility with finish paint systems and capability to provide a sound foundation for site-applied topcoats despite prolonged exposure.

.2 Shop Primer for Zinc Coated Steel: Organic zinc-rich primer complying with SSPC-Paint 20 and compatible with topcoat.

.3 Galvanizing Repair Paint: High zinc dust content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.

Part 3 Execution

3.1 PREPARATION

.1 Advise installers of other work about specific requirements relating to access door installation, including sizes of openings to receive access door and frame, as well as locations of supports, inserts, and anchoring devices.

3.2 INSTALLATION

.1 Installation shall be completed by Section 09 21 16 and Section 09 21 16.23.

.2 Comply with manufacturer's written instructions for installing access doors and frames.

.3 Set frames accurately in position and attach securely to supports with plane of face panels aligned with adjacent finish surfaces.

.4 Install access doors with trimless frames flush with adjacent finish surfaces or recessed to receive finish material.

.5 Remove and replace doors and frames that are warped, bowed, or otherwise damaged.

3.3 ADJUSTING

.1 Adjust doors and hardware after installation for proper operation.

END OF SECTION

Part 1 GENERAL

1.1 RELATED REQUIREMENTS

.1 Section 05 50 01 – Metal Fabrications

.2 Section 07 42 43 – Composite Panels

.3 Section 07 92 00 – Joint Sealants: Sealants installed with glazed aluminum curtain wall systems.

.4 Section 08 71 00 – Door Hardware

.5 Section 08 80 50 - Glazing

1.2 REFERENCES

.1 Aluminum Association (AA)

.1 AA DAF 45-03(R2010), Designation System for Aluminum Finishes.

.2 American Architectural Manufacturers Association (AAMA)

.1 AAMA CW-10-04, Care and Handling of Architectural Aluminum From Shop to Site.

.2 AAMA 611-12, Voluntary Specifications for Anodized Finishes Architectural Aluminum.

.3 ASTM International (ASTM)

.1 ASTM B209-10, Specification for Aluminum and Aluminum-Alloy Sheet and Plate.

.2 ASTM B221-13, Specification for Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.

.3 ASTM E283-04(2012), Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.

.4 ASTM E330-02(2010), Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights, and Curtain Walls, by Uniform Static Air Pressure Difference.

.5 ASTM E331-00(2009), Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls, by Uniform Static Air Pressure Difference.

.6 ASTM E413-10, Classification for Rating Sound Insulation.

.4 Canada Green Building Council (CaGBC)

.1 LEED Canada For New Construction and Major Renovations 2009.

.5 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-1.108-M89, Bituminous Solvent Type Paint.

.2 CAN/CGSB-12.20-M89, Structural Design of Glass for Buildings.

.6 CSA International

.1 CSA G40.20-04(R2009)/G40.21-04(R2009), General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.

.2 CAN/CSA-S157-05/S157.1-05, Strength Design in Aluminum/Commentary on CAN/CSA-S157, Strength Design in Aluminum.

.3 CSA W59-03(R2008), Welded Aluminum Construction.

.7 Green Seal Environmental Standards (GS)

.1 GS-11-2008, 2nd Edition, Paints and Coatings.

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

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

.9 Underwriters Laboratories of Canada (ULC):

.1 CAN/ULC-S710.1-05 Standard For Thermal Insulation – Bead Applied One-Component Polyurethane Air Sealant Foam, Part 1: Material Specification.

.2 CAN/ULC-S710.2-05 Standard For Thermal Insulation – Bead Applied One-Component Polyurethane Air Sealant Foam, Part 2: Installation.

1.3 DEFINITIONS

.1 Delegated Design Professional Engineer: The professional engineer hired or contracted to the fabricator or manufacturer to produce delegated design submittals and shop drawings to meet the requirements of the Project, and registered in the province of the Work, and who is not the Departmental Representative.

1.4 ADMINISTRATIVE REQUIREMENTS

.1 Co-ordination: co-ordinate work of this Section with installation of fire stopping, air barrier placement, vapour retarder placement, and components or materials.

.2 Arrange for site visit with Departmental Representative prior to start of Work to examine existing site conditions adjacent to demolition Work.

.3 Hold project meetings every month.

.4 Ensure key personnel attend.

.5 Departmental Representative will submit written notification of change to meeting schedule established upon contract award 24 hours prior to scheduled meeting.

1.5 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for curtain wall components, anchorage and fasteners, glass and infill, and internal drainage details 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 Indicate system dimensions, framed opening requirements and tolerances, adjacent construction, anchor details anticipated deflection under load, affected related Work, weep drainage network, expansion and contraction joint location and details, and field welding required.

.4 Samples:

.1 Submit for review and acceptance of each unit.

.2 Samples will be returned for inclusion into work.

.3 Submit 2 samples illustrating prefinished aluminum surface, finish, colour, texture, specified glass, insulated infill panels, glazing materials illustrating edge and corner.

.5 Delegated Design Submittals:

.1 Include framing member structural and physical characteristics, calculations, dimensional limitations, special installation requirements.

.6 Test Reports:

.1 Submit substantiating engineering data, test results of previous tests which purport to meet performance criteria, and supportive data.

.7 Sustainable Design Submittals:

.1 LEED Canada-NC 2009 Submittals: in accordance with Section 01 35 21 - LEED Requirements.

.2 Construction Waste Management:

.1 Submit project Waste Management Plan highlighting recycling and salvage requirements.

.2 Submit calculations on end-of-project recycling rates, salvage rates, and landfill rates demonstrating that 75% of construction wastes were recycled or salvaged.

.3 Recycled Content:

.1 Submit listing of recycled content products used, including details of required percentages or recycled content materials and products, showing their costs and percentages of post-consumer and post-industrial content, and total cost of materials for project.

.4 Regional Materials: submit evidence that project incorporates required percentage 20% of regional materials and products, showing their cost, distance from project to furthest site of extraction or manufacture, and total cost of materials for project.

.5 Low-Emitting Materials:

.1 Submit listing of adhesives and sealants and paints and coatings used in building, showing compliance with VOC and chemical component limits or restriction requirements.

1.6 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00.

.2 Operation and Maintenance Data: submit operation and maintenance data for glazed aluminum curtain wall for incorporation into manual.

1.7 MAINTENANCE MATERIAL SUBMITTALS

.1 Extra Stock Materials:

.1 Supply extra stock materials of glass units in accordance with Section 01 78 00.

.2 Supply protected and packaged in wood crates suitable for storage. Clearly identify each crate.

.3 Deliver to Departmental Representative, upon completion of work of this Section.

.4 Store where directed by Departmental Representative.

1.8 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 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 Handle work of this Section in accordance with AAMA CW-10.

.2 Store materials indoors and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.3 Store and protect aluminum glazed curtain wall components from nicks, scratches, and blemishes.

.4 Protect prefinished aluminum surfaces with strippable coating. Do not use adhesive papers or sprayed coatings which bond when exposed to sunlight or weather.

.5 Replace defective or damaged materials with new.

.4 Develop Construction Waste Management Plan related to Work of this Section and in accordance with Section 01 35 21.

.5 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding, and packaging materials as specified in Construction Waste Management Plan in accordance with Section 01 74 20 and Section 01 35 21.

1.9 AMBIENT CONDITIONS

.1 Install sealants when ambient temperature is above 5 degrees C minimum.

.2 Maintain this minimum temperature during and for 48 hours minimum after installation of sealants.

Part 2 PRODUCTS

2.1 SYSTEMS

.1 Description:

.1 Vertical, triple glazed aluminum curtain wall system includes thermally broken tubular aluminum sections with self supporting framing, shop fabricated, factory prefinished, vision glass, related flashings, anchorage and attachment devices.

.2 Assembled system to permit re-glazing of individual glass units without requiring removal of structural mullion sections.

.2 Performance Requirements:

.1 Design and size components to withstand dead and live loads caused by pressure and suction of wind, acting normal to plane of system as calculated in accordance with NBC.

.2 Design and size components to withstand seismic loads and sway displacement as calculated in accordance with applicable codes.

.3 Limit mullion deflection to L/175 with full recovery of glazing materials.

.4 Size glass units and glass dimensions to limits established in CAN/CGSB-12.20.

.5 Ensure system is designed to accommodate the following without damage to components or deterioration of seals:

.1 Movement within system.

.2 Movement between system and perimeter framing components.

.3 Dynamic loading and release of loads.

.4 Deflection of structural support framing.

.5 Shortening of building concrete structural columns.

.6 Creep of concrete structural members.

.6 Thermal Movements: Allow for thermal movements resulting from the following maximum change (range) in ambient temperatures, accounting for surface temperatures of materials due to both solar heat gain and night time sky heat loss:

.1 Temperature Change (Range):

.1 Exterior Ambient: -40°C to +35°C

.2 Interior Ambient: +16°C to +29°C

.3 Adjust calculations to account for colour treatments or coatings on curtain wall framing members.

.2 Allow for thermal movement with no buckling of frame members, stress on glass, glazing edge seal failure, sealant failure, excess stress on curtain wall framing, anchors and fasteners, or reduction of performance.

.7 Condensation Index: Design thermal break to CI to not less than 83g and 80f in accordance with CSA A440 on interior of window metal surfaces to not over 5% of area when conditions are:

.1 Exterior Air Temperature: -30.0°C

.2 Interior Air Temperature: 20.0°C

.3 Interior Relative Humidity: 15%

.8 Air Infiltration: Design system for maximum air leakage of 0.3 L/s m² of fixed wall area when tested in accordance with ASTM E283 at a minimum static air pressure differential of 300 Pa.

.9 Water Penetration Under Static Pressure: Design system for zero water penetration when tested in accordance with ASTM E331 at a minimum differential static pressure of 20% of positive design wind load; but not less than 475 Pa.

.10 Average Thermal Conductance: Combined glass and framing Design system having average insulation factor of not more than 1.32 W/m²•K when tested in accordance with AAMA 1503 using high performance glass specified in Section 08 80 50.

.11 Drain water entering joints, condensation occurring in glazing channels, or migrating moisture occurring within system, to exterior by weep drainage network.

.12 Maintain continuous air barrier and vapour retarder throughout assembly, primarily in line with inside pane of glass and heel bead of glazing compound.

.1 Position thermal insulation on exterior surface of air barrier and vapour retarder.

.13 Ensure no vibration harmonics, wind whistles, noises caused by thermal movement transmitted to other building elements, loosening, weakening, or fracturing of attachments or components of system occur.

2.2 MATERIALS

.1 Aluminum: Materials recommended by manufacturer for type of use and finish indicated, and as follows:

.1 Sheet and Plate: In accordance with ASTM B209/B209M, and ANSI H35.1 AA1100-H14, or AA5005-H32 or H34, anodizing quality.

.2 Extruded Bars, Rods, Profiles, and Tubes: In accordance with ASTM B221), and ANSI H35.1 AA6063-T5 or T6, anodizing quality.

.3 Extruded Structural Pipe and Tubes: In accordance with ASTM B429, and ANSI H35.1 AA6061-T6 or AA6063-T6, anodizing quality.

.4 Structural Profiles: In accordance with ASTM B308/B308M, anodizing quality.

.5 Welding Rods and Bare Electrodes: CSA W59.2.

.2 Steel Reinforcement: Coat steel with manufacturer's standard corrosion resistant primer applied immediately after surface preparation and pre-treatment, and as follows:

.1 Rolled Sheet or Strip: CSA G40.20/G40.21.

.2 Structural Shapes, Plates and Bars: CSA G40.20/G40.21.

.3 Brackets and Reinforcements: Manufacturer's standard high strength aluminum with non-staining, nonferrous shims for aligning system components.

.4 Metal Fabrications and Attachments: Manufacturer’s required steel fabrications and attachments for connecting to deflection control assemblies and structural support systems.

.5 Fasteners and Accessories: Manufacturer's standard corrosion-resistant, non-staining, non-bleeding fasteners and accessories compatible with adjacent materials.

.1 Use self locking devices where fasteners are subject to loosening or turn out from thermal and structural movements, wind loads, or vibration.

.2 Reinforce members to receive fastener threads.

.3 Use only concealed fasteners, unless use of exposed fasteners has been accepted in writing by the Departmental Representative.

.4 Finish exposed portions to match framing system.

.5 Use slip joint linings, spacers, and sleeves at movement joints of material and type recommended by manufacturer.

.6 Anchors: Three way adjustable anchors that accommodate fabrication and installation tolerances in material and finish compatible with adjoining materials and recommended by manufacturer.

.7 Concealed Flashing: Manufacturer's standard corrosion resistant, non-staining, non-bleeding flashing compatible with adjacent materials.

.8 Transition Membranes: Full length self adhering SBS modified bitumen reinforced membrane; having low temperature formulation appropriate for installation requirements and compatible with materials specified in Section 07 25 13.

.9 Liquid Foam Sealant: to CAN/ULC-S710.1 Spray-applied single component polyurethane foam insulation/air barrier sealant, with minimum 75 % closed cell content; and compatible with materials specified in Section 07 25 13.

.10 Glazing Systems

.1 Glass: Specified in Section 08 80 50.

.2 Glazing Gaskets: Manufacturer's standard sealed corner pressure glazing system of black, resilient elastomeric glazing gaskets, setting blocks, and shims or spacers.

.3 Standard Glazing Sealants: As recommended by manufacturer for joint type with materials used on interior side of vapour barrier having a maximum VOC limit of 250 g/L in accordance with SCAQMD Rule 1168.

2.3 COMPONENTS

.1 Mullion profile:

.1 Frame Dimensions: Nominal 65 mm wide x 102 mm deep back section having a glazing throat to accommodate triple glazed unit as specified in Section 08 80 50.

.2 Cover Depth: Nominal 65 mm wide x 19 mm deep.

.3 Thermally broken with interior tubular section insulated from exterior thermally enhanced, non-metallic pressure plate.

.4 Matching stops and pressure plate of sufficient size and strength to ensure adequate bite on glass.

.5 Drainage holes, deflector plates and internal flashings to accommodate internal weep drainage system.

.6 Internal mullion baffles to eliminate "stack effect" air movement within internal spaces.

.7 Sills to be fabricated from extruded aluminum, minimum 3 mm thickness with sill carriers.

2.4 ENTRANCE DOORS – SWING

.1 Exterior Doors: Manufacturer's extruded aluminum glazed doors for manual swing operation, reinforced as required to withstand traffic conditions and as follows:

.1 Construction: Standard medium stile, thermally broken frame sections.

.2 Glazing Method: Square stops for sealed glazing, with non-removable glazing stops on outside of door.

.3 45 mm thickness with 100 mm top rail and 175 mm bottom rail and 100 mm vertical stile width.

2.5 HARDWARE

.1 Weather Stripping: Elastomeric.

.2 Additional hardware supplied under Section 08 71 00 for aluminum doors, aluminum threshold prepared for, and installed by this Section.

2.6 FABRICATION

.1 Fabricate system components with minimum clearances and shim spacing around perimeter of assembly, yet enabling installation and dynamic movement of perimeter seal.

.2 Accurately fit and secure joints and corners. Make joints flush, hairline, and weatherproof.

.3 Prepare components to receive anchor devices. Install anchors.

.4 Arrange fasteners and attachments to ensure concealment from view.

.5 Reinforce framing members for external imposed loads.

.6 Visible manufacturer's identification labels not permitted.

2.7 FINISHES

.1 Clear Anodized Finish:

.1 Class I Finish: Architectural Class I, clear coating 0.018 mm or thicker in accordance with AAMA 611.

2.8 SOURCE QUALITY CONTROL

.1 Perform work in accordance with AAMA GSM-1. Maintain 1 copy on site.

.2 Design structural support framing components to CAN/CSA-S157/S157.1 under direct supervision of a Professional Structural Engineer experienced in design of this Work and licensed in the Province of Ontario.

.3 Perform welding Work in accordance with CSA W59.2.

Part 3 EXECUTION

3.1 EXAMINATION

.1 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts are acceptable for aluminum curtain wall installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Departmental Representative.

.2 Verify dimensions, tolerances, and method of attachment with other work.

.3 Verify wall openings and adjoining air barrier and vapour retarder materials are ready to receive work of this Section.

.4 Inform Departmental Representative of unacceptable conditions immediately upon discovery.

.5 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 INSTALLATION

.1 Install curtain wall system in accordance with manufacturer's instructions.

.2 Attach to structure to permit sufficient adjustment to accommodate construction tolerances and other irregularities.

.3 Use alignment attachments and shims to permanently fasten system to building structure. Clean weld surfaces; apply protective primer to field welds and adjacent surfaces.

.4 Align assembly plumb and level, free of warp or twist. Maintain assembly dimensional tolerances and align with adjacent work.

.5 Use thermal isolation where components penetrate or disrupt building insulation.

.6 Install flashings.

.7 Co-ordinate attachment and seal of perimeter air barrier and vapour retarder materials.

.8 Fill shim spaces at perimeter of assembly with liquid foam sealant in accordance with CAN/ULC S710.2 to maintain continuity of thermal barrier.

.9 Install fire-safing in areas as indicated.

.10 Install glass in accordance with Section 08 80 50, to glazing method required to achieve performance criteria. Place sealant on the up-slope side of the pressure plate cover caps; finish the surface with a slope to encourage drainage over the cap.

.11 Install perimeter sealant to method required to achieve performance criteria.

3.3 SITE TOLERANCES

.1 Maximum variation from plumb: 1.5 mm/m non-cumulative or 12 mm/30 m, whichever is less.

.2 Maximum misalignment of two adjoining members abutting in plane: 0.8 mm.

.3 Maximum sealant space between curtain wall and adjacent construction: 13 mm.

3.4 FIELD QUALITY CONTROL

.1 Manufacturer's Field Services:

.1 Obtain written report from manufacturer of curtain wall verifying compliance of Work, in handling, installing, applying, protecting and cleaning of products, and submit written reports in acceptable format to verify compliance of Work with Contract within 3 days of review.

.2 Submit 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 on which Work of this Section depends is complete, but before installation begins.

.2 Twice during progress of Work at 60% complete.

.3 Upon completion of Work, after cleaning is carried out.

3.5 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11.

.1 Leave Work area clean at end of each day.

.2 Remove protective material from prefinished aluminum surfaces.

.3 Wash down surfaces with a solution of mild detergent in warm water, applied with soft, clean wiping cloths. Take care to remove dirt from corners. Wipe surfaces clean.

.4 Remove excess sealant by moderate use of mineral spirits or other solvent acceptable to sealant manufacturer.

.5 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11.

.2 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 20 and 01 35 21.

.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 glazed aluminum curtain wall installation.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 This Section includes requirements for design, supply and installation of point supported glass assemblies consisting of the following:

.1 Fixed, translucent laminated glass with thickness designed for anticipated loads applicable to location.

.2 Cast stainless steel point load connectors, spider fittings and related architecturally exposed structural steel components required for point supported glass assembly.

.3 Weathering silicone glass panel joints.

.4 Coordination with structural steel cable and threaded rod, and other structural components.

.5 Connections to structural support systems, fasteners, and accessories required for a complete installation of the point supported glass assemblies.

.2 Drawings contain details that suggest directions for solving some of the major design requirements; these details can be developed further by the Subcontractor provided that the final installation adheres to aesthetic criteria established by the drawings and specified dimensions with all elements in planes.

1.2 RELATED REQUIREMENTS

.1 Section 05 12 23 – Structural Steel For Buildings: Steel supporting structures for point supported glass assemblies.

.2 Section 05 50 00 – Metal Fabrications: Structural steel shapes for support of point supported glass assembly components.

.3 Section 08 80 50 – Glass Glazing: Glass unit composition and performance requirements.

1.3 DEFINITIONS

.1 Delegated Design Professional Engineer: The professional engineer hired or contracted to the fabricator or manufacturer to design specialty elements, produce delegated design submittals and shop drawings to meet the requirements of the Authorities Having Jurisdiction; and who is registered in the province of Ontario; and who is not the Departmental Representative.

.2 Commitment to General Reviews by Architects and Engineers and Letter of General Conformance: Documents prepared by the delegated design professional engineer as recommended by PEO guidelines for providing general review of construction by the professional engineer.

.3 Equal Dimensions: Point supported glass assemblies indicating equal dimensions on the drawings shall be calculated to align with in-place structural elements followed by even division of the space between structural elements. This shall mean that point supported glass materials are evenly spaced between adjacent structural members, not necessarily evenly spaced across the entire wall assembly.

1.4 REFERENCE STANDARDS

.1 American Society for Testing and Materials (ASTM):

.1 ASTM A167-99 (2009), Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet and Strip

.2 ASTM A276-13, Standard Specification for Stainless Steel Bars and Shapes

.3 ASTM A666-10, Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar

.4 ASTM A781/A781M-08, Standard Specification for Castings, Steel and Alloy, Common Requirements, for General Industrial Use

.5 ASTM A957-09A, Standard Specification for Investment Castings, Steel and Alloy, Common Requirements, for General Industrial Use

.2 Canadian General Standards Board (CGSB):

.1 CAN/CGSB 12.20-M89, Structural Design of Glass for Buildings

1.5 ADMINISTRATIVE REQUIREMENTS

.1 Delegated Design Requirements: Coordinate design of glass thicknesses and composition in accordance with referenced standards and with Section 08 80 50; coordinate with Section 08 80 50 for edge of glass deflections based on specified bending limitations list in this Section.

.2 Coordination: Coordinate installation of glass point supported glass assemblies with work specified in other Sections to ensure proper placement and installation of the following:

.1 Coordinate seismic restraints for non-structural assembly components with glass and glazing requirements specified in this Section; design and provide seismic restraints for point supported glass as a single source responsibility.

.2 Structural connections and supports for point supported glass; provide loading and deflection criteria to tension framing assemblies to prevent excessive movements, and glass-to-glass or glass-to-metal contact.

.3 Coordinate structural steel specified on the Structural Drawings and with requirements of secondary steel forming a part of point supported glass assemblies so that fabrication of structural steel supports necessary for mechanical connections of point supported glass assemblies align with requirements of this Section.

.4 Sealants so that ambient and surface temperatures are greater than 5°C from time of application until sealants have cured.

.3 Pre-Construction Meetings: Schedule and conduct a pre-construction meeting at project site in accordance with Section 01 31 19 with Contractor, Subcontractor responsible for fabrication and erection of glass point supported glass, Subcontractors affected by work of this Section and the Departmental Representative; agenda for meeting will include the following:

.1 Review methods and procedures related to installation of point supported glass assemblies.

.2 Review glazing procedure and schedule including method of delivery and handling of glass, and installation of glazing materials.

.3 Review structural load limitations.

.4 Review and finalize construction schedule and verify availability of materials, installer's personnel, equipment, and facilities needed to make progress and avoid delays.

.5 Review location and alignment of vertical and horizontal elements as they relate to the aesthetic criteria indicated on the Drawings, and the technical requirements indicated on the shop drawings.

1.6 SUBMITTALS

.1 Provide required information in accordance with Section 01 33 00.

.2 Action Submittals: Provide the following submittals before starting any work of this Section:

.1 Product Data: Submit product data indicating construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of product indicated, in addition to the following specific requirements:

.1 Mechanical Fasteners: Indicate sizes, shear, and pull over loading capacity where applicable.

.2 Shop Drawings: Submit shop drawings prepared by or under the supervision of delegated professional engineer detailing fabrication and assembly of point supported glass assemblies clearly indicating all construction details including, but not limited to, the following:

.1 Layout of complete glazed structure in relation to adjacent work including columns, beams, suspension members and other structures.

.2 Connections and anchor requirements.

.3 Type, size and spacing of fastening devices.

.4 Design loads.

.5 Materials, attachments devices and accessories including necessary tolerances.

.6 Connections to adjacent air and vapour membranes.

.7 Connections of point supported assemblies to structural members.

.8 Sealant locations.

.9 Seal of a professional engineer registered in the Province of the Work for details requiring structural design for load bearing, life and health safety or seismic restraint.

.3 Samples: Submit samples for each type of exposed finish required, in manufacturer's standard sizes for Departmental Representative’s verification of specified finishes; and fabricated 600 mm x 600 mm sample of each vertical to horizontal intersection of specified systems, made from 300 mm square glass units of full size components indicating details of the following:

.1 Glass seals and edges

.2 Joinery

.3 Point supported connectors

.4 Anchorage

.5 Expansion provisions

.6 Glazing

.3 Informational Submittals: Provide the following submittals during the course of the work:

.1 System Certificate: Statement signed by glass manufacturer clearly stating that glass and fittings used on project are part of manufacturer's system and are acceptable to manufacturer and that they have reviewed contract documents and are able to issue warranty incorporating all components for system; letters signed by installer for this section are not acceptable.

.2 Welding Certificate: Submit copies of welder certificates certifying that welders are certified and have the necessary experience to complete work specified in this Section.

.3 Installation Data: Submit manufacturer's written installation requirements.

.4 Delegated Design Submittals: Submit the following in accordance with the requirements of Section 01 33 50:

.1 Commitment to General Reviews by Architects and Engineers: Submit a signed and sealed Letter of Commitment on company letterhead.

.2 Letter of General Conformance on company letterhead.

1.7 PROJECT CLOSEOUT SUBMISSIONS

.1 Operation and Maintenance Data: Submit manufacturer's written instructions for maintenance and adjustment procedures; include name of original installer and contact information in accordance with Section 01 78 00.

.2 Record Documentation: Submit as constructed information in accordance with Section 01 78 00.

1.8 QUALITY ASSURANCE

.1 Materials: Use glazing materials and sealants that are chemically compatible with each other and with materials used during glass fabrication.

.2 Delegated Design Professional Engineer: Retain a professional engineer, registered in the province of the Work, to design fabrication and erection of the Work of this Section in accordance with applicable Building Code and Contract Documents requirements including the following:

.1 Perform design, engineering and fabrication of point supported glass assemblies under a single source responsibility; outsourcing, subcontracting, or joint ventures to achieve a single source will not be acceptable.

.2 Seal and signature to shop drawings and design submittals.

.3 Site review and certification of installed components.

1.9 DELIVERY, STORAGE AND HANDLING

.1 Delivery and Acceptance Requirements: Deliver materials with components clearly labelled and inventoried indicating position within building construction; time delivery of material to site to ensure uninterrupted progress of work.

.2 Storage and Handling Requirements: Store and handle materials and components to prevent damage in accordance with manufacturer's written instructions and as follows:

.1 Store units at site on raised wood pallets protected from the elements and corrosive materials; do not remove from crates or other protective covering until ready for installation.

.2 Store all glass units vertically on end with solid bearing full thickness of sealed units; or horizontally where structural performance of units can withstand lifting forces to vertical installation.

.3 Store factory finished components in a manner that will prevent surfaces from being damages or scratched.

1.10 SITE CONDITIONS

.1 Site Measurements: Verify dimensions of other construction by site measurements before fabrication and indicate measurements on shop drawings where point supported glass assemblies are indicated to fit to other construction.

.2 Established Dimensions: Establish dimensions and proceed with fabricating point supported glass without site measurements where site measurements cannot be made without delaying the Work, coordinated with other construction to ensure that actual dimensions correspond to established dimensions.

.3 Ambient Conditions: Comply with manufacturer's written requirements for ambient and surface temperature under which products can be installed and verify joint conditions are suitable for installation of materials.

Part 2 Products

2.1 DESCRIPTION OF WORK

.1 Responsibility: Delegated design professional engineer is responsible for designing point supported glass assemblies and connections based on design loads and reactions provided by the Departmental Representative, and verifying that safety factor is appropriate for intended installation and meets requirements of the Authority Having Jurisdiction.

.2 Design Requirements: Design and size system components in accordance with CGSB 12.20; free from defects impairing strength, durability and appearance including anchorage capable of withstanding specified loading without failure, and as follows:

.1 Appearance: Design system components and glass system to provide a flush appearance where glass panels abut adjacent glass panels; systems that incorporate additional exposed metal stiffeners and girts will not be permitted.

.2 Exposed Fasteners: Fabricated from same materials design to prevent high stress concentration at glass connection points, colour and finish as material as that to which they are applied and having exposed surfaces with same inherent texture and colour for similar locations throughout system.

.3 Wind (Horizontal) and Structural (Vertical) Loads: Design and fabricate assemblies and systems to resist loads required by Building Code.

.4 Engineering Design: Use professional engineer, registered in the province of the Work, and that has experience in the work required by this Section to prepare structural calculations and design details.

.3 Design Loads and Performance Criteria: Design point supported glass framing system capable of withstanding design loads within limits and under design loads indicated in this Section, and as follows:

.1 Dead Loads: Use design dead load indicated on Drawings.

.2 Axial Loads: Use design axial loads indicated on Drawings.

.3 Structural Deflection and Movement: Allow for movement and deflection of structural support framing; design tension framing system connections to accommodate structural deflections such that loading is not transferred to glass point supported glass assemblies:

.1 Building Movement: Design for movements of supporting structure including twist, column shortening, long term creep, and deflection from uniformly distributed and concentrated live loads and storey drift under combined wind and gravity loads in accordance with the Building Code.

.2 Lateral Loads: Design for q50 wind loads using normal importance factors listed in the Building Code for deflection and strength, modified by the appropriate exposure, gust and pressure (internal and external) factors in accordance with Building Code structural commentaries.

.3 Periodic Maintenance Equipment Loads: Account for loads arising from window cleaning or other maintenance equipment.

.4 Thermal Loads and Movement: Allow for glass movement arising from thermal changes, accounting for surface temperatures of materials due to both solar heat gain and night time sky heat loss and as follows:

.1 Structural Movement: Allow for thermal movement with no buckling of structural components, stress on glass, glazing edge seal failure, sealant failure, excess stress on point supported glass framing, anchors and fasteners, or reduction of performance in accordance with AAMA 505.

.2 Condensation Resistance: Not Required.

.5 Building Envelope Performance Criteria: Design glass and glazing systems to allow for the following:

.1 Air Infiltration: Not Required.

.2 Water Penetration Under Static Pressure: Not Required.

.3 Average Thermal Conductance: Not Required.

.4 Sound Transmission: Not Required.

2.2 METALLIC MATERIALS

.1 Point Supported Glass Fittings: Design point supported glass fittings to meet the spans and loading conditions indicated for this project; design to retain glass at limited points using face-mounted rotational fittings; fittings that allow local bending stresses at the glass hole locations will not be acceptable and as follows:

.1 Movement: Design fittings to allow a maximum of 12 degrees of rotation of the anchor perpendicular to the plane of glass to allow glass to transfer only translational and axial loads to supporting structure; rotation shall be provided with highly predictable behaviour using ball and socket technology; gasket type rotational devices will not be acceptable.

.2 Spider Arm Fittings: Design standard spider arm fittings to connect point supported glass fittings to structural steel components; formed from cast stainless steel.

.2 Stainless Steel Plate and Strip, and Rod and Bar Stock:

.1 Grade: 316 meeting or exceeding the requirements of ASTM A666 and ASTM A276.

.2 Mechanical Properties: Tempered to suit structural design requirements.

.3 Finish: Satin Bead Blast.

.3 Stainless Steel Castings:

.1 Grade: 316 meeting or exceeding the requirements of ASTM A781 and ASTM A957.

.2 Mechanical Properties: Tempered to suit structural design requirements.

.3 Finish: Satin Bead Blast.

.4 Reinforce castings as required to receive fastener threads.

.4 Stainless Steel Sheet:

.1 Grade: 316 meeting or exceeding the requirements of ASTM A167.

.2 Finish: Exposed fasteners finished to match castings.

.5 Stainless Steel Fasteners:

.1 Grade: 316 meeting or exceeding the requirements of ASTM A276.

.2 Mechanical Properties: Strain hardened or tempered to suit structural design requirements.

.3 Self-Locking Devices: Provide self-locking devices where fasteners are subject to loosening or turnout arising from thermal and structural movements, wind loads, or vibration.

.4 Driving Recess: Fillister head, surface mounted profile having twin-pin driving recess for exposed fastener locations; provide manufacturers standard driving recess and profile for unexposed locations.

.5 Finish: Exposed fasteners finished to match castings.

.6 Secondary Steel Connections: Provide steel shapes and components required for connection of point supported stainless steel components to structural steel; refer to Section 05 50 00.

.7 Brackets and Reinforcements: Manufacturer's standard high strength stainless steel type with non-staining, non-ferrous shims for aligning system components.

.8 Accessories: Provide manufacturer's standard corrosion resistant, non-staining, non-bleeding accessory components compatible with adjacent materials:

.1 Finish exposed portions to match framing system.

.2 Use slip joint linings, spacers, and sleeves at movement joints of material and type recommended by manufacturer.

.9 Anchors: Three way adjustable anchors that accommodate fabrication and installation tolerances in material and finish compatible with adjoining materials and recommended by manufacturer.

.10 Concealed Flashing: Manufacturer's standard corrosion resistant, non-staining, non-bleeding flashing compatible with adjacent materials.

2.3 GLASS MATERIALS

.1 Provide glass constructed in a monolithic configuration; minimum nominal thickness as required to meet delegated design requirements listed in this Section and in accordance with CGSB 12.20 using glass materials specified in Section 08 80 50.

2.4 FABRICATION

.1 Fabricate components that have the following characteristics when assembled:

.1 Sharp profiles, straight and free of defects or deformations.

.2 Accurately fitted joints with ends coped or mitred.

.3 Physical and thermal isolation of glazing from framing members.

.4 Accommodations for thermal and mechanical movements of glazing and framing to prevent glazing-to-glazing contact and to maintain required glazing edge clearances.

.5 Structural sealant joints that do not carry gravity loads of glazing.

.6 Provisions for site replacement of glazing from exterior; include accommodations for using temporary support devices to retain glazing in place while sealant cures.

.2 Weld fabricated glass support components in concealed locations to greatest extent possible to minimize distortion or discoloration of finish; remove weld spatter and welding oxides from exposed surfaces by de-scaling or grinding, polish welds in exposed locations to match adjacent finishes.

.3 Code each part for easy identification on site after fabrication, cross referenced to their locations in the Project and referenced to the Shop Drawings and to shipping lists.

.4 Size glass joint width to meet calculated movement and function.

.5 Fabricate detail components and flashings from stainless steel sheet for interfaces between point loaded point supported glass and adjacent construction.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: Verify anchorage and fastening locations before beginning of installation of products specified in this Section:

.1 Installation of glass point supported glass assemblies will denote acceptance of site conditions.

3.2 PREPARATION

.1 Inserts and Anchorages: Provide inserts and anchoring devices that require setting into concrete or attaching to structural steel, and that are required for installation of work of this Section sufficiently in advance to prevent delays.

3.3 INSTALLATION

.1 Erect structure and accessory items in strict accordance with the manufacturer’s written installation instructions and reviewed shop drawings, and as follows:

.1 Do not position glass panels by the use of force.

.2 Do not install damaged components.

.3 Fit joints to produce hairline joints free of burrs and distortion.

.4 Rigidly secure joints.

.5 Install anchors to prevent impeding movement of moving joints and connections.

.6 Seal joints watertight.

.2 Install components plumb and true in alignment with established lines and grades.

.3 Install glass and glazing in accordance with Section 08 80 50; prepare surfaces that will contact sealant in accordance with sealant manufacturer's written instructions to ensure compatibility and adhesion that includes, but is not limited to, cleaning and priming surfaces.

.4 Install weather seal sealant in accordance with sealant manufacturer's written instructions to produce weatherproof joints; install joint filler behind sealant as recommended by sealant manufacturer.

.5 Erection Tolerances: Install point supported glass assemblies to the following maximum tolerances:

.1 Plumb: 3 mm in 3000 mm with aggregate total not exceeding 6 mm in 12000 mm.

.2 Level: 3 mm in 6000 mm with aggregate total not exceeding 6 mm in 12000 mm.

.3 Alignment: Limit misalignment of two adjoining glass panes abutting in the same plane as follows:

.1 Limit offset from true alignment to 1.5 mm where surfaces meet in-line or are separated by reveal or protruding element up to 13 mm wide.

.2 Limit offset from true alignment to 3 mm where surfaces are separated by reveal or protruding element from 13 mm to 25 mm wide.

.3 Limit offset from true alignment to 6 mm where surfaces are separated by reveal or protruding element of 25 mm or wider.

.4 Joint Width: Maintain sealant space between glass and adjacent construction to an average of 16 mm, with a variation of no more than +3 mm and –6 mm.

.5 Location: Limit variation from plane to 3 mm in 300 mm with aggregate total not exceeding 13 mm over total length.

3.4 SITE QUALITY CONTROL

.1 Manufacturer’s Site Services: Provide manufacturer's site representative during installation; representative shall be knowledgeable of erection process for specified tension framing assemblies and provide the following services during construction:

.1 Observation of installation and quality control measures;

.2 Provide Model Schedule S-C signed by Delegated Design professional engineer responsible for the work of this Section indicating that work of this Section substantially meets requirements of the Building Code.

.3 Provide written report indicating observations, procedures, noted deficiencies, corrective measures, and certifying that installation meets requirements of this Section.

3.5 CLEANING AND PROTECTION

.1 Remove protective coatings and coverings from prefinished components; clean structural components and fittings; remove excess sealants and other substances that detract from finished appearance after completion of installation.

.2 Coordinate protective measures required to prevent damage or deterioration of point supported glass assemblies from subsequent construction activities.

END OF SECTION

Part 1 GENERAL

1.1 RELATED REQUIREMENTS

.1 Section 08 11 00 – Metal Doors And Frames

.2 Section 08 14 16 – Flush Wood Doors

.3 Section 08 44 13 – Glazed Aluminum Curtain Walls

1.2 REFERENCES

.1 American National Standards Institute (ANSI) / Builders Hardware Manufacturers Association (BHMA)

.1 ANSI/ICC A117.1-2009, Standard for Accessible and Usable Buildings and Facilities

.2 ANSI/BHMA A156.3-2014, Exit Devices.

.3 ANSI/BHMA A156.5-2014, Auxiliary Locks and Associated Products.

.4 ANSI/BHMA A156.6-2010, Architectural Door Trim.

.5 ANSI/BHMA A156.8-2010, Door Controls – Overhead Stops and Holders

.6 ANSI/BHMA A156.10-2011, Power Operated Pedestrian Doors.

.7 ANSI/BHMA A156.16-2016, Auxiliary Hardware.

.8 ANSI/BHMA A156.18-2012, Materials and Finishes.

.9 ANSI/BHMA A156.19-2013, Power Assist and Low Energy Power - Operated Doors.

.10 ANSI/BHMA A156.23-2010, Electromagnetic Locks

.11 ANSI/BHMA A156.25-2013, Electrified Locking Devices.

.12 ANSI/BHMA A156.26-2012, Continuous Hinges

.13 ANSI/BHMA A156.31-2013,Electric Strikes and Frame Mounted Actuators

.14 ANSI/BHMA-A156.115-2014, Hardware Preparation in Steel Doors or Steel Frames.

.2 Canadian Steel Door Manufacturers' Association (CSDMA)

.1 CSDMA Recommended Dimensional Standards for Commercial Steel Doors and Frames - 2009.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for door hardware and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Samples:

.1 Submit for review and acceptance of each unit.

.2 Samples will be returned for inclusion into work.

.3 Identify each sample by label indicating applicable specification paragraph number, brand name and number, finish and hardware package number.

.4 After approval samples will be returned for incorporation in Work.

.4 Hardware List:

.1 Submit contract hardware list.

.2 Indicate specified hardware, including make, model, material, function, size, finish and other pertinent information.

.5 Test Reports: certified test reports showing compliance with specified performance characteristics and physical properties.

.6 Manufacturer's Instructions: submit manufacturer's installation instructions.

.7 Keying Schedule: After a keying meeting, furnish a keying schedule listing the levels of keying and an explanation of the key system function, the key symbols used and the door numbers controlled as follows:

.1 Utilize “Door and Hardware Institute Key Systems and Nomenclature as a guideline for nomenclature, definitions, and approach for selecting the optimal keying system.

.2 Provide 3 copies of keying schedule for review prepared in and detailed in accordance with referenced DHI publication.

.3 Include schematic keying diagram, and index each key to unique door designations. Index keying schedule by door number, keyset, hardware heading number, cross-keying instructions, and special key stamping instructions.

.4 Provide one complete bitting list of key cuts and one key system schematic illustrating system usage and expansion. Forward bitting list, key cuts, and key system schematic directly to Departmental Representative.

.8 Wiring Diagrams: Coordinate with related Sections, meet with Departmental Representative and Security Subcontractor, and submit a description of the functional use (Mode of Operation) of electrical hardware products specified as follows:

.1 Include operation of ingress, egress fire alarm, and after hours use where applicable.

.2 Include door and frame elevations showing the location of each item of electrical hardware to be installed, mode of operation, including a diagram showing number and size of conductors.

.3 Indicate on elevation drawing items provided by related Sections, include for back boxes, and 120V power sources, provide point to point drawings showing terminal connections necessary for a complete installation.

1.4 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00.

.2 Operation and Maintenance Data: submit operation and maintenance data for door hardware for incorporation into manual.

1.5 QUALITY ASSURANCE

.1 Regulatory Requirements:

.1 Hardware for doors in fire separations and exit doors certified by a Canadian Certification Organization accredited by Standards Council of Canada.

.2 Certificates: product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

.3 Supplier Qualifications: Supplier to employ an Architectural Hardware Consultant (AHC) whose name will be listed on the hardware schedule title page submittal and will be responsible for scheduling, detailing, ordering, and coordination of the finishing hardware for this project.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 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 Package items of hardware including fastenings, separately or in like groups of hardware, label each package as to item definition and location.

.4 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 door hardware from nicks, scratches, and blemishes.

.3 Protect prefinished surfaces with wrapping strippable coating.

.4 Replace defective or damaged materials with new.

.5 Packaging Waste Management: remove for reuse of pallets, crates, padding and packaging materials as specified in Construction Waste Management Plan in accordance with Section 01 74 20.

Part 2 PRODUCTS

2.1 HARDWARE ITEMS

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

2.2 DOOR HARDWARE

.1 Locks and latches:

.1 Mortise locks and latches: to ANSI/BHMA A156.13, series 1000 mortise lock, grade 1, designed for function and keyed as stated in Hardware Schedule.

.2 Lever handles: plain design.

.3 Roses: round.

.4 Normal strikes: box type, lip projection not beyond jamb.

.5 High Security Cylinders: to ANSI/BHMA A156.30 2007

.6 Finished to C26D.

.2 Butts and hinges:

.1 Butts and hinges: to ANSI/BHMA A156.1, designated by numeral identifiers, followed by size and finish, listed in Hardware Schedule.

.3 Exit devices: to ANSI/BHMA A156.3, grade 1, conventional design, finished to C26D

.1 High Security Cylinders: to ANSI/BHMA A156.30 2007

.4 Door Closers and Accessories:

.1 Door controls (closers): to ANSI/BHMA A156.4, designated by numeral identifiers listed in Hardware Schedule, size in accordance with ANSI/BHMA A156.4, table A1, finished to 689.

.2 Door controls - overhead holders: to ANSI/BHMA A156.8, designated by numeral identifiers listed in Hardware Schedule, finished to 689.

.3 Closer/holder release devices: to ANSI/BHMA A156.15, designated by numeral identifiers listed in hardware schedule, finished to 689.

.5 Auxiliary locks and associated products: to ANSI/BHMA A156.5, designated by numeral identifiers as listed below:

.1 Dead bolt, type mortise, finished to 626 or 26D. Key into keying system as directed.

.2 Cylinders: type high security, finished to 626 or 26D, for installation in deadlocks provided with special doors as listed in Hardware Schedule. Key into keying system as directed.

.3 High Security Cylinders: to ANSI/BHMA A156.30 2007

.6 Automatic Swing Door Operators: Provide surface mounted electromechanical swing door operator, consisting of electromechanical swinging door operator and electronic control, aluminum header, connecting hardware, and power on/off switch, relay and wireless actuator switches, and as follows:

.1 Automatic entrance equipment: comply with ANSI A156.10 or A156.19.

.2 Aluminium header extrusions: minimum nominal 4 mm wall thickness with finish anodized AA-M12-C22-A31 clear.

.3 Equipment must operate between -35°C and +55°C in all climate conditions.

.4 Bearings: Fully lubricated and sealed to minimize wear and friction.

.5 Operator: Electromechanical system installed in a header to resist dust, dirt and corrosion; entire operator shall be removable from the header as a unit and as follows:

.6 Operator shall open the door with a 1/8 HP motor through reduction gears, door arm, and linkage assembly, and as follows:

.1 Low energy operator, door opening time: not be less than 4 seconds.

.2 The drive train shall have a positive, constant engagement. The operator shall stop the door in the open position by electrically reducing the motor voltage and stalling against a 90° stop.

.3 Close the door by spring energy; controlled by employing the motor as a dynamic brake.

.4 Door closing time shall not be less than 4.5 seconds.

.5 Pre-load closing spring for positive closing action at a low material stress level for long spring life

.7 Provide obstruction detection to reverse door when closing if an object stops the door and to stop door from opening if object is detected on swing side.

.8 The operator shall function as a manual door closer in the direction of swing with or without electrical power.

.7 Bollard Posts: Type 304 Stainless steel, 3 mm thick square tube, 150 mm x 150 mm, with welded stainless steel cap, with single gang prep located at 915 mm above finished floor, surface mounted and with square U-shaped aluminum bracket with access hole for wiring conduit, satin finish.

.8 Architectural door trim: to ANSI/BHMA A156.6, designated by numeral identifiers as listed below:

.1 Door protection plates: kick plate type B4E-bevelled edge, 1.27 mm thick stainless steel, size 200 mm high x door width less 76 mm, finished to 630.

.9 Auxiliary hardware: to ANSI/BHMA A156.16, designated by numeral identifiers as listed below:

.1 Door Stop: wall mounted: type dome, finished to 26D.

.10 Door bottom seal: heavy duty, door seal of extruded aluminum frame and solid closed cell neoprene seal, surface mounted with drip cap, closed ends, adjustable, automatic retract mechanism when door is open, clear anodized finish.

.11 Thresholds: full width of door opening, clear anodized finish, serrated surface.

.12 Weatherstripping:

.1 Head and jamb seal:

.1 Extruded aluminum frame and solid closed cell neoprene insert, clear anodized finish.

.2 Adhesive backed neoprene material.

.2 Door bottom seal:

.1 Extruded aluminum frame and nylon brush sweep, clear anodized finish.

.13 Astragal: overlapping, extruded aluminum frame with pile insert, finished to match doors.

2.3 FASTENINGS

.1 Use only fasteners provided by manufacturer. Failure to comply may void warranties and applicable licensed labels.

.2 Supply screws, bolts, expansion shields and other fastening devices required for satisfactory installation and operation of hardware.

.3 Exposed fastening devices 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.

.5 Use fasteners compatible with material through which they pass.

2.4 KEYING

.1 Meet with Departmental Representative to finalize keying requirements and obtain keying instructions.

.2 Provide temporary construction keying system during construction period. Permanent keys will be furnished to the Departmental Representative prior to occupancy.

.3 Permanent cylinders to be keyed by factory, combinated in sets or subsets, master keyed or great grandmaster keyed, as directed by Departmental Representative. Permanent keys, keyblanks, and cylinders shall be stamped with the applicable blind code for identification. These visual key control marks or codes will not include the actual key cuts. Stamp cylinders with concealed visual keying for added security. Permanent keys will also be stamped “Patented”. Keys and cylinder identification stamping to be approved by Departmental Representative.

.4 Equip locks and cylinders with patent protected, conventional cylinders with nickel silver blocking pin to check for patented features on keys. Provide a minimum of six pins with nickel silver bottom pins. Cylinders must allow for multiplex master keying, combinated to Departmental Representative’s instructions.

.5 Deliver permanent key blanks and other security keys direct to Departmental Representative from factory by secure courier, return receipt requested.

Part 3 EXECUTION

3.1 INSTALLATION

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

.2 Supply door, frame, and curtain wall manufacturers with complete instructions and templates for preparation of their work to receive hardware.

.3 Provide curtain wall manufacturer with hardware to be installed in curtain wall and aluminum entrances.

.4 Supply manufacturers' instructions for proper installation of each hardware component.

.5 Install hardware to standard hardware location dimensions in accordance with CSDMA Canadian Metric Guide for Steel Doors and Frames (Modular Construction).

.6 Where door stop contacts door pulls, mount stop to strike bottom of pull.

.7 Install key control cabinet.

.8 Use only manufacturer's supplied fasteners.

.1 Use of "quick" type fasteners, unless specifically supplied by manufacturer, is unacceptable.

.9 Install hardware at mounting heights as specified in the manufacturer’s templates or specific references in approved hardware schedule or approved elevation drawings.

.10 Install hardware using only manufacturer supplied and approved fasteners in strict adherence with manufacturers published installation instructions.

.11 Ensure locksets / latchsets / deadlocks are of the correct hand before installation to ensure that the cylinder is in the correct position.

.12 Ensure that exit devices are of the correct hand and adjust device cam/drive screw for proper outside trim function prior to installation. Handing is part of installation procedure.

.13 Adjust of door closers for spring power, closing speed, latching speed and back-check, valve screws to achieve backcheck (4040, 4040XP series) at the time of installation.

.14 Adjust delayed action door closers to forty (40) second delay for barrier free accessibility and movement of materials.

.15 Install head seal weatherstrip prior to installation of soffit mounted hardware. Trim, cut and notch thresholds and saddles neatly to minimally fit the profile of the door frame. Install thresholds and saddles in a bed of caulking completely sealing the underside from water and air penetration.

.16 Counter sink through bolt of door pull under push plate during installation.

.17 Install blocking material of sufficient type and size in cavities of metal and wood stud walls and partitions. Located concave and convex type door bumpers at the appropriate height to properly contact protruding door trim.

.18 Outlet back boxes, provisions for power, conduit complete with pull strings for security systems power and control boxes for integrating of security system with fire alarm system and coordination of complete system to be furnished under the Electrical Division for the project.

.19 At project completion, prior to turn over, jointly inspect each opening, make final adjustments to ensure a complete functional installation.

.20 Install card readers, controllers, master controllers, input panels, interface with EAC hardware and power supplies, low voltage wiring, wire terminations.

.21 Perform final hookup, testing, system setup, and training.

.22 Remove construction cores when directed by Departmental Representative.

.1 Install permanent cores and ensure locks operate correctly.

3.2 ADJUSTING

.1 Adjust door hardware, operators, closures and controls for optimum, smooth operating condition, safety and for weather tight closure.

.2 Lubricate hardware, operating equipment and other moving parts; adjust door hardware to ensure tight fit at contact points with frames.

3.3 FIELD QUALITY CONTROL

.1 Verify each door leaf opens closes and latches. Inspect fire rated openings to ensure they are installed in compliance with NFPA 80 requirements. Test access control system and electrified hardware devices for proper operation, Departmental Representative to sign off on verification of operation. Verify electric door release hardware operates properly upon activation of the fire alarm system.

.2 Perform bi-monthly on-site inspections during hardware installation and provide inspection reports listing progress of work, unacceptable work and corrective measures. Repair or replace as directed by the Departmental Representative.

.3 Before completion of the work but after the hardware has been installed, submit a certificate to the architect stating that final inspection has been made and that hardware has been checked for installation and operation by a technician from the manufacturer and hardware consultant.

3.4 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11.

.1 Leave Work area clean at end of each day.

.2 Clean hardware with damp rag and approved non-abrasive cleaner, and polish hardware in accordance with manufacturer's instructions.

.3 Remove protective material from hardware items where present.

.4 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11.

.2 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 20.

.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 door hardware installation.

3.6 SCHEDULE

Hardware Group No. 01

For use on mark/door #(s):
D003

Provide each PR door(s) with the following:

Qty		Description	Catalog Number	Finish	Mfr
6	EA	HINGE	3CB1 114 X 102 (A8112)	652	ANSI
1	SET	CONST LATCHING BOLT	FB52 (Type 27)	630	ANSI
1	EA	DUST PROOF STRIKE	DP2 (L14011)	626	ANSI
1	EA	STOREROOM LOCK	L9080L 03B (F07)	626	ANSI
1	EA	PRIMUS UL437-XP CYLINDER	20-587-XP EV29 T	626	SCH
1	EA	COORDINATOR	COR X FL (Type 21A)	628	ANSI
1	EA	OH STOP	100S (C01541)	630	ANSI
1	EA	SURFACE CLOSER	4040XP REG (C02011/C02041 PT-4A, PT-4C, PT-4D, PT-4H)	689	ANSI
1	EA	SURFACE CLOSER	4040XP REG ST-1630 (C02011/C02041 PT-4A, PT-4C, PT-4D, PT-4H)	689	ANSI
1	EA	TOP JAMB MTG PLATE	4040XP-18TJ	689	LCN
2	EA	KICK PLATE	CBH 903 200 X SIZE TO SUIT	630	CBH
1	EA	WALL STOP	WS401/402CVX (L12101)	626	ANSI
1	EA	SMOKE SEAL	188S-BK (1XW 2XH)	S-Bk	ZER
2	EA	MEETING STILE	328AA X DR HT	AA	ZER

Hardware Group No. 02

For use on mark/door #(s):
D004

Provide each SGL door(s) with the following:

Qty		Description	Catalog Number	Finish	Mfr
3	EA	HINGE	3CB1 127 X 114 (A8112)	652	ANSI
1	EA	STOREROOM LOCK	L9080L 03B (F07)	626	ANSI
1	EA	PRIMUS UL437-XP CYLINDER	20-587-XP EV29 T	626	SCH
1	EA	SURFACE CLOSER	4040XP REG (C02011/C02041 PT-4A, PT-4C, PT-4D, PT-4H)	689	ANSI
1	EA	KICK PLATE	CBH 903 200 X SIZE TO SUIT	630	CBH
1	EA	FLOOR STOP	FS439	682	IVE

Hardware Group No. 03

For use on mark/door #(s):
D100-1

Provide each SGL door(s) with the following:

Qty		Description	Catalog Number	Finish	Mfr
1	EA	CONT. HINGE	027XY EPT	628	IVE
1	EA	ELEC PANIC HARDWARE	RX-CD-98-EO-1439-CON 4' (Grade 1, Type 1, Function 01)	626	ANSI
1	EA	PRIMUS MORT. CYL.	20-500 114 XQ11-949- EV29 T (E09211A) cylinder dogging	626	ANSI
1	EA	OFFSET DOOR PULL	CBH 7008-1#6 MTG	630	CBH
1	EA	OH STOP	100S (C01541)	630	ANSI
1	EA	SURFACE CLOSER	4021 (C02041 PT-4A, PT-4C, PT-4D, PT-4F, PT-4H)	689	ANSI
1	EA	MOUNTING PLATE	4020-18G	689	LCN
1	EA		WEATHERSTRIP BY DOOR SUPPLIER		
1	EA	DOOR SWEEP	39A X DR WIDTH	A	ZER
1	EA	THRESHOLD	625A-V3-MSLA-10 X DR WIDTH	A	ZER
1	EA	DOOR CONTACT	679-05HM	BLK	SCE

Hardware Group No. 04 - Card Access/Door Operator

For use on mark/door #(s):
D100-2

Provide each SGL door(s) with the following:

Qty		Description	Catalog Number	Finish	Mfr
1	EA	CONT. HINGE	027XY EPT	628	IVE
1	EA	POWER TRANSFER	EPT10	689	VON
1	EA	ELEC PANIC HARDWARE	QEL-SD-98-NL-OP-110MD-1439-CON 4' (Grade 1, Type 1, Function 03)	626	ANSI
1	EA	PRIMUS MORT. CYL.	20-500 114 EV29 T (E09211A) keyswitch	626	ANSI
1	EA	PRIMUS MORT. CYL.	20-500 114 XQ11-949- EV29 T (E09211A) cylinder dogging	626	ANSI
1	EA	PRIMUS RIM CYLINDER	20-510-XP EV29 T (E09221A)	626	ANSI
1	EA	OFFSET DOOR PULL	CBH 7008-1#6 MTG	630	CBH
1	EA	OH STOP	100S ADJ (C01541)	630	ANSI
1	EA	SURF. AUTO OPERATOR	9542 MS (C0Unknown)	ANCLR	ANSI
2	EA	ACTUATOR, WALL MOUNT 6" DIA	8310-852	630	LCN
1	EA	ESCUTCHEON 6" DIA	8310-876	689	LCN
1	EA	BOLLARD	BY OTHERS		UNK
1	EA		WEATHERSTRIP BY DOOR SUPPLIER		
1	EA	DOOR SWEEP	39A X DR WIDTH	A	ZER
1	EA	THRESHOLD	625A-V3-MSLA-10 X DR WIDTH	A	ZER
1	EA	WIRE HARNESS	CON - ___ SIZE TO SUIT		VON
1	EA	WIRE HARNESS	CON-6W		VON
1	EA	CARD READER	BY SECURITY		UNK
1	EA	KEY SWITCH	653-14 L2 on/off/hold switch for operator	630	SCE
1	EA	DOOR CONTACT	679-05HM	BLK	SCE
1	EA	POWER SUPPLY	PS902 900-4RL	LGR	SCE

Hardware Group No. 05 - Card Access/Door Operator

For use on mark/door #(s):
D100-3

Provide each SGL door(s) with the following:

Qty		Description	Catalog Number	Finish	Mfr
1	EA	CONT. HINGE	027XY EPT	628	IVE
1	EA	POWER TRANSFER	EPT10	689	VON
1	EA	ELEC PANIC HARDWARE	RX-QEL-SD-98-NL-OP-110MD-1439-CON 4' (Grade 1, Type 1, Function 03)	626	ANSI
1	EA	PRIMUS MORT. CYL.	20-500 114 EV29 T (E09211A) keyswitch	626	ANSI
1	EA	PRIMUS MORT. CYL.	20-500 114 XQ11-949- EV29 T (E09211A) cylinder dogging	626	ANSI
1	EA	PRIMUS RIM CYLINDER	20-510-XP EV29 T (E09221A)	626	ANSI
1	EA	OFFSET DOOR PULL	CBH 7008-1#6 MTG	630	CBH
1	EA	OH STOP	100S ADJ (C01541)	630	ANSI
1	EA	SURF. AUTO OPERATOR	9542 MS (C0Unknown)	ANCLR	ANSI
2	EA	ACTUATOR, WALL MOUNT 6" DIA	8310-852	630	LCN
2	EA	ESCUTCHEON 6" DIA	8310-876	689	LCN
1	EA	WIRE HARNESS	CON - ___ SIZE TO SUIT		VON
1	EA	WIRE HARNESS	CON-6W		VON
1	EA	CARD READER	BY SECURITY		UNK
1	EA	KEY SWITCH	653-14 L2 on/off/hold switch for operator	630	SCE
1	EA	DOOR CONTACT	679-05HM	BLK	SCE
1	EA	POWER SUPPLY	PS902 900-4RL	LGR	SCE

Hardware Group No. 06

For use on mark/door #(s):
D100-4

Provide each SGL door(s) with the following:

Qty		Description	Catalog Number	Finish	Mfr
1	EA	CONT. HINGE	027XY EPT	628	IVE
1	EA	POWER TRANSFER	EPT10	689	VON
1	EA	ELEC PANIC HARDWARE	RX-CD-98-EO-1439-CON 4' (Grade 1, Type 1, Function 01)	626	ANSI
1	EA	PRIMUS MORT. CYL.	20-500 114 XQ11-949- EV29 T (E09211A) cylinder dogging	626	ANSI
1	EA	OFFSET DOOR PULL	CBH 7008-1#6 MTG	630	CBH
1	EA	OH STOP	100S (C01541)	630	ANSI
1	EA	SURFACE CLOSER	4021 (C02041 PT-4A, PT-4C, PT-4D, PT-4F, PT-4H)	689	ANSI
1	EA	MOUNTING PLATE	4020-18G	689	LCN
1	EA	DOOR CONTACT	679-05HM	BLK	SCE

Hardware Group No. 07

For use on mark/door #(s):
D101

Provide each SGL door(s) with the following:

Qty		Description	Catalog Number	Finish	Mfr
3	EA	HINGE	3CB1 127 X 114 (A8112)	652	ANSI
1	EA	OFFICE LOCK	L9056L 03B L583-363	626	SCH
1	EA	PRIMUS UL437-XP CYLINDER	20-587-XP EV29 T	626	SCH
1	EA	SURFACE CLOSER	1461 REG (C02011/C02041 PT-4A, PT-4C, PT-4D, PT-4F, PT-4H)	689	ANSI
1	EA	WALL STOP	WS401/402CVX (L12101)	626	ANSI
1	EA	SOUND SEAL	#485A (1XW 2XH)	A	ZER
1	EA	DOOR BOTTOM(SURFACE)	365AA6 X DR WIDTH	AA	ZER
1	EA	THRESHOLD	564A-MSLA-10 X DR WIDTH	A	ZER

Hardware Group No. 08

For use on mark/door #(s):
D102-1

Provide each SGL door(s) with the following:

Qty		Description	Catalog Number	Finish	Mfr
3	EA	HINGE	3CB1 127 X 114 NRP (A8112)	652	ANSI
1	EA	STOREROOM LOCK	L9080L 03B (F07)	626	ANSI
1	EA	PRIMUS UL437-XP CYLINDER	20-587-XP EV29 T	626	SCH
1	EA	SURFACE CLOSER	1461 HDPA (C02021 PT-4A, PT-4C, PT-4D, PT-4F, PT-4H) mount on push side template for 180 degree opening	689	ANSI
1	EA	WALL STOP	WS401/402CVX (L12101)	626	ANSI
1	EA	SOUND SEAL	870AA (1XW 2XH)	AA	ZER
1	EA	DOOR BOTTOM(SURFACE)	365AA6 X DR WIDTH	AA	ZER
1	EA	THRESHOLD	564A-MSLA-10 X DR WIDTH	A	ZER

Hardware Group No. 09 - Card Access

For use on mark/door #(s):
D102-2 D104 D170 D200-1 D201

Provide each SGL door(s) with the following:

Qty		Description	Catalog Number	Finish	Mfr
3	EA	HW HINGE	3CB1HW 127 X 114 NRP (A8111)	652	ANSI
1	EA	PANIC HARDWARE	LD-98-L-NL-03 4' (Grade 1, Type 1, Function 09)	626	ANSI
1	EA	PRIMUS RIM CYLINDER	20-510-XP EV29 T (E09221A)	626	ANSI
2	EA	MORTAR BOX	TA-6410	GRY	TAC
1	EA	ELECTRIC STRIKE	6111 FSE DS CON (E59311) Use DS switch for RX switch.	630	ANSI
1	EA	SURFACE CLOSER	4040XP EDA (C02021 PT-4A, PT-4C, PT-4D, PT-4H)	689	ANSI
1	EA	KICK PLATE	CBH 903 200 X SIZE TO SUIT	630	CBH
1	EA	WALL STOP	WS401/402CVX (L12101)	626	ANSI
1	EA	WIRE HARNESS	CON-6W		VON
1	EA	CARD READER	BY SECURITY		UNK
1	EA	DOOR CONTACT	679-05HM	BLK	SCE
1	EA	POWER SUPPLY	PS902	LGR	SCE

Hardware Group No. 10 - Door Operator

For use on mark/door #(s):
D103 D157

Provide each SGL door(s) with the following:

Qty		Description	Catalog Number	Finish	Mfr
3	EA	HINGE	3CB1 127 X 114 (A8112)	652	ANSI
1	EA	STOREROOM LOCK	L9080L 03B XL11-422 (F07)	626	ANSI
1	EA	INTERFACE BOX	JB7	GRAY	VON
1	EA	PRIMUS UL437-XP CYLINDER	20-587-XP EV29 T	626	SCH
2	EA	MORTAR BOX	TA-6410	GRY	TAC
1	EA	ELECTRIC STRIKE	6211 FS CON (E59321)	630	ANSI
1	EA	SURF. AUTO OPERATOR	9542 MS (C0Unknown)	ANCLR	ANSI
1	EA	ROCKER SWITCH	8310-806R on/off/hold switch for operator	689	LCN
2	EA	ACTUATOR, WALL MOUNT 6" DIA	8310-852	630	LCN
2	EA	ESCUTCHEON 6" DIA	8310-876	689	LCN
1	EA	MOUNTING PLATE	9540-18 To be used with door operator	689	LCN
1	EA	KICK PLATE	CBH 903 200 X SIZE TO SUIT	630	CBH
1	EA	WALL STOP	WS401/402CVX (L12101)	626	ANSI
1	EA	WIRE HARNESS	CON-6W		VON
1	EA	PUSH TO LOCK BUTTON	CM-400/8FE Bilingual Signage	630	CAM
1	EA	DOOR CONTACT	679-05HM	BLK	SCE
1	EA	LED ANNUNCIATOR	CM-AF500 Bilingual Signage		CAM
1	EA	ADVANCED LOGIC RELAY	CX-33		CAM
1	EA	EMERG CALL KIT UNIV RESTRMS	CX-WEC10FE Bilingual Signage		CAM

Hardware Group No. 11

For use on mark/door #(s):

D105	D106	D112	D117	D118	D120
D121-1	D121-2	D126	D127	D130	D206
D207	D209-1	D209-2	D212	D215	D220
D221	D223				

Provide each SGL door(s) with the following:

Qty		Description	Catalog Number	Finish	Mfr
3	EA	HINGE	3CB1 127 X 114 (A8112)	652	ANSI
1	EA	OFFICE LOCK	L9056L 03B L583-363	626	SCH
1	EA	PRIMUS UL437-XP CYLINDER	20-587-XP EV29 T	626	SCH
1	EA	SURFACE CLOSER	1461 REG (C02011/C02041 PT-4A, PT-4C, PT-4D, PT-4F, PT-4H)	689	ANSI
1	EA	KICK PLATE	CBH 903 200 X SIZE TO SUIT	630	CBH
1	EA	WALL STOP	WS406/407CVX (L52101)	630	ANSI
1	EA	SOUND SEAL	#485A (1XW 2XH)	A	ZER
1	EA	DOOR BOTTOM(MORTISE)	364AA	AA	ZER

Hardware Group No. 12 - Card Access

For use on mark/door #(s):

D111-1	D111-2	D113-1	D113-2	D113A	D115A
D203-1	D203-2	D205			

Provide each SGL door(s) with the following:

Qty		Description	Catalog Number	Finish	Mfr
3	EA	HINGE	3CB1 127 X 114 (A8112)	652	ANSI
1	EA	STOREROOM LOCK	L9080L 03B XL11-422 (F07)	626	ANSI
1	EA	PRIMUS UL437-XP CYLINDER	20-587-XP EV29 T	626	SCH
2	EA	MORTAR BOX	TA-6410	GRY	TAC
1	EA	ELECTRIC STRIKE	6211 FSE DS CON (E59321) Use DS switch for RX switch.	630	ANSI
1	EA	SURFACE CLOSER	4040XP REG (C02011/C02041 PT-4A, PT-4C, PT-4D, PT-4H)	689	ANSI
1	EA	KICK PLATE	CBH 903 200 X SIZE TO SUIT	630	CBH
1	EA	WALL STOP	WS401/402CVX (L12101)	626	ANSI
1	EA	SMOKE SEAL	188S-BK (1XW 2XH)	S-Bk	ZER
1	EA	WIRE HARNESS	CON-6W		VON
1	EA	CARD READER	BY SECURITY		UNK
1	EA	DOOR CONTACT	7764	628	SCE
1	EA	POWER SUPPLY	PS902	LGR	SCE

Hardware Group No. 13 - Card Access

For use on mark/door #(s):

D114	D122	D129	D152	D153	D154
D155	D156	D208	D214		

Provide each SGL door(s) with the following:

Qty		Description	Catalog Number	Finish	Mfr
3	EA	HINGE	3CB1 127 X 114 (A8112)	652	ANSI
1	EA	STOREROOM LOCK	L9080L 03B XL11-422 (F07)	626	ANSI
1	EA	PRIMUS UL437-XP CYLINDER	20-587-XP EV29 T	626	SCH
2	EA	MORTAR BOX	TA-6410	GRY	TAC
1	EA	ELECTRIC STRIKE	6211 FSE DS CON (E59321) Use DS switch for RX switch.	630	ANSI
1	EA	SURFACE CLOSER	4040XP REG (C02011/C02041 PT-4A, PT-4C, PT-4D, PT-4H)	689	ANSI
1	EA	KICK PLATE	CBH 903 200 X SIZE TO SUIT	630	CBH
1	EA	WALL STOP	WS401/402CVX (L12101)	626	ANSI
1	EA	WIRE HARNESS	CON-6W		VON
1	EA	CARD READER	BY SECURITY		UNK
1	EA	DOOR CONTACT	679-05HM	BLK	SCE
1	EA	POWER SUPPLY	PS902	LGR	SCE

Hardware Group No. 14 - Door Operator

For use on mark/door #(s):

D123

Provide each SGL door(s) with the following:

Qty		Description	Catalog Number	Finish	Mfr
3	EA	HW HINGE	3CB1HW 127 X 114 (A8111)	652	ANSI
1	EA	DOOR PULL	CBH 7023-1 #1 MTG	630	CBH
1	EA	PUSH PLATE W/PICTO	CBH 923 125 X 500 X TAPE X P/M1 P/HC3	630	CBH
1	EA	SURF. AUTO OPERATOR	9542 MS (C0Unknown)	ANCLR	ANSI
1	EA	ROCKER SWITCH	8310-806R on/off/hold switch for operator	689	LCN
2	EA	ACTUATOR, WALL MOUNT 6" DIA	8310-852	630	LCN
2	EA	ESCUTCHEON 6" DIA	8310-876	689	LCN
1	EA	MOUNTING PLATE	9540-18 To be used with door operator	689	LCN
1	EA	KICK PLATE	CBH 903 200 X SIZE TO SUIT	630	CBH
1	EA	WALL STOP	WS401/402CVX (L12101)	626	ANSI

Hardware Group No. 15 - Door Operator

For use on mark/door #(s):
D125 D218

Provide each SGL door(s) with the following:

Qty		Description	Catalog Number	Finish	Mfr
3	EA	HW HINGE	3CB1HW 127 X 114 (A8111)	652	ANSI
1	EA	DOOR PULL	CBH 7023-1 #1 MTG	630	CBH
1	EA	PUSH PLATE W/PICTO	CBH 923 125 X 500 X TAPE X P/W2 P/HC3	630	CBH
1	EA	SURF. AUTO OPERATOR	9542 MS (C0Unknown)	ANCLR	ANSI
1	EA	ROCKER SWITCH	8310-806R on/off/hold switch for operator	689	LCN
2	EA	ACTUATOR, WALL MOUNT 6" DIA	8310-852	630	LCN
2	EA	ESCUTCHEON 6" DIA	8310-876	689	LCN
1	EA	MOUNTING PLATE	9540-18 To be used with door operator	689	LCN
1	EA	KICK PLATE	CBH 903 200 X SIZE TO SUIT	630	CBH
1	EA	WALL STOP	WS401/402CVX (L12101)	626	ANSI

Hardware Group No. 16

For use on mark/door #(s):
D124 D217

Provide each SGL door(s) with the following:

Qty		Description	Catalog Number	Finish	Mfr
3	EA	HINGE	3CB1 127 X 114 (A8112)	652	ANSI
1	EA	STOREROOM LOCK	L9080L 03B (F07)	626	ANSI
1	EA	PRIMUS UL437-XP CYLINDER	20-587-XP EV29 T	626	SCH
1	EA	SURFACE CLOSER	4041 DEL REG (C02Unknown1 PT-4A, PT-4C, PT-4D, PT-4H)	689	ANSI
1	EA	KICK PLATE	CBH 903 200 X SIZE TO SUIT	630	CBH
1	EA	WALL STOP	WS401/402CVX (L12101)	626	ANSI

Hardware Group No. 17 - Card Access/Door Operator

For use on mark/door #(s):
D150-1

Provide each SGL door(s) with the following:

Qty		Description	Catalog Number	Finish	Mfr
1	EA	CONT. HINGE	027XY EPT	628	IVE
1	EA	POWER TRANSFER	EPT10	689	VON
1	EA	ELEC PANIC HARDWARE	RX-QEL-SD-98-NL-OP-110MD-1439-CON 4' (Grade 1, Type 1, Function 03)	626	ANSI
1	EA	PRIMUS MORT. CYL.	20-500 114 EV29 T (E09211A) keyswitch	626	ANSI
1	EA	PRIMUS MORT. CYL.	20-500 114 XQ11-949- EV29 T (E09211A) cylinder dogging	626	ANSI
1	EA	PRIMUS RIM CYLINDER	20-510-XP EV29 T (E09221A)	626	ANSI
1	EA	OFFSET DOOR PULL	CBH 7008-1#6 MTG	630	CBH
1	EA	OH STOP	100S ADJ (C01541)	630	ANSI
1	EA	SURF. AUTO OPERATOR	9542 MS (C0Unknown)	ANCLR	ANSI
2	EA	ACTUATOR, WALL MOUNT 6" DIA	8310-852	630	LCN
2	EA	ESCUTCHEON 6" DIA	8310-876	689	LCN
1	EA		WEATHERSTRIP BY DOOR SUPPLIER		
1	EA	DOOR SWEEP	39A X DR WIDTH	A	ZER
1	EA	THRESHOLD	625A-V3-MSLA-10 X DR WIDTH	A	ZER
1	EA	WIRE HARNESS	CON - ___ SIZE TO SUIT		VON
1	EA	WIRE HARNESS	CON-6W		VON
1	EA	CARD READER	BY SECURITY		UNK
1	EA	KEY SWITCH	653-14 L2 on/off/hold switch for operator	630	SCE
1	EA	DOOR CONTACT	679-05HM	BLK	SCE
1	EA	POWER SUPPLY	PS902 900-4RL	LGR	SCE

Hardware Group No. 18 - Card Access

For use on mark/door #(s):
D150-2

Provide each SGL door(s) with the following:

Qty		Description	Catalog Number	Finish	Mfr
3	EA	HW HINGE	3CB1HW 127 X 114 NRP (A8111)	652	ANSI
1	EA	STOREROOM LOCK	L9080L 03B XL11-422 (F07)	626	ANSI
1	EA	PRIMUS UL437-XP CYLINDER	20-587-XP EV29 T	626	SCH
2	EA	MORTAR BOX	TA-6410	GRY	TAC
1	EA	ELECTRIC STRIKE	6211 FSE DS CON (E59321) Use DS switch for RX switch.	630	ANSI
1	EA	SURFACE CLOSER	4040XP EDA (C02021 PT-4A, PT-4C, PT-4D, PT-4H)	689	ANSI
1	EA	KICK PLATE	CBH 903 150 X SIZE TO SUIT	630	CBH
1	EA	WALL STOP	WS401/402CVX (L12101)	626	ANSI
1	EA	WIRE HARNESS	CON-6W		VON
1	EA	CARD READER	BY SECURITY		UNK
1	EA	DOOR CONTACT	679-05HM	BLK	SCE
1	EA	POWER SUPPLY	PS902	LGR	SCE

Hardware Group No. 19

For use on mark/door #(s):
D150A

Provide each SGL door(s) with the following:

Qty		Description	Catalog Number	Finish	Mfr
3	EA	HINGE	3CB1 127 X 114 (A8112)	652	ANSI
1	EA	OFFICE LOCK	L9056L 03B L583-363	626	SCH
1	EA	PRIMUS UL437-XP CYLINDER	20-587-XP EV29 T	626	SCH
1	EA	SURFACE CLOSER	1461 REG (C02011/C02041 PT-4A, PT-4C, PT-4D, PT-4F, PT-4H)	689	ANSI
1	EA	KICK PLATE	CBH 903 200 X SIZE TO SUIT	630	CBH
1	EA	WALL STOP	WS406/407CVX (L52101)	630	ANSI

Hardware Group No. 20 - Card Access

For use on mark/door #(s):
D156A

Provide each SGL door(s) with the following:

Qty		Description	Catalog Number	Finish	Mfr
3	EA	HINGE	3CB1 127 X 114 (A8112)	652	ANSI
1	EA	STOREROOM LOCK	L9080L 03B XL11-422 (F07)	626	ANSI
1	EA	PRIMUS UL437-XP CYLINDER	20-587-XP EV29 T	626	SCH
1	EA	MORTAR BOX	TA-6410	GRY	TAC
1	EA	ELECTRIC STRIKE	6211 FSE DS CON (E59321) Use DS switch for RX switch.	630	ANSI
1	EA	SURFACE CLOSER	4040XP SCUSH (C02021 PT-4A, PT-4C, PT-4D, PT-4G, PT-4H)	689	ANSI
1	EA	KICK PLATE	CBH 903 200 X SIZE TO SUIT	630	CBH
1	EA	WIRE HARNESS	CON-6W		VON
1	EA	CARD READER	BY SECURITY		UNK
1	EA	DOOR CONTACT	679-05HM	BLK	SCE
1	EA	MORTAR GUARD	TAC-LD1-DC	BLK	TAC
1	EA	POWER SUPPLY	PS902	LGR	SCE

Hardware Group No. 21

For use on mark/door #(s):
D157A

Provide each SGL door(s) with the following:

Qty		Description	Catalog Number	Finish	Mfr
3	EA	HINGE	3CB1 127 X 114 (A5112)	630	ANSI
1	EA	PRIVACY LOCK W/INDICATOR	L9456L 03B L583-363 L283-722 (F13)	626	ANSI
1	EA	PRIMUS UL437-XP CYLINDER	20-587-XP EV29 T	626	SCH
1	EA	KICK PLATE	CBH 903 200 X SIZE TO SUIT	630	CBH
1	EA	WALL STOP	WS406/407CVX (L52101)	630	ANSI

Hardware Group No. 22

For use on mark/door #(s):
D157C

Provide each SGL door(s) with the following:

Qty		Description	Catalog Number	Finish	Mfr
3	EA	HINGE	3CB1 127 X 114 (A8112)	652	ANSI
1	EA	PRIVACY LOCK W/INDICATOR	L9456L 03B L583-363 L283-722 (F13)	626	ANSI
1	EA	PRIMUS UL437-XP CYLINDER	20-587-XP EV29 T	626	SCH
1	EA	KICK PLATE	CBH 903 200 X SIZE TO SUIT	630	CBH
1	EA	WALL STOP	WS401/402CVX (L12101)	626	ANSI

Hardware Group No. 23 - Card Access

For use on mark/door #(s):
D161

Provide each SGL door(s) with the following:

Qty		Description	Catalog Number	Finish	Mfr
3	EA	HINGE	3CB1 127 X 114 (A8112)	652	ANSI
1	EA	STOREROOM LOCK	L9080L 03B XL11-422 (F07)	626	ANSI
1	EA	PRIMUS UL437-XP CYLINDER	20-587-XP EV29 T	626	SCH
2	EA	MORTAR BOX	TA-6410	GRY	TAC
1	EA	ELECTRIC STRIKE	6211 FSE DS CON (E59321) Use DS switch for RX switch.	630	ANSI
1	EA	SURFACE CLOSER	4040XP SCUSH (C02021 PT-4A, PT-4C, PT-4D, PT-4G, PT-4H)	689	ANSI
1	EA	KICK PLATE	CBH 903 200 X SIZE TO SUIT	630	CBH
1	EA	WIRE HARNESS	CON-6W		VON
1	EA	CARD READER	BY SECURITY		UNK
1	EA	DOOR CONTACT	679-05HM	BLK	SCE
1	EA	POWER SUPPLY	PS902	LGR	SCE

Hardware Group No. 24 - Card Access

For use on mark/door #(s):
DS-01-1 DS-01-3 DS-02-04 DS-02-2 DS-03-3

Provide each SGL door(s) with the following:

Qty		Description	Catalog Number	Finish	Mfr
3	EA	HW HINGE	3CB1HW 127 X 114 NRP (A8111)	652	ANSI
1	EA	POWER TRANSFER	EPT10	689	VON
1	EA	ELEC FIRE EXIT HARDWARE	RX-98-L-F-E996-03-FSE-CON 4' (Grade 1, Type 1, Function 08)	626	ANSI
1	EA	PRIMUS RIM CYLINDER	20-510-XP EV29 T (E09221A)	626	ANSI
2	EA	MORTAR BOX	TA-6410	GRY	TAC
1	EA	OH STOP	100S (C01541)	630	ANSI
1	EA	SURFACE CLOSER	4040XP EDA (C02021 PT-4A, PT-4C, PT-4D, PT-4H)	689	ANSI
1	EA	KICK PLATE	CBH 903 200 X SIZE TO SUIT	630	CBH
1	EA	SMOKE SEAL	188S-BK (1XW 2XH)	S-Bk	ZER
1	EA	WIRE HARNESS	CON-6W		VON
1	EA	CARD READER	BY SECURITY		UNK
1	EA	DOOR CONTACT	7764	628	SCE
1	EA	POWER SUPPLY	PS902	LGR	SCE

Hardware Group No. 25 - Card Access

For use on mark/door #(s):
DS-02-14

Provide each SGL door(s) with the following:

Qty		Description	Catalog Number	Finish	Mfr
1	EA	CONT. HINGE	027XY EPT	628	IVE
1	EA	POWER TRANSFER	EPT10	689	VON
1	EA	ELEC PANIC HARDWARE	RX-QEL-98-NL-OP-110MD-1439-CON 4' (Grade 1, Type 1, Function 03)	626	ANSI
1	EA	PRIMUS RIM CYLINDER	20-510-XP EV29 T (E09221A)	626	ANSI
1	EA	OFFSET DOOR PULL	CBH 7008-1#6 MTG	630	CBH
1	EA	OH STOP	100S (C01541)	630	ANSI
1	EA	SURFACE CLOSER	4021 (C02041 PT-4A, PT-4C, PT-4D, PT-4F, PT-4H)	689	ANSI
1	EA	MOUNTING PLATE	4020-18G	689	LCN
1	EA		WEATHERSTRIP BY DOOR SUPPLIER		
1	EA	DOOR SWEEP	39A X DR WIDTH	A	ZER
1	EA	THRESHOLD	625A-V3-MSLA-10 X DR WIDTH	A	ZER
1	EA	WIRE HARNESS	CON-6W		VON
1	EA	CARD READER	BY SECURITY		UNK
1	EA	DOOR CONTACT	679-05HM	BLK	SCE
1	EA	POWER SUPPLY	PS902	LGR	SCE

Hardware Group No. 26 - Card Access

For use on mark/door #(s):
DS-02-3 DS-03-2 DS-04-2 DS-04-3

Provide each SGL door(s) with the following:

Qty		Description	Catalog Number	Finish	Mfr
3	EA	HW HINGE	3CB1HW 127 X 114 NRP (A8111)	652	ANSI
1	EA	POWER TRANSFER	EPT10	689	VON
1	EA	ELEC FIRE EXIT HARDWARE	RX-98-L-F-E996-03-FSE-CON 4' (Grade 1, Type 1, Function 08)	626	ANSI
1	EA	PRIMUS RIM CYLINDER	20-510-XP EV29 T (E09221A)	626	ANSI
2	EA	MORTAR BOX	TA-6410	GRY	TAC
1	EA	SURFACE CLOSER	4040XP REG (C02011/C02041 PT-4A, PT-4C, PT-4D, PT-4H)	689	ANSI
1	EA	KICK PLATE	CBH 903 200 X SIZE TO SUIT	630	CBH
1	EA	WALL STOP	WS401/402CVX (L12101)	626	ANSI
1	EA	SMOKE SEAL	188S-BK (1XW 2XH)	S-Bk	ZER
1	EA	WIRE HARNESS	CON-6W		VON
1	EA	CARD READER	BY SECURITY		UNK
1	EA	DOOR CONTACT	7764	628	SCE
1	EA	POWER SUPPLY	PS902	LGR	SCE

Hardware Group No. 27 - Card Access

For use on mark/door #(s):
DS-03-1

Provide each SGL door(s) with the following:

Qty		Description	Catalog Number	Finish	Mfr
1	EA	CONT. HINGE	027XY EPT	628	IVE
1	EA	POWER TRANSFER	EPT10	689	VON
1	EA	ELEC PANIC HARDWARE	RX-QEL-98-NL-OP-110MD-1439-CON 4' (Grade 1, Type 1, Function 03)	626	ANSI
1	EA	PRIMUS RIM CYLINDER	20-510-XP EV29 T (E09221A)	626	ANSI
1	EA	OFFSET DOOR PULL	CBH 7008-1#6 MTG	630	CBH
1	EA	SURFACE CLOSER	4021 (C02041 PT-4A, PT-4C, PT-4D, PT-4F, PT-4H)	689	ANSI
1	EA	MOUNTING PLATE	4020-18G	689	LCN
1	EA		WEATHERSTRIP BY DOOR SUPPLIER		
1	EA	WALL STOP	WS406/407CVX (L52101)	630	ANSI
1	EA	DOOR SWEEP	39A X DR WIDTH	A	ZER
1	EA	THRESHOLD	625A-V3-MSLA-10 X DR WIDTH	A	ZER
1	EA	WIRE HARNESS	CON-6W		VON
1	EA	CARD READER	BY SECURITY		UNK
1	EA	DOOR CONTACT	679-05HM	BLK	SCE
1	EA	POWER SUPPLY	PS902	LGR	SCE

Hardware Group No. 28

For use on mark/door #(s):
DS-04-1

Provide each SGL door(s) with the following:

Qty		Description	Catalog Number	Finish	Mfr
3	EA	HW HINGE	3CB1HW 127 X 114 NRP (A5111)	630	ANSI
1	EA	PANIC HARDWARE	LD-98-EO 4' (Grade 1, Type 1, Function 01)	626	ANSI
1	EA	MORTAR BOX	TA-6410	GRY	TAC
1	EA	OH STOP	100S (C01541)	630	ANSI
1	EA	SURFACE CLOSER	4040XP EDA (C02021 PT-4A, PT-4C, PT-4D, PT-4H)	689	ANSI
1	EA	KICK PLATE	CBH 903 200 X SIZE TO SUIT	630	CBH
1	EA	GASKETING	328AA (1XW 2XH) brackets for closer & exit device)	AA	ZER
1	EA	DOOR SWEEP	39A X DR WIDTH	A	ZER
1	EA	THRESHOLD	625A-V3-MSLA-10 X DR WIDTH	A	ZER
2	EA	MOUNTING BRACKET	328SPB		ZER
1	EA	DOOR CONTACT	679-05HM	BLK	SCE

Hardware Group No. 29 - Door Operator

For use on mark/door #(s):
D216

Provide each SGL door(s) with the following:

Qty		Description	Catalog Number	Finish	Mfr
3	EA	HW HINGE	3CB1HW 127 X 114 (A8111)	652	ANSI
1	EA	DOOR PULL	CBH 7023-1 #1 MTG	630	CBH
1	EA	PUSH PLATE W/PICTO	CBH 923 125 X 500 X TAPE X P/M1 P/HC3	630	CBH
1	EA	OH STOP	100S ADJ (C01541)	630	ANSI
1	EA	SURF. AUTO OPERATOR	9542 MS (C0Unknown)	ANCLR	ANSI
1	EA	ROCKER SWITCH	8310-806R on/off/hold switch for operator	689	LCN
2	EA	ACTUATOR, WALL MOUNT 6" DIA	8310-852	630	LCN
2	EA	ESCUTCHEON 6" DIA	8310-876	689	LCN
1	EA	MOUNTING PLATE	9540-18 To be used with door operator	689	LCN
1	EA	KICK PLATE	CBH 903 200 X SIZE TO SUIT	630	CBH

Hardware Group No. 30

For use on mark/door #(s):
D300

Provide each SGL door(s) with the following:

Qty		Description	Catalog Number	Finish	Mfr
3	EA	HW HINGE	3CB1HW 127 X 114 NRP (A5111)	630	ANSI
1	EA	INSTITUTION W/DB	L9482L 03B	626	SCH
2	EA	PRIMUS UL437-XP CYLINDER	20-587-XP EV29 T	626	SCH
1	EA	MORTAR BOX	TA-6410	GRY	TAC
1	EA	SURFACE CLOSER	4040XP SHCUSH (C02061 PT-4A, PT-4C, PT-4D, PT-4G, PT-4H)	689	ANSI
1	EA	KICK PLATE	CBH 903 200 X SIZE TO SUIT	630	CBH
1	EA	GASKETING	328AA (1XW 2XH) brackets for closer & exit device	AA	ZER
1	EA	DOOR SWEEP	39A X DR WIDTH	A	ZER
1	EA	THRESHOLD	625A-V3-MSLA-10 X DR WIDTH	A	ZER
2	EA	MOUNTING BRACKET	328SPB		ZER
1	EA	DOOR CONTACT	679-05HM	BLK	SCE

Miscellaneous Items

Qty		Description	Catalog Number	Finish	Mfr	Handing
5	EA	RIM CYLINDER	20-021 EV C145 (E09221)Construction Cylinder Key Alike	626	SCH	
30	EA	MORTISE CYLINDER	30-001 EV C145 118 (E09211)Construction Cylinder Key Alike		SCH	
6	EA	PRIMUS-XP MASTER KEY	49-199-XP EV29 T	468	SCH	

END OF SECTION

Part 1 GENERAL

1.1 RELATED REQUIREMENTS

.1 Section 05 73 13 – Glazed Structural Metal Railings

.2 Section 08 11 00 – Metal Doors and Frames

.3 Section 08 44 13 – Glazed Aluminum Curtain Walls

.4 Section 08 44 26 – Point Supported Glass Assemblies

1.2 REFERENCES

.1 ASTM International

.1 ASTM C542-05(2011), Standard Specification for Lock-Strip Gaskets.

.2 ASTM D790-10, Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.

.3 ASTM D1003-13, Standard Test Method for Haze and Luminous Transmittance of Plastics.

.4 ASTM D1929-13a, Standard Test Method for Determining Ignition Temperature of Plastics.

.5 ASTM E2190-10, Standard Specification for Insulating Glass Unit Performance and Evaluation

.6 ASTM D2240-05(2010), Standard Test Method for Rubber Property - Durometer Hardness.

.7 ASTM E84-14, Standard Test Method for Surface Burning Characteristics of Building Materials.

.8 ASTM E330/E330M-14, Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.

.9 ASTM F1233-08(2013), Standard Test Method for Security Glazing Materials and Systems.

.2 Canada Green Building Council (CaGBC)

.1 LEED Canada-NC 2009, LEED (Leadership in Energy and Environmental Design): Green Building Rating System Reference Package For New Construction and Major Renovations (including Addenda).

.3 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-12.1-M90, Tempered or Laminated Safety Glass.

.2 CAN/CGSB-12.3-M91, Flat, Clear Float Glass.

.3 CAN/CGSB-12.8-97, Insulating Glass Units.

.4 CAN/CGSB-12.8-97 (Amendment), Insulating Glass Units.

.5 CAN/CGSB-12.9-M91, Spandrel Glass.

.4 Environmental Choice Program (ECP)

.1 CCD-045-95(R2005), Sealants and Caulking Compounds.

.5 Glass Association of North American (GANA)

.1 GANA Glazing Manual 50th Anniversary Edition-2008.

.2 GANA Laminated Glazing Reference Manual - 2009.

.3 GANA Sealant Manual-2008.

.4 GANA Laminated Glazing Reference Manual (2009).

.5 GANA Guide to Architectural Glass (2010).

.6 GANA/PGC International Protective Glazing Manual (2010).

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

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

1.3 ADMINISTRATIVE REQUIREMENTS

.1 Arrange for site visit with Departmental Representative prior to start of Work to examine existing site conditions adjacent to demolition Work.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for glass, sealants, and glazing accessories 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.

.4 Samples:

.1 Submit for review and acceptance of each unit.

.2 Samples will be returned for inclusion into work.

.5 Certificates: submit product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

.6 Test Reports: certified test reports showing compliance with specified performance characteristics and physical properties.

.1 Submit testing of glass under provisions of Section 01 45 00.

.2 Submit shop inspection for glass.

.7 Sustainable Design Submittals:

.1 LEED Canada-NC Submittals: in accordance with Section 01 35 21.

.2 Construction Waste Management:

.1 Submit project Waste Management Plan highlighting recycling and salvage requirements.

.2 Submit calculations on end-of-project recycling rates, salvage rates, and landfill rates demonstrating that 75% of construction wastes were recycled or salvaged.

.3 Recycled Content:

.1 Submit listing of recycled content products used, including details of required percentages or recycled content materials and products, showing their costs and percentages of post-consumer and post-industrial content, and total cost of materials for project.

.4 Regional Materials: submit evidence that project incorporates required percentage 20% of regional materials and products, showing their cost, distance from project to furthest site of extraction or manufacture, and total cost of materials for project.

.5 Low-Emitting Materials:

.1 Submit listing of adhesives and sealants used in building, showing compliance with VOC and chemical component limits or restrictions requirements.

1.5 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00.

.2 Operation and Maintenance Data: submit operation and maintenance data for glazing for incorporation into manual.

1.6 QUALITY ASSURANCE

.1 Certificates: product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

1.7 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 and with manufacturer's written instructions.

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

.3 Storage and Handling Requirements:

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

.2 Store and protect glazing and frames from nicks, scratches, and blemishes.

.3 Protect prefinished aluminum surfaces with strippable coating.

.4 Replace defective or damaged materials with new.

.4 Develop Construction Waste Management Plan related to Work of this Section and in accordance with Section 01 35 21.

.5 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding and packaging materials as specified in Construction Waste Management Plan in accordance with Section 01 74 20.

1.8 AMBIENT CONDITIONS

.1 Ambient Requirements:

.1 Install glazing when ambient temperature is 10 degrees C minimum. Maintain ventilated environment for 24 hours after application.

.2 Maintain minimum ambient temperature before, during and 24 hours after installation of glazing compounds.

Part 2 PRODUCTS

2.1 MATERIALS

.1 Design Criteria:

.1 Ensure continuity of building enclosure vapour and air barrier using glass and glazing materials as follow:

.1 Utilize inner light of multiple light sealed units for continuity of air and vapour seal.

.2 Size glass to withstand wind loads, dead loads and positive and negative live loads to ASTM E330.

.3 Limit glass deflection to 1/200 with full recovery of glazing materials.

.2 Flat Glass:

.1 Float glass: to CAN/CGSB-12.3, glazing quality, minimum 6 mm thick.

.2 Safety glass: to CAN/CGSB-12.1, transparent, minimum 6 mm thick.

.1 Type 2-tempered

.2 Class B-float.

.3 Category 11.

.3 Laminated Glass Type 1 (Glass Balustrades): to UL 972, for indoor use, constructed of 2 layers of 6 mm transparent heat strengthened glass, with 1.5mm PVB interlayer, CPSC Category II, 12 mm nominal overall thickness.

.4 Laminated Glass Type 2 (IGUs): to UL 972, for indoor use, constructed of 2 layers of 3 mm transparent heat strengthened glass, with 1.5mm PVB interlayer, CPSC Category II, 6 mm nominal overall thickness.

.3 Laminated Glass Type 3 (Glass Canopies): In accordance with CAN/CGSB 12.1 as follows:

.1 Glass: Clear

.2 Type: 1 – Laminated as follows:

.1 Translucent Film: Translucent film, 0.50 mm thickness providing appearance of uniformly acid etched glass, compatible with structural lamination film.

.2 Structural Film: Clear film, 0.75 mm thickness providing improved edge exposure stability.

.3 Class: B – Float Glass.

.4 Category: I – Heat Strengthened.

.5 Minimum Thickness of Laminating Film: Improved stiffness interlayer, designed specifically for structural glazing systems and as follows:

.1 Overhead Glazing Applications: 1.50 mm.

.2 Laminating Film Colour: Clear.

.6 Edges: Ground with no chips, cracks or flaws, with sharp corners and edges eased and polished.

.7 Exposed Edge Alignment: Grind and polish edges after assembly to minimize mismatch of exposed edges to a tolerance not exceeding +1.25 mm / –0.00 mm.

.8 Labelling: Label each light to show manufacturer's name or trademark, and type of glass in accordance with CAN/CGSB 12.1.

.9 Silvered mirror glass: 6 mm thick.

.1 Type 1B-float glass for high humidity use.

.10 Low emissivity (Low E) glass, 6 mm thick.

.1 Glass Quality: Float glass, glazing quality, heat strengthened or tempered as required to prevent glass breakage arising from thermal shock.

.2 Tint: Clear glass, having the following similar nominal monolithic properties:

.1 USI Factor: 3.22 W/m^2-K

.2 Emissivity: 0.035

.3 Shading Coefficient (SC): 0.52

.4 Solar Heat Gain Coefficient (SHGC): 0.45

.5 Visible Light Transmission (Tvis): 0.79

.6 Relative Heat Gain (RHG): 343 $W/^{m2}$

.11 Fire Rated Glass: Comprised of tempered ceramic, providing clear, distortion free viewing through pane and as follows:

.1 Thickness: As required by manufacturer to meet structural requirements for performance range specified

.2 Impact Safety Rating: Category I in accordance with ANSI Z97.1

.3 Fire Rating: as indicated in door and frame schedule on Drawings.

.4 Labelled: Permanent logo listing name of product, manufacturer, testing laboratory, fire rating period and safety requirements

.4 Insulating Glass Units (IGU):

.1 Insulating glass units: to CAN/CGSB-12.8, triple unit, 45 mm overall thickness.

.1 Unit Composition:

.1 Exterior Lite: Clear heat strengthened or tempered glass, having high performance Low E coating on #2 surface.

.2 Air Space: 13 mm Argon filled, with thermally enhanced non-metallic spacer.

.3 Middle Lite: Clear heat strengthened or tempered glass, having high performance Low E coating on #4 surface.

.4 Air Space: 13 mm Argon filled, with thermally enhanced non-metallic spacer.

.5 Interior Lite: Clear annealed, tempered or Type 3 Laminated glass, refer to Drawings for locations.

.2 Unit Properties:

.1 USI Factor: 0.68 W/m^2-K.

.2 Shading Coefficient (SC): 0.36.

.3 Solar Heat Gain Coefficient (SHGC): 0.31.

.4 Visible Light Transmission (Tvis): 0.56.

.5 Relative Heat Gain (RHG): 231 W/m^2.

.5 Sealant: in accordance with Section 07 92 00.

.1 VOC limit 250 g/L maximum to SCAQMD Rule 1168.

.1 VOC limit: 5% maximum by weight to CCD-045.

.2 Ensure sealant does not contain chemical restrictions to CCD-045.

2.2 ACCESSORIES

.1 Setting blocks: silicone, 90 Shore A durometer hardness to ASTM D2240, to suit glazing method, glass light weight and area.

.2 Enhanced insulating edge spacer, thermoset foam spacer incorporating primary seal, desiccant, and secondary seal, maximum thermal conductivity of 0.141 W/m°K, with no fogging and I.G. durability in accordance ASTM E2190.

.3 Spacer shims: silicone, 50-60 Shore A durometer hardness to ASTM D2240, 75 mm long x one half height of glazing stop x thickness to suit application. Self adhesive on one face.

.4 Glazing tape:

.1 Preformed butyl compound with integral resilient tube spacing device, 10-15 Shore A durometer hardness to ASTM D2240; coiled on release paper; black colour.

.2 Closed cell polyvinyl chloride foam, coiled on release paper over adhesive on two sides, maximum water absorption by volume 2%, designed for compression of 25%, to effect an air and vapour seal.

.5 Glazing splines: resilient silicone, extruded shape to suit glazing channel retaining slot, colour as selected.

.6 Lock-strip gaskets: to ASTM C542.

.7 Mirror attachment accessories: Mirror adhesive, chemically compatible with mirror coating and wall substrate.

.8 Privacy Film (GF): Single layer polyester, translucent, mat frosted pattern film with pressure sensitive ultraviolet resistant adhesive and scratch resistant coating and as follows:

.1 Visible Light Transmission: 34%

.2 Visible Light Reflectance: 31%

.3 Thickness: 0.07 mm

.4 Opacity: Translucent

.5 Film Colour: White

2.3 FABRICATION

.1 Cut all glass to field measurement with proper clearances. Cut to produce clean, straight edges with no chips, cracks or flaws.

.2 Make any cut outs, openings to approved drawings. Grind exposed edges smooth round off corners.

2.4 FABRICATION: FIRE RATED GLASS

.1 Fabricate glass and other glazing products in sizes required to glaze openings indicated for project, with edge and face clearances, edge and surface conditions, and bite complying with recommendations of product manufacturer and referenced glazing standards as required to comply with system performance requirements.

Part 3 EXECUTION

3.1 EXAMINATION

.1 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts are acceptable for glazing installation in accordance with manufacturer's written instructions.

.1 Verify that openings for glazing are correctly sized and within tolerance.

.2 Verify that surfaces of glazing channels or recesses are clean, free of obstructions, and ready to receive glazing.

.3 Visually inspect substrate in presence of Departmental Representative.

.4 Inform Departmental Representative of unacceptable conditions immediately upon discovery.

.5 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 PREPARATION

.1 Clean contact surfaces with solvent and wipe dry.

.2 Seal porous glazing channels or recesses with substrate compatible primer or sealer.

.3 Prime surfaces scheduled to receive sealant.

3.3 INSTALLATION: EXTERIOR - DRY METHOD (PREFORMED GLAZING)

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

.2 Perform work in accordance with GANA Glazing Manual for glazing installation methods.

.3 Cut glazing tape to length; install on glazing light. Seal corners by butting tape and sealing junctions with sealant in accordance with GANA Sealant Manual.

.4 Place setting blocks at ¼ points, with edge block maximum 150 mm from corners.

.5 Rest glazing on setting blocks and push against fixed stop with sufficient pressure to attain full contact.

.6 Install removable stops without displacing glazing tape. Exert pressure for full continuous contact.

.7 Trim protruding tape edge.

3.4 INSTALLATION: INTERIOR - DRY METHOD (TAPE AND TAPE)

.1 Perform work in accordance with GANA Glazing Manual for glazing installation methods.

.2 Cut glazing tape to length and set against permanent stops, projecting 1.6 mm above sight line.

.3 Place setting blocks at ¼ points, with edge block maximum 150 mm from corners.

.4 Rest glazing on setting blocks and push against tape for full contact at perimeter of light or unit.

.5 Place glazing tape on free perimeter of glazing in same manner described.

.6 Install removable stop without displacement of tape. Exert pressure on tape for full continuous contact.

.7 Knife trim protruding tape.

3.5 INSTALLATION: MIRRORS

.1 Set mirrors with adhesive, applied in accordance with adhesive manufacturer's instructions.

.2 Set mirrors with clips. Anchor rigidly to wall construction.

.3 Set in frame.

.4 Place plumb and level.

3.6 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11.

.1 Leave Work area clean at end of each day.

.1 Remove traces of primer, caulking.

.2 Remove glazing materials from finish surfaces.

.3 Remove labels.

.4 Clean glass and mirrors using approved non-abrasive cleaner in accordance with manufacturer's instructions.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11.

.2 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 20.

.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.7 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 After installation, mark each light with an "X" by using removable plastic tape or paste.

.1 Do not mark heat absorbing or reflective glass units.

.3 Repair damage to adjacent materials caused by glazing installation.

END OF SECTION

Part 1 GENERAL

1.1 RELATED SECTIONS

.1 Section 08 80 50 - Glazing.

1.2 REFERENCES

.1 American National Standards Institute (ANSI)

.1 ANSI Z97.1-2015, Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test.

.2 American Society for Testing and Materials (ASTM)

.1 ASTM D882-12, Standard Test Method for Tensile Properties of Thin Plastic Sheeting.

.2 ASTM D1004-13, Standard Test Method for Tear Resistance (Graves Tear) of Plastic Film and Sheeting.

.3 ASTM D1044-13, Standard Test Method for Resistance of Transparent Plastics to Surface Abrasion.

.4 ASTM D2582-16, Standard Test Method for Puncture-Propagation Tear Resistance of Plastic Film and Thin Sheeting.

.5 ASTM F1642-12, Standard Test Method for Glazing and Glazing Systems Subject to Air Blast Loadings.

.3 Government of Canada

.1 Canada Labour Code, WHMIS data sheets.

1.3 DEFINITIONS

.1 For the purposes of this specification applying definitions follow:

.1 Safety: Reduction of risk of injury, loss or death due to accidental, natural or unintentional causes.

.2 Security: Reduction of risk of injury, loss or death due to intentional actions of others.

.2 Security and safety film types:

.1 Type 1: Areas of concern related to common residential or light commercial accidents.

.2 Type 2: Areas of concern related to seismographic upgrade, low end smash and grab break and entry and over pressure due to violent weather or low bomb blast.

.3 Type 3: Areas of concern related to bomb blast and small arms projectiles.

1.4 SAMPLES

.1 Submit samples in accordance with Section 01 33 00.

.2 Submit one 500 x 500 mm sample of film installed on 7 mm thick clear plate glass.

1.5 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Section 01 33 00.

1.6 TEST REPORTS

.1 Submit test reports from approved independent testing laboratories, certifying compliance with specifications, for film applied to glass.

1.7 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with section 01 61 00.

.2 Provide and maintain dry, off-ground weatherproof storage.

.3 Store rolls of security film flat on cross supports. Do not stand rolls of film on end.

.4 Remove only in quantities required for same day use.

.5 Store materials in accordance with manufacturers written instructions.

1.8 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 74 20, and with Waste Reduction Workplan.

.2 Place materials defined as hazardous or toxic waste in designated containers.

.3 Ensure emptied containers are sealed and stored safely for disposal away from children.

1.9 ENVIRONMENTAL AND SAFETY 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 acceptable to Canada Labour Code.

1.10 WARRANTY

.1 Work of this Section 12 months warranty period prescribed in subsection GC3.13 of General Conditions is extended to 5 years.

.2 Ensure warranty includes items as follows:

.1 Maintain adhesion properties without blistering, bubbling or delaminating from glass.

.2 Maintain appearance without discolouration.

.3 Remove, replace and reapply defective materials.

.4 In event of product failure under warranty terms, remove and re-apply film without glass replacement at no cost to Departmental Representative.

1.11 MAINTENANCE DATA

.1 Provide operation and maintenance data for window film for incorporation into manual specified in Section 01 78 00.

Part 2 PRODUCTS

2.1 MATERIALS

.1 Security Film – General (SF): Optically opaque polyester film with factory applied adhesive, abrasion resistant coating and release liner.

- .1 Number of layers: 1
- .2 Total thickness of installed film: 0.35 mm.
- .3 Elongation: to ASTM D882.
- .4 Break strength: to ASTM D882.
- .5 Young's Modulus: to ASTM D882.
- .6 Tear resistance: to ASTM D1004.
- .7 Impact resistance: to ASTM F1642
- .8 Abrasion resistance: ASTM D1044.
- .9 Flammability: surface burn characteristics to ASTM E84.
- .10 Adhesive: high mass pressure sensitive, acrylic base, peel strength: 2.5 - 3.5 kg/25 mm width to ANSI Z97.1.
- .11 Tensile strength: minimum 172.25 MPa to ASTM D882.
- .12 Type 1 Security Film:
  - .1 Puncture resistance: 0.8 kg to ASTM D2582.
  - .2 Colour: Acrylic, abrasion resistant coating, colour to be selected by Departmental Representative from manufacturer’s full range.

2.2 FABRICATION

.1 Shop installation of security film to glass windows:

- .1 Remove window stops and window sealing device.
- .2 Ensure no deleterious material adheres to glass by blading surface of glass using industrial razors.
- .3 Ensure dust, grease, and chemical residue are removed from surface of glass before installation of film.
- .4 Examine glass under natural daylight and identify cracks, blisters, bubbles, discolouration, edge defects or other anomalies that may cause film to delaminate, or cause vision transparency or distortion problems. Report findings to Departmental Representative before starting Work.
- .5 Proceed with Work only after receipt of written approval from Departmental Representative.
- .6 Install security film to glass windows ensuring no blisters, bubbles, scratches or distortions.
- .7 Cut film edges straight and square.

.2 Shop installation of security film to glass panels:

- .1 Ensure dust, grease, and chemical residue are removed from surface of glass before installation of film.

.2 Examine glass under natural daylight and identify cracks, blisters, bubbles, discolouration, edge defects or other anomalies that may cause film to delaminate, or cause vision transparency or distortion problems. View glass from 2.0 m minimum. Report findings to Departmental Representative.

.3 Proceed with Work only after receipt of written approval from Departmental Representative.

.4 Install security film to glass panels ensuring no blisters, bubbles, scratches, edge defects or distortions.

.1 Cut film edges straight and square to within 3 mm of edge of panel.

.5 Deliver glass panels complete with security film installed to site in accordance with section 01 61 00.

Part 3 EXECUTION

3.1 INSPECTION

.1 Return to work place after 30 days but no longer than 40 days for final cleaning and inspection of installed film.

.2 Ensure finished surface of film is vision free of blisters, bubbles, tears, scratches, edge defects, delaminating or vision distortion when viewed under natural daylight from 2.0 m minimum.

.3 Remove and replace window unit that continues to show blisters, bubbles, tears, scratches, edge defects or vision distortion when viewed under natural daylight from 2.0m minimum after 30 day period.

.4 Remove and replace without glass replacement, film that continues to show blisters, bubbles, tears, scratches, edge defects or vision distortion when viewed under natural daylight from 2.0 m minimum after 30 day period.

3.2 FINAL CLEANING

.1 Wash interior and exterior of each glass panel and film using cleaning solution recommended by film manufacturer.

3.3 MAINTENANCE

.1 Follow manufacturers written instructions for care and maintenance of security film.

.2 Use only cleaning solution recommended by manufacturer for regularly scheduled cleaning of security film.

END OF SECTION

Part 1 GENERAL

1.1 RELATED REQUIREMENTS

.1 Section 07 92 00 - Joint Sealants

.2 Section 08 11 00 - Metal Door and Frames

.3 Section 09 91 23 - Interior Painting

1.2 REFERENCES

.1 ASTM International

.1 ASTM C473-12, Standard Test Methods for Physical Testing of Gypsum Panel Products.

.2 ASTM C475/C475M-15, Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board.

.3 ASTM C514-04(2014), Standard Specification for Nails for the Application of Gypsum Board.

.4 ASTM C645-09a, Standard Specification for Non-structural Steel Framing Members

.5 ASTM C754-11, Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products.

.6 ASTM C840-13, Standard Specification for Application and Finishing of Gypsum Board.

.7 ASTM C1002-14, 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.

.8 ASTM C1047-14a, Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base.

.9 ASTM C1178/C1178M-13, Standard Specification for Coated Glass Mat Water-Resistant Gypsum Backing Panel.

.10 ASTM C1396/C1396M-14a, Standard Specification for Gypsum Board.

.11 ASTM C1658/C1658M-13, Standard Specification for Glass Mat Gypsum Panels

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

.13 ASTM E2638-10 Standard Test Method for Objective Measurement of the Speech Privacy Provided by a Closed Room.

.14 ASTM F1267-15 Standard Specification for Metal, Expanded, Steel.

.2 Association of the Wall and Ceilings Industries International (AWCI)

.1 AWCI Levels of Gypsum Board Finish 101a-97.

.3 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-51.34-M86(R1988), Vapour Barrier, Polyethylene Sheet for Use in Building Construction.

.2 CAN/CGSB-71.25-M88, Adhesive, for Bonding Drywall to Wood Framing and Metal Studs.

.4 Canada Green Building Council (CaGBC)

.1 LEED Canada For New Construction and Major Renovations 2009.

.5 Underwriters' Laboratories of Canada (ULC)

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

.6 American National Standards Institute (ANSI)

.1 ANSI A118.9-1992, Test Methods and Specifications for Cementitious Backer Units.

.7 Canadian Standards Association (CSA)

.1 CSA S136-12, North American Specification for the Design of Cold-Formed Steel Structural Members and Commentary

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00.

.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 Sustainable Design Submittals:

.1 LEED Canada-NC Submittals: in accordance with Section 01 35 21.

.2 Construction Waste Management:

.1 Submit project Waste Management Plan highlighting recycling and salvage requirements.

.2 Submit calculations on end-of-project recycling rates, salvage rates, and landfill rates demonstrating that 95% of construction wastes were recycled or salvaged.

.3 Recycled Content:

.1 Submit listing of recycled content products used, including details of required percentages or recycled content materials and products, showing their costs and percentages of post-consumer and post-industrial content, and total cost of materials for project.

.4 Regional Materials: submit evidence that project incorporates required percentage 20% of regional materials and products, showing their cost, distance from project to furthest site of extraction or manufacture, and total cost of materials for project.

.5 Low-Emitting Materials:

.1 Submit listing of adhesives and sealants and paints and coatings used in building, showing compliance with VOC and chemical component limits or restriction requirements.

1.4 DESIGN REQUIREMENTS

.1 Partition assembly to be fire resistance rated.

.2 Minimum sound transmission rating of installed panel partition to be STC 30, tested to ASTM E90.

.3 Minimum speech privacy category SPC Standard Speech Privacy 60-65, tested to ASTM E2638.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 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 level off ground, indoors, 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. 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 Develop Construction Waste Management Plan related to Work of this Section and in accordance with Section 01 35 21.

1.6 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.

Part 2 PRODUCTS

2.1 MATERIALS

.1 Standard board: to ASTM C1396/C1396M, minimum 40% recycled content, regular, thickness as indicated on Drawings, 1200 mm wide x maximum practical length, ends square cut, edges bevelled.

.2 Paper faced mould resistant gypsum board facers: Paper faced, microbial treated, water resistant gypsum board meeting requirements of ASTM C1396; having water resistance 5% or less after a 2 hour immersion in accordance with ASTM C473 and mould resistant facers meeting a rating of 10 (zero mould growth) in accordance with ASTM D3273; Type X ULC fire rating; with long edges tapered; thickness as indicated on drawings.

.3 Glass mat faced mould resistant gypsum liner panels: Glass mat faced gypsum board meeting requirements of ASTM C1658/C1658M with mould resistant facers meeting a rating of 10 (zero mould growth) in accordance with ASTM D3273; Type X ULC fire rating; with long edges tapered; thickness as indicated on drawings.

.4 Non-load bearing channel stud framing: to ASTM C645, stud size as indicated on Drawings, roll formed from 0.53 mm thickness hot dipped galvanized steel sheet, for screw attachment of gypsum board. Knock-out service holes at 460 mm centres. Steel: minimum 25% recycled content.

.1 Use 0.91 mm thickness stud framing to support fire rated door frames.

.5 Structural channel stud framing: Meeting requirements of CSA S136; identified for type, grade and mechanical properties; minimum 92 mm deep x 38 mm wide x metal core nominal thickness 1.15 mm spaced at 406 mm on centre, hot dipped galvanized steel; roll formed with knurled flanges, services and bracing cut outs; Steel: minimum 25% recycled content

.1 Use 1.3 mm thickness stud framing to support security mesh.

.2 Track: Meeting requirements of CSA S136 having minimum metal core nominal thickness to match studs, hot dipped galvanized steel and as follows:

.1 Top track flanges of depth to suit vertical deflection; do not fix top of studs to track; width to suit studs; single top track system.

.3 Floor track to suit stud width, with 33 mm flanges.

.4 Channel Stiffener: 19 mm cold rolled channel of 1.15 mm, electro-galvanized steel.

.6 Shaft Wall Framing System: To ASTM C645 manufacturer’s standard shaft wall steel framing system having ASTM A653/A653M, Z180, hot-dip galvanized zinc coating; minimum steel thickness of 0.46 mm thick or heavier as required by detailed design requirements listed in this section for indicated spans; including head and bottom rails, channels, trim and accessories required for a complete installation.

.7 Floor and ceiling tracks: to ASTM C645, in widths to suit stud sizes, 32 mm flange height. Steel: minimum 25% recycled content.

.8 Slotted Deflection Track: Premanufactured slotted top runner with 63 mm down standing legs and having 6 mm wide x 38 mm high slots spaced at 25 mm on centre along length of runner; tested and certified for use in fire rated wall construction and have a ULC or $_{C}UL_{US}$ labelled assembly for fire rated assemblies.

.9 Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated; 1.2 mm nominal base metal thickness x 400 mm wide

.10 Metal channel stiffener: 19 x 38 mm size, 1.4 mm thick cold rolled steel, coated with rust inhibitive coating, minimum 25% recycled content.

.11 Metal furring runners, hangers, tie wires, inserts, anchors: to ASTM C645.

.12 Drywall furring channels: 0.5 mm core thickness galvanized steel channels for screw attachment of gypsum board.

.13 Resilient clips: 0.5 mm base steel thickness galvanized steel for resilient attachment of gypsum board.

.14 Rivets: 4.8 mm diameter, dome head style, steel body and mandrel pop rivets with positive mechanical locking system for securing studs to top and bottom tracks in secure demising walls.

.15 Security Mesh:

.1 Expanded carbon steel security screen mesh to ASTM F1267, Type II, Class 1, Grade A.

.2 Style: 25 mm - #10 flattened, 63 - 70% open area.

.3 Mesh size: Nominal 32 mm x 60 mm opening size.

.4 Opening size: Nominal 25 mm x 50 mm.

.5 Thickness: 3.2 mm overall.

.6 Security Mesh Fastening Assembly: Rivet and Fender Washer fastening as follows:

.1 Rivets: 4.8 mm diameter, dome head style, steel body and mandrel pop rivets with positive mechanical locking system.

.2 Washers: 38 mm, # 10 size, low carbon steel flat washer with zinc finish.

.16 Steel drill screws: to ASTM C1002.

.17 Laminating compound: as recommended by manufacturer, asbestos-free.

.18 Casing beads, corner beads, control joints and edge trim: to ASTM C1047, aluminum coated, 0.5 mm base thickness, perforated flanges, one piece length per location.

.19 Sealants: in accordance with Section 07 92 00.

.1 Acoustic sealant: in accordance with Section 07 92 00.

.20 Insulating strip: rubberized, moisture resistant, 3 mm thick closed cell neoprene strip, 12 mm wide, with self sticking permanent adhesive on one face, lengths as required.

.21 Joint Tape: To ASTM C475/C475M, Type as recommended by gypsum board manufacturer for type of installation; use only mould resistant materials for mould and moisture resistant materials.

.22 Joint Compound: To ASTM C475/C475M, bedding and finishing types recommended by gypsum board manufacturer; casein, vinyl or latex base.

.23 Acoustic Sound Batts for Non-Rated Assemblies: Meeting the requirements of ASTM C423, ASTM E90 and ASTM E413, and ULC S702 mineral fibre acoustic sound batts, Type 1 for all properties other than thermal, width to friction fit steel studs; un-faced, thickness to fill a minimum of 90% of the cavity thickness, nominal density 12.2 kg/m^3 minimum; STC 45 rating.

.24 Corner and Casing Beads: To ASTM C645, minimum 0.43 mm core thickness galvanized sheet steel to ASTM A653/A653M with Z275 zinc finish, type with perforated flanges, to be finished with joint compound.

.25 Access Panels: Refer to Section 08 31 00, rated to suit shaft wall fire rating.

Part 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 STEEL STUD FRAMING INSTALLATION

.1 Install steel framing members to receive screw-attached gypsum board in accordance with ASTM C754 except where specified otherwise.

.2 Align partition tracks at floor and ceiling and secure at 600 mm on centre maximum.

.3 Install damp proof course under stud shoe tracks of partitions on slabs on grade.

.4 Place studs vertically at centres indicated on Drawings and not more than 50 mm from abutting walls, and at each side of openings and corners. Position studs in tracks at floor and ceiling. Cross brace steel studs as required to provide rigid installation to manufacturer's instructions.

.5 Erect metal studding to tolerance of 1:1000.

.6 Attach studs to bottom and ceiling track using rivets.

.7 Co-ordinate simultaneous erection of studs with installation of service lines. When erecting studs ensure web openings are aligned.

.8 Co-ordinate erection of studs with installation of door/window frames and special supports or anchorage for work specified in other Sections.

.9 Provide two studs extending from floor to ceiling at each side of openings wider than stud centres specified. Secure studs together, 50 mm apart using column clips or other approved means of fastening placed alongside frame anchor clips.

.10 Erect track at head of door openings to accommodate intermediate studs. Secure track to studs at each end, in accordance with manufacturer's instructions. Install intermediate studs above openings in same manner and spacing as wall studs.

.11 Frame openings and around built-in equipment, access panels, on four sides. Extend framing into reveals. Check clearances with equipment suppliers.

.12 Install steel studs or furring channel between studs for attaching electrical and other boxes.

.13 Extend partitions to ceiling height except where noted otherwise on drawings.

.14 Maintain clearance under beams and structural slabs to avoid transmission of structural loads to studs. Use Slotted Deflection Track.

.15 Install continuous insulating strips to isolate studs from uninsulated surfaces.

.16 Install structural channel steel framing members to receive security mesh, sheet steel strapping and gypsum board in accordance with ASTM C754 except where specified otherwise.

3.3 FURRING INSTALLATION

.1 Erect hangers and runner channels for suspended gypsum board ceilings to ASTM C840 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 perimeter of openings for access panels, light fixtures, diffusers and grilles.

.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 C840, except where specified otherwise.

.7 Furr beams, columns, pipes and exposed services where indicated.

3.4 INSTALLATION OF SECURITY MESH

.1 Install security mesh continuously from floor to ceiling across the face of metal studs on outside (non-tenant side) of room.

.2 Support all edges by anti-spread bracing, studs, or corners.

.3 Align the sheet edges at every vertical and horizontal seam on the centre line of the steel stud.

.4 Fasten security mesh to face of metal studs using washers and pop rivets 200 mm O/C on vertical studs, horizontal plates, and tracks and around openings.

.5 Security mesh installation shall be approved by Departmental Representative prior to installation of gypsum board.

3.5 ACCESSORIES 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 around perimeter of suspended ceilings.

.3 Install casing beads where gypsum board butts against surfaces having no trim concealing junction and where indicated. Seal joints with sealant.

.4 Install insulating strips continuously at edges of gypsum board and casing beads abutting metal window and exterior door frames, to provide thermal break.

.5 Construct control joints of preformed units set in gypsum board facing and supported independently on both sides of joint.

.6 Provide continuous polyethylene dust barrier behind and across control joints.

.7 Locate control joints where indicated and at changes in substrate construction.

.8 Install control joints straight and true.

.9 Construct expansion joints as detailed, at building expansion and construction joints. Provide continuous dust barrier.

.10 Install expansion joint straight and true.

.11 Splice corners and intersections together and secure to each member with 3 screws.

.12 Install access doors to electrical and mechanical fixtures specified in respective sections.

.1 Rigidly secure frames to furring or framing systems.

3.6 GYPSUM BOARD INSTALLATION AND FINISHING

.1 Do installation and finishing of gypsum board to ASTM C840 except where specified otherwise.

.2 Apply gypsum board after bucks, anchors, blocking, electrical and mechanical work have been reviewed.

.3 Apply single or double layer gypsum board to metal furring or framing using screw fasteners for first layer, screw fasteners for second 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 C840.

.2 Apply gypsum board vertically unless indicated otherwise. If horizontal is required, provide sheet lengths that will minimize end joints.

.2 Double-Layer Application:

.1 Install gypsum board for base layer and exposed gypsum board for face layer.

.2 Apply base layer to ceilings prior to base layer application on walls; apply face layers in same sequence. Offset joints between layers at least 250 mm.

.3 Apply base layers at right angles to supports unless otherwise indicated.

.4 Apply base layer on walls and face layers vertically with joints of base layer over supports and face layer joints offset at least 250 mm with base layer joints.

.4 Install ceiling boards in direction that will minimize number of end-butt joints. Stagger end joints at least 250 mm.

.5 Install gypsum board on walls vertically to avoid end-butt joints. At stairwells and similar high walls, install boards horizontally with end joints staggered over studs, except where local codes or fire-rated assemblies require vertical application.

.6 Install gypsum board with face side out.

.7 Do not install damaged or damp boards.

.8 Locate edge or end joints over supports. Stagger vertical joints over different studs on opposite sides of wall.

.9 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 0: Not Used

.2 Level 1: Not Used

.3 Level 2: Not Used

.4 Level 3: Not Used

.5 Level 4: 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; surfaces smooth and free of tool marks and ridges.

.6 Level 5: Not Used

.10 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.

.11 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.

.12 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.

.13 Sand lightly to remove burred edges and other imperfections. Avoid sanding adjacent surface of board.

.14 Completed installation to be smooth, level or plumb, free from waves and other defects and ready for surface finish.

.15 Mix joint compound slightly thinner than for joint taping.

.16 Apply thin coat to entire surface using trowel or drywall broad knife to fill surface texture differences, variations or tool marks.

.17 Allow skim coat to dry completely.

.18 Remove ridges by light sanding or wiping with damp cloth.

3.7 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11.

.2 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 20.

.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.8 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

Part 1 GENERAL

1.1 REFERENCES

.1 American National Standards Institute (ANSI)/Ceramic Tile Institute (CTI)

.1 ANSI A108.1- 2013, Specification for the Installation of Ceramic Tile (Includes ANSI A108.1A-C, 108.4-.13, A118.1-.10, ANSI A136.1).

.2 CTI A118.3-2013, Specification for Chemical Resistant, Water Cleanable Tile Setting and Grouting Epoxy and Water Cleanable Tile Setting Epoxy Adhesive (included in ANSI A108.1).

.3 CTI A118.4-2013, Specification for Latex Cement Mortar (included in ANSI A108.1).

.4 CTI A118.5-2013, Specification for Chemical Resistant Furan Resin Mortars and Grouts for Tile Installation (included in ANSI A108.1).

.5 CTI A118.6-2013, Specification for Ceramic Tile Grouts (included in ANSI A108.1).

.2 American Society for Testing and Materials International (ASTM)

.1 ASTM C979/C979M-10, Standard Specification for Pigments for Integrally Coloured Concrete.

.3 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-75.1-M88, Tile, Ceramic.

.4 Canadian Standards Association (CSA International)

.1 CSA A123.3-05(R2010), Asphalt Saturated Organic Roofing Felt.

.2 CSA A3000-13, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).

.5 Terrazzo, Tile and Marble Association of Canada (TTMAC):

.1 Tile Specification Guide 09 30 00 2012/2013, Tile Installation Manual.

.2 Tile Maintenance Guide 2000.

1.2 SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00.

.2 Provide product data in accordance with Section 01 33 00.

.1 Include manufacturer's information on:

.1 Ceramic tile, marked to show each type, size, and shape required.

.2 Chemical resistant mortar and grout (Epoxy).

.3 Divider strip.

.4 Elastomeric membrane and bond coat.

.5 Reinforcing tape.

.6 Levelling compound.

.3 Provide samples in accordance with Section 01 33 00.

.1 Base tile: submit duplicate, 300 x 300 mm sample panels of each colour, texture, size, and pattern of tile.

.2 Floor tile: submit duplicate, 300 x 300 mm sample panels of each colour, texture, size, and pattern of tile.

.3 Trim shapes, bullnose cap and cove including bullnose cap and base pieces at internal and external corners of vertical surfaces, each type, colour, and size.

.4 Adhere tile samples to 11 mm thick plywood and grout joints to represent project installation.

1.3 QUALITY ASSURANCE

.1 Quality Assurance Submittals:

.1 Manufacturer's Instructions: manufacturer's installation instructions.

.2 Manufacturer's Field Reports: manufacturer's field reports specified.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Packing, shipping, handling and unloading:

.1 Deliver, store and handle materials in accordance with Section 01 61 00.

.2 Waste Management and Disposal:

.1 Separate waste materials for reuse and recycling in accordance with Section 01 74 20.

1.5 AMBIENT CONDITIONS

.1 Maintain air temperature and structural base temperature at ceramic tile installation area above 12 degrees C for 48 hours before, during, and 48 hours after, installation.

.2 Do not install tiles at temperatures less than 12 degrees C or above 38 degrees C.

.3 Do not apply epoxy mortar and grouts at temperatures below 15 degrees C or above 25 degrees C.

1.6 MAINTENANCE

.1 Extra Materials:

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

.2 Provide minimum 2% of each type and colour of tile required for project for maintenance use. Store where directed.

.3 Maintenance material same production run as installed material.

Part 2 PRODUCTS

2.1 FLOOR TILE

.1 Porcelain tile (FF3): to CAN/CGSB-75.1, Type 4, Class MR 2, CR 1, 10 x 300 x 300 mm size, cushion edges, porcelain with abrasive admixture and slip resistant surface, matte glazed surface, colour as selected by Departmental Representative. Matching coved base, 300 x 100 mm high.

2.2 WALL TILE

.1 Ceramic tile (T1): to CAN/CGSB-75.1, Type 5 Class MR 2, CR 1, 8 x 300 x 300 mm size, cushion edges, bright glazed surface, colour as selected by Departmental Representative. Matching bullnose edge trim to suit application.

2.3 BASE TILE

.1 Base: coved; type, size, colour and texture and properties to match adjacent flooring material.

2.4 TRIM SHAPES

.1 Conform to applicable requirements of adjoining floor and wall tile.

.2 Use slip resistant trim shapes for horizontal surfaces.

.3 Use trim shapes sizes conforming to size of adjoining field wall tile, including existing spaces, unless specified otherwise.

.4 Internal and External Corners: provide trim shapes as follows where indicated.

.1 Bullnose shapes for external corners including edges.

.2 Coved shapes for internal corners.

.3 Special shapes for:

.1 Base to floor internal corners to provide integral coved vertical and horizontal joint.

.2 Base to floor external corners to provide bullnose vertical edge with integral coved horizontal joint. Use as stop at bottom of openings having bullnose return to wall.

2.5 MORTAR MATERIALS

.1 Primer: Low VOC, low viscosity primer as recommended by manufacturer to suit substrate and site conditions; provide proof of bonding ability of setting system where manufacturer recommends that a primer is not necessary to installation.

.2 Rapid Setting Mortar: Dry set mortar meeting or exceeding the requirements of ASTM C627 for Extra Heavy installation using rapid curing, latex modified, portland cement mortar meeting requirements of ANSI A108.1.

.3 Water: potable and free of minerals and chemicals which are detrimental to mortar and grout mixes.

2.6 BOND COAT

.1 Epoxy bond coat: non-toxic, non-flammable, non-hazardous during storage, mixing, application, and when cured. To produce shock and chemical resistant mortars having the following physical characteristics:

.1 Compressive Strength: 246 kg/cm^2.

.2 Bond Strength: 53 kg/cm^2.

.3 Water Absorption: 4.0% Max.

.4 Ozone Resistance, 200 hours @ 200 ppm: no loss of strength.

.5 Smoke Contribution Factor: 0.

.6 Flame Contribution Factor: 0.

.7 Finished mortar and grout to be resistant to urine, dilute acid, dilute alkali, sugar, brine and food waste products, petroleum distillates, oil and aromatic solvents.

.8 Bond Coat: maximum VOC limit 65 g/L.

.2 Chemical-Resistant Bond Coat:

.1 Epoxy Resin Type: CTI A118.3.

.2 Furan Resin Type: CTI A118.5.

.3 Bond Coat: maximum VOC limit 65 g/L

2.7 GROUT

.1 Colouring Pigments:

.1 Pure mineral pigments, limeproof and nonfading, complying with ASTM C979/C979M.

.2 Colouring pigments to be added to grout by manufacturer.

.3 Job coloured grout are not acceptable.

.4 Use in Commercial Cement Grout, Dry-Set Grout, and Latex Cement Grout.

.2 Chemical-Resistant Grout:

.1 Epoxy grout: to ANSI A108.1, having quality, colour and characteristics to match epoxy bond coat. Adhesive and grout by same manufacturer.

.2 Furan grout: to CTI A118.5.

2.8 MEMBRANES

.1 Uncoupling Membrane:

.1 Rigid polyethylene membrane with a grid structure of square cavities 3 mm high each cut back in a dovetail configuration having anchoring fleece laminated to underside complete with manufacturers recommended floor adhesives and setting materials.

2.9 ACCESSORIES

.1 Straight Edge Strips: Roll formed stainless steel edge strips, 3 mm wide at top edge; height as required to suit tile installation; with integral perforated anchoring leg for setting the strip into the setting material.

.2 Transition Edge Strips: Extruded brushed stainless steel edge strips; height as required to suit tile installation; with integral perforated anchoring leg for setting the strip into the setting material.

.3 Movement Joint Strips: Extruded aluminum profiles joined by a soft thermoplastic movement joint material, with integral perforated anchoring legs for setting the joint into the setting bed; 11 mm wide x height as required to suit application; colour as selected by Departmental Representative from standard range.

.4 Sealant: in accordance with Section 07 92 00.

.1 Sealants: maximum VOC limit 250 g/L.

.5 Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers and as follows:

.1 Job Site Cleaner: Phosphoric acid/nitric acid based cleaning solution mixed in accordance with cleaner manufacturers recommendations and as recommended by tile manufacturer.

.2 Maintenance Cleaner: Non-toxic, electrolytic, biodegradable, non-ammonia containing, pH controlled cleaning solution mixed in accordance with manufacturer’s recommendations.

2.10 PATCHING AND LEVELLING COMPOUND

.1 Cement base, acrylic polymer compound, manufactured specifically for resurfacing and leveling concrete floors. Products containing gypsum are not acceptable.

.2 Have not less than the following physical properties:

.1 Compressive strength - 25 MPa.

.2 Tensile strength - 7 MPa.

.3 Flexural strength - 7 MPa.

.4 Density - 1.9.

.3 Capable of being applied in layers up to 50 mm thick, being brought to feather edge, and being trowelled to smooth finish.

.4 Ready for use in 48 hours after application.

2.11 CLEANING COMPOUNDS

.1 Specifically designed for cleaning masonry and concrete and which will not prevent bond of subsequent tile setting materials including patching and leveling compounds and elastomeric waterproofing membrane and coat.

.2 Materials containing acid or caustic material are not acceptable.

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 WORKMANSHIP

.1 Do tile work in accordance with TTMAC Tile Installation Manual 2012/2013, "Ceramic Tile", except where specified otherwise.

.2 Apply tile to clean and sound surfaces.

.3 Fit tile around corners, fitments, fixtures, drains and other built-in objects. Maintain uniform joint appearance. Cut edges smooth and even. Do not split tiles.

.4 Maximum surface tolerance 1:800.

.5 Make joints between tile uniform and approximately 3.0 mm wide, plumb, straight, true, even and flush with adjacent tile. Ensure sheet layout not visible after installation. Align patterns.

.6 Lay out tiles so perimeter tiles are minimum 1/2 size.

.7 Sound tiles after setting and replace hollow-sounding units to obtain full bond.

.8 Make internal angles square, external angles bullnosed.

.9 Use bullnose edged tiles at termination of wall tile panels, except where panel abuts projecting surface or differing plane.

.10 Install divider strips at junction of tile flooring and dissimilar materials.

.11 Allow minimum 24 hours after installation of tiles, before grouting.

.12 Clean installed tile surfaces after installation and grouting cured.

.13 Make control joints at 3 m in each direction. Make joint width same as tile joints. Fill control joints with sealant in accordance with Section 07 92 00. Keep building expansion joints free of mortar and grout.

3.3 MOVEMENT JOINTS

.1 Install movement joints in tile Work in accordance with detail 301EJ from TTMAC Installation Manual to suit installation indicated.

.2 Locate expansion, control, contraction, and isolation joints, as indicated in following table, unless specifically indicated otherwise on the Drawings:

Environment	**Minimum**	**Maximum**		**Joint Width**
Interior	4880 mm	6100 mm		6 mm
Interior/Sunlight	3660 mm	4880 mm		6 mm
Exterior/Normal	**2440 mm**	3660 mm		10 mm
Exterior/Excessive	2440 mm	3050 mm		13 mm
Elevator Cabs	Around perimeter of elevator cab floor.			

.3 Do not saw-cut joints after installing tiles:

.1 Locate joints in tile surfaces directly above joints in concrete substrates.

.2 Provide floor control joints over structural control joints.

.3 Install prefabricated joint profiles in accordance with manufacturer’s written instructions, set with top surface of joint profile slightly below top surface of tile.

.4 Prepare joints and apply sealants in accordance with requirements of Section 07 92 00.

.5 Keep control and movement joints free from setting materials.

.4 Form an open joint for sealant in tile Work wherever a change in the backing wall material occurs, at all vertical interior corners, around penetrating pipes and fixtures, and where tile abuts other materials or fixtures.

3.4 INSTALLATION SCHEDULE

.1 Wall Tile

.1 Install in accordance with TTMAC detail 305W.

.2 Floor Tile

.1 Install in accordance with TTMAC detail 311F, Detail B.

.3 Elevator Cab Floor Tile

.1 Install in accordance with TTMAC detail 313F, Detail D.

3.5 FIELD QUALITY CONTROL

.1 Manufacturer's Field Services:

.1 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.

3.6 CLEANING

.1 Proceed in accordance with Section 01 74 11.

END OF SECTION

Part 1 GENERAL

1.1 REFERENCES

.1 American Society for Testing and Materials (ASTM)

.1 ASTM E1264-08e1, Standard Classification for Acoustical Ceiling Products.

.2 ASTM E2638-10, Standard Test Method for Objective Measurement of the Speech Privacy Provided by a Closed Room.

.2 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-51.34-M86, Vapour Barrier, Polyethylene Sheet, for Use in Building Construction.

.2 CAN/CGSB-92.1-M89, Sound Absorptive Prefabricated Acoustical Units.

.3 Canadian Standards Association (CSA)

.1 CSA B111-74(R1998), Wire Nails, Spikes and Staples.

.4 Underwriters Laboratories of Canada (ULC)

.1 CAN/ULC-S102-10, Surface Burning Characteristics of Building Materials.

1.2 SAMPLES

.1 Submit samples in accordance with Section 01 33 00.

.2 Submit duplicate full size samples of each type acoustical units.

1.3 REGULATORY REQUIREMENTS

.1 Fire-resistance rated floor/ceiling and roof/ceiling assembly: certified by a Canadian Certification Organization accredited by Standards Council of Canada.

1.4 QUALITY ASSURANCE

.1 Minimum speech privacy category SPC Standard Speech Privacy 60-65 tested to ASTM E2638.

1.5 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 74 20.

.2 Collect and separate plastic, paper packaging and corrugated cardboard in accordance with Waste Management Plan.

1.6 ENVIRONMENTAL REQUIREMENTS

.1 Permit wet work to dry before commencement of installation.

.2 Maintain uniform minimum temperature of 15°C and humidity of 20 - 40% before and during installation.

.3 Store materials in work area 48 hours prior to installation.

Part 2 PRODUCTS

2.1 MATERIALS

.1 ACT: Acoustic units for suspended ceiling system: to CAN/CGSB-92.1.

- .1 Type XII.
- .2 Glass fibre with minimum 35% recycled content.
- .3 Pattern: match existing.
- .4 Flame spread rating of Class A or less in accordance with CAN/ULC-S102.
- .5 Smoke developed 50 or less in accordance with CAN/ULC-S102.
- .6 Noise reduction coefficient (NRC) designation of 0.95.
- .7 Ceiling Attenuation Class (CAC) rating N/A, in accordance with ASTM E1264
- .8 Light reflectance range of 0.86.
- .9 Edge type square.
- .10 Colour white.
- .11 Size 610 x 610 x 25 mm thick.

.2 Adhesive: low VOC type recommended by acoustic unit manufacturer.

.3 Staples, nails and screws: to CSA B111 non-corrosive finish as recommended by acoustic unit manufacturer.

.4 Polyethylene: to CAN/CGSB-51.34, 0.15 mm thick.

.5 Hold down clips: purpose made clips to secure tile to suspension system, approved for use in fire-rated systems.

Part 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 Install acoustical panels and tiles in ceiling suspension system.

.2 In fire rated ceiling systems, secure lay-in panels with hold-down clips and protect over light fixtures, diffusers, air return grilles and other appurtenances according to Certification Organizations design requirements.

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

Part 1 GENERAL

1.1 REFERENCES

.1 ASTM International

.1 ASTM C635/C635M-13a, Standard Specifications for the Manufacture, Performance and Testing of Metal Suspension Systems for Acoustical Tile and Lay-In Panel Ceilings.

.2 ASTM C636/C636M-13, Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels.

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

.1 Material Safety Data Sheets (MSDS).

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for acoustical suspension 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 reflected ceiling plans for special grid patterns as indicated.

.3 Indicate lay-out, insert and hanger spacing and fastening details, splicing method for main and cross runners, location of access splines, change in level details, access door dimensions, and locations and acoustical unit support at ceiling fixture.

.4 Samples:

.1 Submit for review and acceptance of each unit.

.2 Samples will be returned for inclusion into work.

.3 Submit one representative model of ceiling suspension system.

.4 Ceiling system to show basic construction and assembly, treatment at walls, recessed fixtures, splicing, interlocking, finishes, acoustical unit installation.

1.3 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00.

.2 Operation and Maintenance Data: submit operation and maintenance data for acoustical suspension for incorporation into manual.

1.4 QUALITY ASSURANCE

.1 Fire-resistance rated suspension system: certified by a Canadian Certification Organization accredited by Standards Council of Canada.

.2 Certifications: 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 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 acoustical ceiling tiles and tracks from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

.4 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding and packaging materials as specified in Waste Reduction Workplan in accordance with Section 01 74 20.

Part 2 PRODUCTS

2.1 DESIGN CRITERIA

.1 Design Requirements: maximum deflection: 1/360th of span to ASTM C635/C635M deflection test.

2.2 MATERIALS

.1 Intermediate duty system to ASTM C635/C635M.

.2 Basic materials for suspension system: commercial quality cold rolled steel, zinc coated.

.3 Suspension system: non fire rated, made up as follows:

.1 2 directional exposed tee bar grid to match existing.

.2 Concealed tee access spline.

.4 Exposed tee bar grid components: shop painted satin sheen. Components die cut. Main tee with double web, rectangular bulb and 25 mm rolled cap on exposed face. Cross tee with rectangular bulb; web extended to form positive interlock with main tee webs; lower flange extended and offset to provide flush intersection.

.1 Colour:

.1 White for Acoustic Ceiling Panels

.5 Hanger wire: galvanized soft annealed steel wire:

.1 3.6 mm diameter for access tile ceilings.

.6 Hanger inserts: purpose made.

.7 Carrying channels: 38mm galvanized steel, as recommended by acoustic unit manufacturer.

.8 Accessories: splices, clips, wire ties, retainers and wall moulding flush, to complement suspension system components, as recommended by system manufacturer.

Part 3 EXECUTION

3.1 EXAMINATION

.1 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts are acceptable for acoustical ceiling tile and track installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Departmental Representative.

.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 INSTALLATION

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

.2 Installation: to ASTM C636/C636M except where specified otherwise.

.3 Do not erect ceiling suspension system until work above ceiling has been inspected and approved by Departmental Representative.

.4 Secure hangers to overhead structure using attachment methods acceptable to Departmental Representative.

.5 Install hangers spaced at maximum 1200 mm centres and within 150 mm from ends of main tees.

.6 Lay out system according to reflected ceiling plan.

.7 Ensure suspension system is co-ordinated with location of related components.

.8 Install wall moulding to provide correct ceiling height.

.9 Completed suspension system to support super-imposed loads, such as lighting fixtures, diffusers and grilles.

.10 Support at light fixtures and diffusers with additional ceiling suspension hangers within 150 mm of each corner and at maximum 600 mm around perimeter of fixture.

.11 Interlock cross member to main runner to provide rigid assembly.

.12 Frame at openings for light fixtures, air diffusers and at changes in ceiling heights.

.13 Install access splines to provide 10% ceiling access.

.14 Finished ceiling system to be square with adjoining walls and level within 1:1000.

.15 Expansion joints:

.1 Supply and install "Z" shaped metal trim pieces at each side of expansion joint. Design to accommodate plus or minus 25 mm movement and maintain visual closure. Finish metal components to match adjacent exposed metal trim. Provide backing plates behind butt joints.

3.3 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11.

.1 Touch up scratches, abrasions, voids and other defects in painted surfaces.

.3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 20.

.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 acoustical suspension installation.

END OF SECTION

Part 1 GENERAL

1.1 RELATED REQUIREMENTS

.1 Section 02 41 99 –Demolition: Removal of existing floor finishes ready for work of this

.2 Section 08 71 00 – Door Hardware: Stainless Steel threshold at fire rated doors with combustible floor finishes.

.3 Section 09 30 13 – Ceramic Tiling

.4 Section 09 68 13 – Tile Carpeting

.5 Division 22 – Mechanical: Floor Drains.

.6 Division 26 – Electrical: Floor mounted accessories.

1.2 REFERENCES

.1 ASTM International (ASTM)

.1 ASTM F150-06, Standard Test Method for Electrical Resistance of Conductive and Static Dissipative Resilient Flooring

.2 ASTM F1303-04(2014), Standard Specification for Sheet Vinyl Floor Covering with Backing.

.2 National Fire Protection Association (NFPA):

.1 NFPA 255-2006, Standard Method of Test of Surface Burning Characteristics of Building Materials

.3 Underwriters Laboratories of Canada (ULC):

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

1.3 ADMINISTRATIVE REQUIREMENTS

.1 Coordination: Close spaces to traffic during flooring installation and until time period after installation recommended in writing by manufacturer; install flooring and accessories after other finishing operations, including painting and ceiling construction have been completed and as follows:

.1 Work of this Section includes floor levelling and patching required to meet resilient flooring manufacturer’s installation requirements; Coordinate where differences occur between manufacturer’s requirements and actual conditions.

.2 Coordinate installation of prefabricated integral cove bases with resilient flooring installation.

.3 Install flooring before laboratory millwork and other surface mounted fixtures are installed.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for resilient sheet flooring and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Samples:

.1 Submit duplicate 300 x 300 mm sample pieces of sheet material, 300 mm long base, edge strips.

.2 Prefabricated Integral Cove Base: Submit duplicate 100 mm x 100 mm samples of bases representative of colour, pattern, riser height and toe lengths specified. Samples shall represent one completed inside corner and one completed outside corner, with seams sealed and finished.

1.5 MAINTENANCE MATERIAL SUBMITTALS

.1 Extra Materials:

.1 Provide extra materials of resilient sheet flooring and adhesives in accordance with Section 01 78 00 - Closeout Submittals.

.2 Provide 5% of total installation with a minimum of 3000 mm length and large remnants of each colour and type for project for maintenance use.

.3 Extra materials one piece and from same production run as installed materials.

.4 Identify each roll of sheet flooring and each container of adhesive.

.5 Prefabricated Integral Cove Base: 5% of total installation with a minimum of 3000 mm of each colour and type

.6 Resilient Base and Accessories: 5% of total installation with a minimum of 2400 mm length of each colour and type

.7 Deliver to Departmental Representative, upon completion of the work of this section.

.8 Store where directed by Departmental Representative.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 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 Prefabricated Cove Bases: Deliver prefabricated integral cove bases in accordance with manufacturer’s written instructions; store flat on clean, dry floor area, away from construction activities to prevent damage.

.4 Storage and Handling Requirements:

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

.2 Store and protect specified materials from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

.5 Packaging Waste Management: remove for reuse and return by manufacturer of packaging materials as specified in Waste Reduction Workplan in accordance with Section 01 74 21.

1.7 SITE CONDITIONS

.1 Ambient Conditions:

.1 Maintain air temperature and structural base temperature at flooring installation area above 20 degrees for 48 hours before, during and 48 hours after installation.

Part 2 PRODUCTS

2.1 MATERIALS

.1 Unbacked Sheet Vinyl Flooring: Homogenous sheet vinyl with a polyurethane coating conforming to ASTM F1913, Type II and the following:

.1 Classification: Commercial

.2 Wear Layer: Clear UV cured polyurethane

.3 Fire Performance: CAN/ULC S 102.2

.1 Flame Spread: 100 or less.

.2 Smoke Developed: < 300.

.4 Static Dissipation Range: having a resistance of 1.0 X 106 to 1.0 X 109 ohms in accordance with ASTM F150.

.5 Colour: selected by Departmental Representative

.6 Pattern: Smooth

.7 Total Thickness: nominal 2 mm

.8 Width: minimum nominal 2000 mm

.9 Length: Manufacturers standard roll length

.2 Sheet rubber flooring (Stair 2-4 Landings): conforming to ASTM F1344, 3 vulcanized layers composed of a checker design rubber wear layer, a cushioning middle layer and a polyester back, overall thickness 3.0 mm, width 1.4 m, weldable seams.

.1 Fire Resistance: ASTM E 648/NFPA 253 - Class 1

.2 Adhesive: Manufacturer’s recommended adhesive

.3 Colour: to be selected by Departmental Representative from manufacturer’s standard range.

.3 Vinyl Stair Treads (Stair 2-4): 6 mm thick, surface applied PVC stair treads with extruded slip resistant ribs, full width and depth of tread with 50 mm square nosing and 50 mm photoluminescent strip, meeting ASTM F-2169 Type TV, Class 2, Group 2, Grade 1 and as follows:

.1 Hardness: ASTM D 2240 - Not less than 85 Shore A

.2 Abrasion Resistance: ASTM D 3389 - 0.22 mg/cycle

.3 Fire Resistance: ASTM E 648/NFPA 253 - Class 1

.4 Adhesive: Manufacturer’s recommended adhesive

.5 Colour: to be selected by Departmental Representative from manufacturer's standard range.

.4 Tactile Warning Strips: Coordinate with Section 05 51 29.

.5 Prefabricated Integral Cove Base: Fabricated from same materials and dye lots as resilient flooring, in maximum practical lengths, with 38 mm x 38 mm formed aluminum reinforcing bonded to back of base material.

.1 Riser: 100 mm

.2 Toe: 75 mm

.3 Metal Base Cap: Adhesive installation; stainless steel cap as recommended by manufacturer.

.6 Resilient base: continuous, top set, complete with premoulded end stops and external corners:

.1 Type: rubber.

.2 Style: cove.

.3 Thickness: 3.17 mm.

.4 Height: 101.6 mm.

.5 Lengths: cut lengths minimum 2400 mm.

.6 Colour: selected by Departmental Representative.

.7 Primers and adhesives: of types recommended by resilient flooring manufacturer for specific material on applicable substrate, above, on or below grade and as follows:

.1 Adhesives: Solvent free, water resistant primer and adhesive as recommended by flooring or resilient accessory manufacturer to suit resilient products specified and substrate materials and conditions maximum VOC limit 50 g/L, and as follows:

.1 Flooring Adhesive: Light bodied adhesive recommended by flooring manufacturer

.2 Prefabricated Integral Cove Base Adhesive: Low-VOC premium cove base adhesive as recommended by prefabricated cove base manufacturer.

.8 Sub-floor filler and leveller: Latex modified, portland cement based formulation provided or approved by resilient product manufacturer for applications indicated; Gypsum based materials will not be accepted for use on this project.

.9 Chemical Bonding Compound: Product of flooring manufacturer for chemically bonding seams.

.10 Metal edge strips:

.1 Stainless steel, smooth, polished with lip to extend under floor finish, shoulder flush with top of adjacent floor finish.

.11 External corner protectors: stainless steel, type recommended by flooring manufacturer.

.12 Edging to floor penetrations: stainless steel type recommended by flooring manufacturer.

Part 3 EXECUTION

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for resilient sheet flooring 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 SITE VERIFICATION OF CONDITIONS

.1 Ensure concrete floors are clean and dry by using test methods recommended by flooring manufacturer.

3.3 PREPARATION

.1 Remove or treat old adhesives to prevent residual, old flooring adhesives from bleeding through to new flooring and/or interfering with the bonding of new adhesives.

.2 Clean floor and apply filler; trowel and float to leave smooth, flat hard surface. Prohibit traffic until filler cured and dry.

.3 Remove sub-floor ridges and bumps. Fill low spots, cracks, joints, holes and other defects with sub-floor filler.

.4 Provide a leveling coat over the entire sub-floor.

.5 Prime concrete slab to resilient flooring manufacturer's printed instructions.

3.4 APPLICATION: FLOORING

.1 Provide high ventilation rate, with maximum outside air, during installation, and for 48 to 72 hours after installation. If possible, vent directly to outside. Do not let contaminated air recirculate through district or whole building air distribution system. Maintain extra ventilation for at least two weeks following building occupation.

.2 Apply adhesive uniformly using recommended trowel. Do not spread more adhesive than can be covered by flooring before initial set takes place.

.3 Lay flooring with seams parallel to building lines to produce a minimum number of seams. Border widths minimum 1/3 width of full material.

.4 Run sheets in direction of traffic. Heat weld according to manufacturer's printed instructions.

.5 As installation progresses, and after installation roll flooring with 45 kg minimum roller to ensure full adhesion.

.6 Cut flooring around fixed objects.

.7 Continue flooring over areas which will be under built-in furniture.

.8 Continue flooring through areas to receive movable type partitions without interrupting floor pattern.

.9 Terminate flooring at centreline of door in openings where adjacent floor finish or colour is dissimilar.

.10 Install metal edge strips at unprotected or exposed edges where flooring terminates.

3.5 APPLICATION: PREFABRICATED INTEGRAL COVE BASE:

.1 Provide prefabricated cove base for all integral base as indicated.

.2 Dry fit base; cut and fit material to required lengths; mitre cut inside and outside corners.

.3 Dry-fit, and cut metal cover cap prior to base installation.

.4 Scribe glue line on walls and floor at edge of base material.

.5 Apply adhesive in full spread (100% coverage on two surfaces) for full length of base material. Apply base to wall surface straight and level.

.6 Slide cove cap behind base material.

.7 Hand roll base material onto wall and floor surface, and remove all bumps, ripples, and fish mouths. Remove all excess adhesive.

.8 Seam seal all seams (vertical and horizontal) in base material.

3.6 APPLICATION: COVE BASE

.1 Lay out base to keep number of joints at minimum.

.2 Clean substrate and prime with one coat of adhesive.

.3 Apply adhesive to back of base.

.4 Set base against wall and floor surfaces tightly by using 3 kg hand roller.

.5 Install straight and level to variation of 1:1000.

.6 Scribe and fit to door frames and other obstructions. Use premoulded end pieces at flush door frames.

.7 Cope internal corners. Use premoulded corner units for right angle external corners. Use formed straight base material for external corners of other angles.

.8 Heat weld base in accordance with manufacturer's printed instructions.

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.8 Heat weld base in accordance with manufacturer's printed instructions.

3.8 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11.

.1 Clean flooring and base] surfaces to flooring manufacturer's printed instructions.

.3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21.

.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.9 PROTECTION

.1 Protect new floors from time of final set of adhesive until final inspection.

.2 Prohibit traffic on floor for 48 hours after installation.

3.10 SCHEDULES

.1 Floor Type F1: Where indicated on drawings; provide integral cove base.

END OF SECTION

Part 1 GENERAL

1.1 REFERENCES

.1 American Association of Textile Chemists and Colorists (AATCC)

- .1 AATCC Test Method 16-2004, Colorfastness to Light.
- .2 AATCC Test Method 23-2005, Colorfastness to Burn Gas Fumes.
- .3 AATCC Test Method 129-2005, Colourfastness to Ozone in the Atmosphere Under High Humidities.
- .4 AATCC Test Method 134-2006, Electrostatic Propensity of Carpets.
- .5 AATCC Test Method 171-2005, Carpets: Cleaning of; Hot Water Extraction Method.
- .6 AATCC Test Method 175-2008, Stain Resistance: Pile Floor Coverings.
- .7 AATCC Test Method 189-2007, Fluorine Content of Carpet Fibers.

.2 ASTM International

- .1 ASTM D297-13, Standard Test Methods for Rubber Products-Chemical Analysis.
- .2 ASTM D1335-12, Standard Test Method for Tuft Bind of Pile Yarn Floor Coverings.
- .3 ASTM D2661-11, Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) Schedule 40 Plastic Drain, Waste, and Vent Pipe and Fittings.
- .4 ASTM D1667-05(2011), Standard Specification for Flexible Cellular Materials-Vinyl Chloride Polymers and Copolymers (Closed-Cell Foam).
- .5 ASTM D3574-11, Standard Test Methods for Flexible Cellular Materials - Slab, Bonded, and Molded Urethane Foams.
- .6 ASTM D3936-12, Standard Test Method for Resistance to Delamination of the Secondary Backing of Pile Yarn Floor Covering.

.3 Canadian General Standards Board (CGSB)

- .1 CAN/CGSB-4.2 No. 22-2004, Textile Test Methods - Colourfastness to Rubbing (Crocking).
- .2 CAN/CGSB-4.2 No.27.6M-2004, Textile Test Methods - Flame Resistance - Methemine Tablet Test for Textile Floor Coverings.
- .3 CAN/CGSB-4.2 No. 76-94/ISO 2551: 1981, Textile Test Methods - Machine-Made Textile Floor Coverings - Determination of Dimensional Changes Due to the Effects of Varied Water and Heat Conditions.
- .4 CAN/CGSB-4.2 No.77.1-94/ISO 4919:2000, Textile Test Methods - Carpets - Determination of Tuft Withdrawal Force.
- .5 CAN/CGSB-4.129-93(R1997), Carpets for Commercial Use.

.4 Canadian Standards Association (CSA)

- .1 CSA B651-12, Accessible Design for the Built Environment.

.5 Carpet and Rug Institute (CRI)

.1 CRI Carpet Installation Standard 2011.

.2 CRI Green Label Indoor Air Quality Testing Program.

.3 CRI Green Label Plus Indoor Air Quality Testing Program.

.6 Environmental Choice Program (ECP)

.1 CCD-152-2009, Flooring Products, Commercial Non-modular Textile Flooring.

.7 Health Canada

.1 C.R.C., c.923-10, Hazardous Products Act - Carpet Regulations, Part II of Schedule 1.

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

.1 Material Safety Data Sheets (MSDS).

.9 National Floor Covering Association (NFCA)

.1 National Floor Covering Specification Manual 2007.

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

.1 SCAQMD Rule 1113-A2007, Architectural Coatings.

.2 SCAQMD Rule 1168-A2005, Adhesives and Sealants Applications.

.11 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-S102.2-10, Standard Method of Test for Surface Burning Characteristics of Flooring, Floor Coverings and Miscellaneous Materials and Assemblies.

1.2 ADMINISTRATIVE REQUIREMENTS

.1 Pre-Installation Meetings:

.1 Convene pre-installation meeting 1 week prior to beginning work of this Section with Contractor's Representative and Departmental Representative in accordance with Section 01 31 19 to:

.1 Verify project requirements.

.2 Review installation and substrate conditions.

.3 Co-ordination with other construction subtrades.

.4 Review manufacturer's written installation instructions and warranty requirements.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for each carpet tile, adhesive, and subfloor patching compound and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Submit 2 copies of WHMIS MSDS.

.3 Shop Drawings:

.1 Information on shop drawings to indicate:

.1 Nap: direction, open edges, special patterns.

.2 Cutouts: show locations where cutouts are required.

.3 Edgings: show location of edge moldings and edge bindings.

.4 Samples:

.1 Submit for review and acceptance of each unit.

.2 Samples will be returned for inclusion into work.

.3 Submit duplicate samples of each type of carpet tile specified and duplicate tiles for each colour selected, 150 mm length base.

.5 Certificates: submit product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

.6 Test and Evaluation Reports:

.1 Certified test reports showing compliance with specified performance characteristics and physical properties.

.7 Manufacturer's Instructions: submit manufacturer's installation and storage instructions.

.8 Manufacturers Reports:

.1 Manufacturer's Field Reports: submit manufacturer's written reports within 3 days of review, verifying compliance with specifications.

.9 Qualification Statements:

.1 Compliance: to CAN/ULC-S102 and CAN/ULC-S102.2.

.2 Testing: passes testing requirements of:

.1 Green Label Indoor Air Quality Testing Program.

.3 Tuft bind: meets requirements of CAN/CGSB-4.129 when tested to CAN/CGSB-4.2 No.77.1.

1.4 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00.

.2 Operation and Maintenance Data: submit operation and maintenance data for installed products for incorporation into manual.

1.5 MAINTENANCE MATERIAL SUBMITTALS

.1 Extra stock materials in accordance with Section 01 78 00 – Closeout Submittals: deliver to Departmental Representative 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.

.1 Quantity: provide minimum of:

.1 Carpet tile: 2%

.2 Carpet base: 5%

.3 Adhesives: 2%

.2 Delivery, storage and protection: comply with Departmental Representative's requirements for delivery and storage of extra materials.

1.6 QUALITY ASSURANCE

.1 Regulatory Requirements:

.1 Prequalification: compliance with Health Canada regulations under "Hazardous Products Act", Part II of Schedule 1, to CAN/CGSB-4.2 No. 27.6.

.2 Qualifications:

.1 Manufacturer: capable of providing field service representation during construction and approving application method.

.2 Flooring Installer:

.1 Certified by carpet manufacturer prior to bid submission.

.2 Must not sub-contract labour without written approval of Departmental Representative.

.3 Responsible for proper product installation, including floor testing and preparation as specified and in accordance with carpet manufacturer's written instructions.

1.7 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 and with manufacturer's written instructions.

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

.3 Storage and Handling Requirements:

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

.2 Store materials protected from exposure to harmful weather conditions and at temperature conditions recommended by manufacturer.

.3 Store and protect carpet tile and adhesive in original containers or wrapping with manufacturer's seals and labels intact.

.4 Store and protect carpet tile and accessories in location as directed by Departmental Representative.

.5 Store carpet and adhesive at minimum temperature of 18 degrees C and relative humidity of maximum 65% for minimum of 48 hours before installation.

.6 Prevent damage to materials during handling and storage. Keep materials under cover and free from dampness.

.7 Safety: comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of hazardous materials.

.8 Off gas carpet products off site in accordance with CSA B651.

.9 Replace defective or damaged materials with new.

1.8 SITE CONDITIONS

.1 Ambient Conditions:

.1 Moisture: ensure substrate is within moisture limits and alkalinity limits recommended by manufacturer. Prepare moisture testing and provide report to Departmental Representative.

.2 Temperature: maintain ambient temperature of not less than 18 degrees C from 48 hours before installation to at least 48 hours after completion of work.

.3 Relative humidity: maintain between 10% and 65% for 48 hours before, during and 48 hours after installation.

.4 Ventilation:

.1 Ventilate area of work as directed by Departmental Representative by use of approved portable supply and exhaust fans.

.2 Ventilate enclosed spaces in accordance with Section 01 51 00. Provide fans with HEPA filters.

.3 Provide continuous ventilation during and after carpet application. Run ventilation system 24 hours per day during installation; provide continuous ventilation for 7 days after completion of carpet installation.

.5 Install carpet after space is enclosed and weatherproof, wet-work in space is completed and nominally dry, work above ceilings is complete.

Part 2 PRODUCTS

2.1 PERFORMANCE

.1 Flammability: certified for flammability to Health Canada regulations under "Hazardous Products - Carpet Regulations", Part II of Schedule 1.

.2 Flame Spread: maximum flame spread rating 300, maximum smoke developed classification 500, when tested to CAN/ULC-S102.2.

.3 Smoke Development: 450 or less per ASTM E662.

.4 Dry Breaking Strength: to ASTM D2661, minimum acceptable tear strength in both length and width:

.1 11.3 kg for carpets installed by glue down installation.

.5 Wear: maximum 10% of pile face fiber by weight for 10 years.

.6 Edge Ravel: none for 10 years.

.7 Static Resistance: permanent static control to AATCC 134, 2000 V maximum at 20% RH and 22 degrees C.

.8 Static Generation: less than 3.0 kV per AATCC 134 for 10 years.

.9 Tuft Bind: Tuft Lock: to ASTM D1335, minimum acceptable 3.6 kilograms.

.10 De-lamination of Secondary Backing: Lamination Strength of Secondary Backing: to ASTM D3936, minimum acceptable peel strength of 1.6 kg/25 mm.

.11 Stain resistance: to AATCC 175, 8.

.12 Soil Resistance: 350 ppm fluorine minimum. Fluorine Durability Level to AATCC 189.

.13 Colourfastness to light: to CAN/CGSB-4.2 No.18.3

.14 Colourfastness to atmosphere: to AATCC 129 and AATCC 23.

.15 Colourfastness to crocking: to CAN/CGSB-4.2 No. 22.

.16 Indoor Air Quality Certification: certified to CRI Green Label IAQ requirements.

2.2 FABRICATION

.1 Type CPT-1: colour and pattern to be selected by Departmental Representative from manufacturer's standard range, size 610 mm x 610 mm.

.2 Face construction: Tufted.

.3 Pile Surface Appearance: Level loop; textured.

.4 Pile fibre: to CAN/CGSB-4.129.

.1 Nylon: BCF.

.1 Type: Nylon 6.

.5 Dyeing Method: solution dyed.

.6 Tufted Carpet Backing: to CAN/CGSB-4.129.

.1 Primary backing:

.1 Polypropylene: Cut Pile Carpet: 100% woven polypropylene at a minimum weight of 126 g/m^2.

.7 Secondary and Unitary Backings: to CAN/CGSB-4.129.

.8 Stitches: 39.4 stitches/10 cm.

.9 Gauge: 50.4 rows/10 cm.

.10 Finished Pile Height: minimum 4.7 mm average.

.11 Surface Pile Weight: minimum 711.9 g/sq.m.

.12 Total Weight: 3330 g/sq.m.

.13 Dimensional Stability: maximum + 0.15% to CAN/CGSB-4.2 No. 76/ISO 2551.

2.3 TILE CUSHION BACKING

.1 Density: urethane 224 kg/m^3; EVA and PVC 240 kg/m^3 to ASTM D3574.

.2 Compression force deflection, minimum: urethane 34.5 kN/m^2 to ASTM D3574.

.3 Compression deflection, minimum: EVA and PVC 48.3 kN/m^2 to ASTM D1667.

.4 Compression set at 50%, maximum: urethane 15% to ASTM D3574.

.5 Compression set at 25%, maximum: EVA and PVC 10% to ASTM D3574.

.6 Ash content, maximum: urethane 50%; EVA and PVC 50% to ASTM D297.

.7 Anti-microbial Resistance: to AATCC 174, 2 mm minimum halo of inhibition for gram positive bacteria.

.1 1 mm minimum halo of inhibition for gram negative bacteria.

.2 Ensure no fungal growth.

2.4 ACCESSORIES

.1 Base:

.1 Resilient Base: as specified in 09 65 19.

.2 Edge Strips:

.1 Metal:

.1 Designed for carpet being installed.

.2 Floor flange minimum 38 mm wide, face minimum 16 mm wide.

.3 Finish: clear anodic coating.

.3 Adhesive:

.1 Pressure Sensitive Type: recommended by carpet tile manufacturer for direct glue down installation of specialty backed carpet tiles.

.2 On site application VOC limit: 50 g/L maximum to SCAQMD Rule 1168.

.3 Adhesive in compliance with CCD-152.

.4 Transition Mouldings:

.1 Carpet edge / reducer strip: Extruded vinyl shapes meeting or exceeding ADA Recommendations for change of level transitions for transition between floors finishes having different levels.

.5 Carpet protection: non-staining heavy duty kraft paper.

.6 Subfloor patching compound: Portland cement base filler, mix with latex and water to form cementitious paste.

Part 3 EXECUTION

3.1 INSTALLERS

.1 Use experienced and qualified technicians to carry out assembly and installation of tile carpet.

3.2 EXAMINATION

.1 Examine conditions, substrates and work to receive work of this Section.

.2 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts are acceptable for carpet tile installation in accordance with manufacturer's written instructions.

.1 Inform Departmental Representative of unacceptable conditions immediately upon discovery.

.2 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.3 PREPARATION

.1 Subfloor Preparation:

.1 Inspect concrete and determine special care required to make it a suitable for carpet.

.2 Fill and level cracks 3 mm wide or protrusions over 0.8 mm with appropriate and compatible latex patching compound.

.3 Comply with manufacturer's written recommendations for maximum patch thickness.

.4 Prime large patch areas with compatible primer.

.5 Ensure concrete substrates are cured, clean and dry.

.6 Ensure concrete substrates are free of paint, dirt, grease, oil, curing or parting agents, and other contaminates, including sealers, that interfere with the bonding of adhesive.

.7 Where powdery or porous concrete surface is encountered, apply primer compatible with adhesive to provide a suitable surface for glue-down installation.

.2 Surface Preparation: prepare surface in accordance with manufacturer's written recommendations.

.1 Prepare floor surfaces in accordance with CRI Carpet Installation Standard.

.3 Tile Carpeting Preparation:

.1 Pre-condition carpeting: following manufacturer's written instructions.

3.4 INSTALLATION

.1 Install carpet tiles in accordance with manufacturer's written instructions, and CRI Carpet Installation Standard and co-ordinate with Section 01 73 00 - Execution.

.2 Co-ordinate tile carpeting work with work of other trades, for proper time and sequence to avoid construction delays.

.3 Install carpet tile after finishing work is completed but before demountable office partitions and telephone and electrical pedestal outlets are installed.

.4 Install carpet tile as per manufacturer's recommendation. This can include quarter-turn 90 degree format, monolithic, random, quarter turn ashlar, horizontal, herringbone or vertical ashlar.

.5 Snugly join carpet tiles in completed installation.

.1 Measure distance covered by 11 carpet tiles (10 joints) and ensure distance is in compliance with manufacturer specifications.

.2 Do not trap yarn between carpet tiles.

.6 Apply thin film of pressure-sensitive adhesive according to manufacturer's recommendations.

.7 Ensure finished installation presents smooth wearing surface free from conspicuous seams, burring and other faults.

.8 Use material from same dye lot.

.1 Ensure colour, pattern and texture match within visual areas.

.2 Maintain constant pile direction.

.9 Fit around architectural, mechanical, electrical and telephone outlets, and furniture fitments, around perimeter of rooms into recesses, and around projections.

.10 Extend carpet tiles into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.

.11 Install carpet tiles smooth and free from bubbles, puckers, and other defects.

.12 Protect exposed carpet tile edges at transition to other flooring materials with suitable transition strips.

.13 Base Installation: Install base in accordance with Section 09 65 00 – Resilient Sheet Flooring.

3.5 SITE QUALITY CONTROL

.1 Site Tests and Inspections:

.1 Co-ordinate site test with Section 01 45 00 – Quality Control.

.2 Manufacturer's Field Services:

.1 Co-ordinate manufacturer's services with Section 01 45 00 – Quality Control. Have manufacturer review work involved in 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:

.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 Work, after cleaning is carried out.

.4 Obtain reports within 3 days of review and submit immediately to Departmental Representative.

3.6 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

.1 Vacuum carpets clean immediately after completion of installation.

3.7 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Prohibit traffic on carpet for period of 24 hours minimum after installation and until adhesive is cured.

.3 Install carpet protection to satisfaction of Departmental Representative.

.4 Repair damage to adjacent materials caused by tile carpeting installation.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Requirements for supply and installation of access flooring system consisting of a series of modular, removable, interchangeable panels on an elevated support system forming an accessible under floor cavity bolted on stringer under structure.

1.2 REFERENCE STANDARDS

.1 Architectural Aluminum Manufacturers Association (AAMA):

.1 High Performance Organic Coatings on Aluminum Extrusions and Panels

.2 American Society for Testing and Materials (ASTM):

.1 ASTM F150-06, Electrical Resistance of Conductive and Static Resilient Flooring

.3 National Association of Architectural Metal Manufacturers (NAAMM):

.1 AMP 500 Series, Metal Finishes Manual

.4 Ceilings and Interior Systems Construction Association (CISCA):

.1 Recommended Test Procedures for Access Floors, 2007 Edition

.5 National Fire Protection Association (NFPA):

.1 NFPA 75-2008, Standard for the Protection of Information Technology Equipment

.6 Underwriters Laboratories Canada (ULC):

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

.2 CAN/ULC S102.2-10, Standard Method of Test for Surface Burning Characteristics of Flooring

.3 CAN/ULC S135-04, Standard Test Method for the Determination of Combustibility Parameters of Building Materials Using

1.3 ADMINISTRATIVE REQUIREMENTS

.1 Coordination: Coordinate with adjacent work and verify that concrete floors are acceptable for installation of specified materials.

.2 Pre-Construction Meetings: Conduct pre-construction meeting to verify project requirements and any unique conditions affecting installation, manufacturer's installation instructions and manufacturer's warranty requirements attended by Contractor, Subcontractor’s affected by work of this Section, access flooring manufacturer’s representative and Departmental Representative in accordance with Section 01 31 19.

.3 Scheduling: Order materials and provide site verified dimensions for preparation of shop drawings in sufficient time to allow for manufacturer’s fabrication lead time and project installation requirements.

1.4 SUBMITTALS

.1 Provide required information in accordance with Section 01 33 00 – Submittal Procedures.

.2 Action Submittals: Provide the following submittals before starting any work of this Section:

.1 Product Data: Submit manufacturer's printed product literature and installation instructions, specifications and data sheet indicating specific materials used for work of this Section.

.2 Shop Drawings: Submit measured shop drawings indicating layout of the work using verified site dimensional relationships to adjoining work and installation tolerances; sizes and details of components; anchorage methods; edge and fascia details; elevations differences and; floor finishes ; and location of connection to building grounding electrode.

.3 Samples:

.1 Access Floor System:

.1 Submit one full size sample consisting of 4 panels of complete access flooring system including specified finishes.

.2 Sample can be incorporated into finished installation when accepted by Departmental Representative.

.4 Components: Submit one of each of following components for review and acceptance by the Departmental Representative:

.1 Quarter size floor panel.

.2 Pedestal.

.3 Stringer member

.4 Resilient flooring

.5 Resilient accessories and trims; minimum 300 mm long.

.6 Exposed metal accessories; minimum 300 mm long.

.7 Fasteners.

.8 Accessories.

.5 Informational Submittals: Provide the following submittals when requested by the Departmental Representative:

.1 Certificates: Submit product certificates signed by manufacturer certifying that materials supplied for the project comply with specified performance characteristics, design criteria and physical requirements.

.2 Structural Site Quality Control Submittals: Submit manufacturer’s site review report within time period listed in Site Quality Control requirements below.

1.5 QUALITY ASSURANCE

.1 Regulatory Requirements: Provide access flooring meeting the requirements of NFPA 75 and combustibility requirements of Authority Having Jurisdiction; provide only ULC or CSA listed electric and mechanical devices.

.2 Qualifications: Provide proof of qualifications when requested by Departmental Representative:

.1 Manufacturer: Obtain access flooring from a single source and from a single manufacturer, with panels clearly and permanently marked on underside with panel type and concentrated load rating, tested in accordance with CISCA standards for access flooring.

.2 Zinc Whiskers Protection: Provide steel components coated with electrostatic, baked on corrosion resistant coatings; galvanized coatings will not be acceptable.

.3 Installer: Use manufacturer approved installer having experience with similar installations and complexity.

.4 Design: Provide access floor system designed to support loads and configurations indicated; consisting of modular and removable panels supported by an adjustable height under structure support system; with individual panels capable of being removed by one person using manufacturer's standard lifting device; including all required accessories, quantities and finished floor height necessary for a complete and functional installation.

.3 Certifications: Provide proof of the following during the course of the Work:

.1 Compliance Certification: Third party quality auditor is required to provide certificates indicating tested performance requirements stated in this Section were attained by the installed assemblies:

.2 Installation of access flooring system must be coordinated with the ongoing testing requirements of the third party quality auditor.

.3 Inspections and testing will be conducted as work progresses; work of this Section is responsible for notifying the Contractor so that the third party quality auditor and Departmental Representative are present during installation.

1.6 SITE CONDITIONS

.1 Site Measurements: Verify dimensions by site measurements before fabrication and indicate measurements on shop drawings where access flooring system is indicated to fit between or around walls, columns and other construction contiguous with access flooring; coordinate fabrication schedule with construction progress to avoid delaying the Work; indicate site measurements on shop drawings.

.2 Ambient Conditions: Install access flooring system after spaces are fully enclosed, and area of installation is operating under permanent building ambient temperature and humidity.

Part 2 Products

2.1 DESIGN CRITERIA

.1 Structural Performance for Panels: Provide access flooring panels capable of withstanding the following loads and stresses within limits and under conditions indicated, as determined by testing manufacturer's current standard products in accordance with referenced procedures in CISCA Recommended Test Procedures for Access Floors:

.1 Design Load Performance: Provide access flooring systems supported on actual under structure system components capable of withstanding a minimum design load of 450 kg; signifying that panels will support a concentrated load placed on a 6.5 cm^2 area at any location in the panel without yielding and having a safety factor of 2 without failing; failure is defined as the point at which access flooring system will not take any additional load.

.2 Uniform Load Performance: Provide access flooring systems supported on actual under structure system components capable of supporting a nominal uniform load of 16.75 kN/m^2

.3 Rolling Load Performance: Provide access flooring systems capable of withstanding rolling loads of the following magnitude applied to non-perforated panels, with a combination of local and overall deformation not to exceed nominal 1.0 mm after exposure to rolling load over CISCA Path A or B, whichever path produces the greatest top surface deformation, and as follows:

.1 Wheel 1 Rolling Load: Nominal 360 kg for 10 Passes using 75 mm diameter x 46 mm wide wheel.

.2 Wheel 2 Rolling Load: Nominal 270 kg for 10,000 Passes using 150 mm diameter x 50 mm wide wheel.

.4 Impact Load Performance: Provide access flooring systems capable of withstanding an impact load of 68 kg dropped from a height of 915 mm onto a 6.5 cm^2 area using a round or square indenter to any location on the panel.

.5 Panel Drop Test: Provide panel capable of being dropped face up onto to a concrete slab from a height of 915 mm that continues to meet all load performance requirements as previously defined after completion of test.

.6 Panel Cut Out: Provide panel having 200 mm diameter cut out capable of withstanding ultimate load of 680 kg without failure applied anywhere on panel.

.7 Flammability of Finishes: Provide access flooring system having a flame spread rating of 5; fuel contribution of 10 and smoke development of 15 when tested in accordance with CAN/ULC S102 and S102.2.

.8 Combustibility of Support Components and Panels: Provide access floor panels qualifying as non-combustible when tested in accordance with CAN/ULC S135.

.2 Structural Performance for Pedestal Assemblies: Provide pedestal assemblies capable of withstanding the following loads and stresses within design limits and conditions indicated in accordance with CISCA testing criteria:

.1 Pedestal Axial Load Performance: Provide pedestal assemblies, without panels or other supports in place, capable of withstanding a 22. kN axial load per pedestal.

.2 Pedestal Overturning Moment Performance: Provide pedestal assemblies, without panels or other supports in place, capable of withstanding an overturning moment of 113 Nm per pedestal applied horizontally at top of pedestal when secured to subfloor.

.3 Provide a means of levelling and locking the assembly at a selected height and that requires deliberate action to change height setting and prevents displacement as a result of vibration.

.4 Ultimate Load Carrying Capacity: Not less than twice design strength.

.3 Stringers: Provide stringer components capable of withstanding the following loads and stresses within design limits and conditions indicated:

.1 Stringer Concentrated Load Performance: Provide stringers, without panels in place, capable of withstanding a concentrated load of 890 N at center of span with a permanent set not to exceed 0.25 mm in accordance with CISCA testing criteria.

.2 Stability: Assembly to remain completely braced and rigid after a maximum of eight abutting panels are removed.

.4 Grounding: Provide direct positive contact to components for safe continuous electrical grounding of entire access flooring system to achieve a maximum panel to under structure resistance of not more than 10 ohms.

.5 Static Electricity Control: Provide resistance range for flooring materials from a minimum of 0.5 mega ohms to a maximum of 20,000 mega ohms, with maximum electrical resistance measured from top of panel to grounded subfloor; exposed metal will not be allowed at the wearing surface of the floor.

.6 Earthquake Load Performance: Provide access flooring capable of withstanding a lateral seismic force (Fp) in seismic zone applicable to this Project, in accordance with requirements provincial Building Code and Authority Having Jurisdiction.

2.2 SYSTEM DESCRIPTION

.1 Panels: Provide panels that are fully interchangeable except those altered to meet special installation conditions, and as follows:

.1 Panel Type: Corrosion protected steel panel with light weight cementitious core.

.2 Module Size: 610 mm x 610 mm.

.3 Top of Panel Finish: Vinyl composite tile as specified in Section 09 65 19.

.4 Underside and Edge Panel Finish: Baked on, static deposited, corrosion resistant epoxy finish, colour selected from manufacturer’s standard range.

.2 Pedestals: Manufactured from corrosion resistant steel, all welded construction with adjustable height range to suit finished floor height and pedestal base adhesive or mechanical fastener, forming a part of manufacturer’s standard access flooring system.

.3 Stringers: Manufactured from corrosion resistant steel, mechanically fastened to pedestal to provide positive electrical contact; connection based on gravity or spring action are not acceptable, and forming a part of the manufacturer’s standard access flooring system.

.4 Accessories: Provide premanufactured components meeting manufacturer’s system requirements in configurations and locations as indicated on Drawings and as follows:

.1 Vertical Closures (Fascia): Provide manufacturer's standard metal closure plates with factory applied finish where under floor cavity is not enclosed by abutting walls or other construction.

.2 Perimeter Support: Provide manufacturer's standard method for supporting panel edge and form transition between access flooring and adjoining floor covering at same level as access flooring.

2.3 FINISHES

.1 Apply finishes in factory after products are fabricated.

.2 Protect finishes on exposed surfaces with protective covering before shipment.

Part 3 Execution

3.1 EXAMINATION

.1 Verify that concrete sealers (if used) are compatible with pedestal adhesives before starting installation of access flooring systems.

.2 Verify that subfloor is dry and free of any surface irregularities that could reasonably be anticipated to adversely affect access flooring system appearance or performance before starting installation of access flooring systems.

3.2 INSTALLATION

.1 Install components in accordance with access flooring system manufacturer's written instructions including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.

.2 Pedestals and Stringers:

.1 Arrange pedestal assemblies to meet grid spacing required.

.2 Secure base plate to concrete floor with mechanical fasteners after adhesive has cured.

.3 Install additional pedestal assemblies where grid pattern is disturbed by columns, walls, ramps, openings, and steps, and at cut outs that impair floor load capacity.

.4 Install stringers rigidly brace floor pedestals four ways.

.3 Floor Panels:

.1 Install floor panels solidly on pedestals, level to maximum variation over entire floor of 1:2000.

.2 Seal site cuts with plastic angles or channels; exposed cut edges will not be permitted.

.4 Fascia Panels:

.1 Install fascia panels at exposed sides and where indicated.

.2 Secure panels to continuous angles mechanically secured to structural floor and to edge of floor panels.

.3 Install metal trim at intersection of fascia panels and access floor and at abutting walls and columns.

.5 Provide electrical grounding connectors and arrange for connection by Division 26.

.6 Adjust floor panel system for smooth, quiet operation.

3.3 SITE QUALITY CONTROL

.1 Manufacturer's Site Services:

.1 Manufacturer’s representative shall review work of this Section involving handling, installation, protection and cleaning, and submit written reports in acceptable format to verify compliance of work with manufacturer’s written installation instructions and shop drawings.

.2 Provide manufacturer's site 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 following stages:

.1 After delivery and storage of products, and when preparatory work affecting this Section is complete, before installation begins.

.2 Twice during progress of work; at 25% and 60% complete.

.3 At completion of work; after cleaning is completed.

.4 Submit written reports within three (3) days of review to Departmental Representative.

3.4 CLOSEOUT ACTIVITIES

.1 Cleaning: Perform cleaning after installation to remove construction and accumulated environmental dirt as required:

.1 Clean surfaces after installation using manufacturer's recommended cleaning procedures using only manufacturer recommended cleaning products.

.2 Remove surplus materials, rubbish, tools and equipment barriers and dispose of legally off site.

.2 Protection: Protect access floor in accordance with manufacturer’s instructions until Substantial Performance to prevent damage to finished surfaces.

END OF SECTION

Part 1 GENERAL

1.1 REFERENCES

.1 Canada Green Building Council (CaGBC)

.1 LEED Canada-NC 2009, LEED (Leadership in Energy and Environmental Design): Green Building Rating System Reference Package For New Construction and Major Renovations.

.2 Environmental Protection Agency (EPA)

.1 Test Method for Measuring Total Volatile Organic Compound Content of Consumer Products, Method 24 (for Surface Coatings).

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

.1 Material Safety Data Sheets (MSDS).

.4 The Master Painters Institute (MPI)

.1 Architectural Painting Specification Manual - 2015.

.2 Standard GPS-1-05, MPI Green Performance Standard for Painting and Coatings.

.5 National Fire Code of Canada, 2010 (NFC).

.6 Society for Protective Coatings (SSPC)

.1 Systems and Specifications, SSPC Painting Manual 2005.

1.2 QUALITY ASSURANCE

.1 Qualifications:

.1 Conform to latest MPI requirements for exterior painting work including preparation and priming.

.2 Materials: in accordance with MPI Painting Specification Manual "Approved Product" listing and from a single manufacturer for each system used.

.3 paint materials such as linseed oil, shellac, and turpentine to be highest quality product of an approved manufacturer listed in MPI Painting Specification Manual and to be compatible with other coating materials as required.

.4 Retain purchase orders, invoices and documents to prove conformance with noted MPI requirements when requested by Departmental Representative.

.5 Standard of Acceptance:

.1 Walls: No defects visible from a distance of 1000 mm at 90 degrees to surface.

.2 Soffits: 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.

1.3 PERFORMANCE REQUIREMENTS

.1 Environmental Performance Requirements:

.1 Provide paint products meeting MPI "Environmentally Friendly" E2 ratings based on VOC (EPA Method 24) content levels.

.2 Green Performance in accordance with MPI Standard GPS-1.

1.4 SCHEDULING

.1 Submit work schedule for various stages of painting to Departmental Representative for approval. 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 in and about building.

1.5 SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00.

.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 WHMIS MSDS - Material Safety Data Sheets.

.3 Upon completion, submit records of products used. List products in relation to finish system and include the following:

.1 Product name, type and use.

.2 Manufacturer's product number.

.3 Colour numbers.

.4 MPI Environmentally Friendly classification system rating.

.5 Manufacturer's Material Safety Data Sheets (MSDS).

.4 Provide samples in accordance with Section 01 33 00.

.1 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 Painting Specification Manual standards submitted on the following substrate materials:

.1 3 mm plate steel for finishes over metal surfaces.

.2 50 mm concrete block for finishes over concrete or concrete masonry surfaces.

.3 13 mm gypsum board for finishes over gypsum board and other smooth surfaces.

.2 When approved, samples shall become acceptable standard of quality for appropriate on-site surface with one of each sample retained on-site.

.3 Submit full range of available colours where colour availability is restricted.

.5 Provide LEED Submittals:

.1 Co-ordinate submittals requirements in accordance with Section 01 35 21.

1.6 QUALITY CONTROL

.1 Provide mock-up in accordance with Section 01 45 00.

.2 When requested by Departmental Representative or Paint Inspection Agency, prepare and paint designated surface, area, room or item to requirements specified herein, with specified paint or coating showing selected colours, number of coats, gloss/sheen, textures and workmanship to MPI Painting Specification Manual standards for review and approval. When approved, surface, area, room and/or items shall become acceptable standard of finish quality and workmanship for similar on-site work.

1.7 MAINTENANCE

.1 Extra Materials:

.1 Submit maintenance materials in accordance with Section 01 78 00.

.2 Submit 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.

1.8 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00, supplemented as follows:

.1 Deliver and store materials in original containers, sealed, with labels intact.

.2 Labels: to indicate:

.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.

.3 Remove damaged, opened and rejected materials from site.

.4 Provide and maintain dry, temperature controlled, secure storage.

.5 Observe manufacturer's recommendations for storage and handling.

.6 Store materials and supplies away from heat generating devices.

.7 Store materials and equipment in well ventilated area with temperature range 7 degrees C to 30 degrees C.

.8 Store temperature sensitive products above minimum temperature as recommended by manufacturer.

.9 Keep areas used for storage, cleaning and preparation, clean and orderly to approval of Departmental Representative. After completion of operations, return areas to clean condition to approval of Departmental Representative.

.10 Remove paint materials from storage only in quantities required for same day use.

.11 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling storage, and disposal of hazardous materials.

.12 Fire Safety Requirements:

.1 Provide one 9 kg Type ABC 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 the National Fire Code of Canada.

.2 Waste Management and Disposal:

.1 Separate waste materials for reuse and recycling in accordance with Section 01 74 00.

.2 Paint, stain and wood preservative finishes and related materials (thinners, solvents, etc.) 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.

.3 Material which cannot be reused must be treated as hazardous waste and disposed of in an appropriate manner.

.4 Place materials defined as hazardous or toxic waste, including used sealant and adhesive tubes and containers, in containers or areas designated for hazardous waste.

.5 To reduce the amount of contaminants entering waterways, sanitary/storm drain systems or into the ground the following procedures shall be strictly adhered to:

.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 an approved legal manner in accordance with hazardous waste regulations.

.5 Empty paint cans are to be dry prior to disposal or recycling (where available).

.6 Where paint recycling is available, collect waste paint by type and provide for delivery to recycling or collection facility.

.7 Deliver to or arrange collection by employees, individuals, or organizations for verifiable re-use or re-manufacturing.

.8 Close and seal tightly partly used sealant and adhesive containers and store protected in well ventilated fire-safe area at moderate temperature.

1.9 AMBIENT CONDITIONS

.1 Heating, Ventilation and Lighting:

.1 Do not perform painting work unless adequate and continuous ventilation and sufficient heating facilities are in place 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.

.2 Where required, provide continuous ventilation for seven days after completion of application of paint.

.3 Co-ordinate use of existing ventilation system with Departmental Representative and ensure its operation during and after application of paint as required.

.4 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.

.5 Perform no painting work unless a minimum lighting level of 323 Lux is provided on surfaces to be painted. Adequate lighting facilities to be provided by General Contractor.

.2 Temperature, Humidity and Substrate Moisture Content Levels:

.1 Unless specifically pre-approved by specifying body, Paint Inspection Agency and, applied product manufacturer, perform no painting work when:

.1 Ambient air and substrate temperatures are below 10 degrees C.

.2 Substrate temperature is over 32 degrees C unless paint is specifically formulated for application at high temperatures.

.3 Substrate and ambient air temperatures are expected to fall outside MPI or paint manufacturer's prescribed limits.

.4 Relative humidity is above 85% or when dew point is less than 3 degrees C variance between air/surface temperature.

.5 Rain or snow are forecast to occur before paint has thoroughly cured or when it is foggy, misty, raining or snowing at site.

.2 Perform no painting work when maximum moisture content of substrate exceeds:

.1 12% for concrete and masonry (clay and concrete brick/block).

.2 15% for wood.

.3 12% for plaster and gypsum board.

.3 Conduct moisture tests using a properly calibrated electronic Moisture Meter, except test concrete floors for moisture using a simple "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 noted herein.

.3 Apply paint when previous coat of paint is dry or adequately cured.

.4 Apply paint finishes when conditions forecast for entire period of application fall within manufacturer's recommendations.

.5 Do not apply paint when:

.1 Temperature is expected to drop below 10 degrees C before paint has thoroughly cured.

.2 Substrate and ambient air temperatures are expected to fall outside MPI or paint manufacturer's limits.

.3 Surface to be painted is wet, damp or frosted.

.6 Provide and maintain cover when paint must be applied in damp or cold weather. Heat substrates and surrounding air to comply with temperature and humidity conditions specified by manufacturer. Protect until paint is dry or until weather conditions are suitable.

.7 Schedule painting operations such that surfaces exposed to direct, intense sunlight are scheduled for completion during early morning.

.8 Remove paint from areas which have been exposed to freezing, excess humidity, rain, snow or condensation. Prepare surface again and repaint.

.9 Paint occupied facilities in accordance with approved schedule only. Schedule operations to approval of Departmental Representative such that painted surfaces will have dried and cured sufficiently before occupants are affected.

Part 2 PRODUCTS

2.1 MATERIALS

.1 Paint materials listed in latest edition of MPI Approved Products List (APL) are acceptable for use on this project.

.2 Paint materials for paint systems: to be products of single manufacturer.

.3 Only qualified products with E2 "Environmentally Friendly" ratings are acceptable for use on this project.

.4 Paint materials listed in the MPI Approved Products List (APL) are acceptable for use on this project.

.5 Paint materials for paint systems shall be products of a single manufacturer.

.6 Only qualified products with E2 "Environmentally Friendly" rating are acceptable for use on this project.

.7 Paints, coatings, adhesives, solvents, cleaners, lubricants, and other fluids, shall:

.1 be manufactured without compounds which contribute to ozone depletion in the upper atmosphere.

.2 be manufactured without compounds which contribute to smog in the lower atmosphere.

.3 do not contain methylene chloride, chlorinated hydrocarbons, toxic metal pigments.

.8 Water-borne surface coatings must be manufactured and transported in a manner that steps of processes, including disposal of waste products arising therefrom, will meet requirements of applicable governmental acts, by-laws and regulations including, for facilities located in Canada, Fisheries Act and Canadian Environmental Protection Act (CEPA).

.9 Water-borne surface coatings must not be formulated or manufactured with aromatic solvents, formaldehyde, halogenated solvents, mercury, lead, cadmium, hexavelant chromium or their compounds.

.10 Water-borne surface coatings and recycled water-borne surface coatings must have flash point of 61.0 degrees C or greater.

.11 Both water-borne surface coatings and recycled water-borne surface coatings must be made by a process that does not release:

.1 Matter in undiluted production plant effluent generating a 'Biochemical Oxygen Demand' (BOD) in excess of 15 mg/L to a natural watercourse or a sewage treatment facility lacking secondary treatment.

.2 Total Suspended Solids (TSS) in undiluted production plant effluent in excess of 15 mg/L to a natural watercourse or a sewage treatment facility lacking secondary treatment.

.12 Water-borne paints and stains, recycled water-borne surface coatings and water borne varnishes must meet a minimum "Environmentally Friendly" E2 rating.

.13 Recycled water-borne surface coatings must contain 50% post-consumer material by volume.

.14 Recycled water-borne surface coatings must not contain:

.1 Lead in excess of 600.0 ppm weight/weight total solids.

.2 Mercury in excess of 50.0 ppm weight/weight total product.

.3 Cadmium in excess of 1.0 ppm weight/weight total product.

.4 Hexavelant chromium in excess of 3.0 ppm weight/weight total product.

.5 Organochlorines or polychlorinated biphenyls (PCBS) in excess of 1.0 ppm weight/weight total product.

.15 The following must be performed on each batch of consolidated post-consumer material before surface coating is reformulated and canned. These tests must be performed at a laboratory or facility which has been accredited by the Standards Council of Canada.

.1 Lead, cadmium and chromium are to be determined using ICP-AES (Inductively Coupled Plasma - Atomic Emission Spectroscopy) technique no. 6010 as defined in EPA SW-846.

.2 Mercury is to be determined by Cold Vapour Atomic Absorption Spectroscopy using Technique no. 7471 as defined in EPA SW-846.

.3 Organochlorines and PCBs are to be determined by Gas Chromatography using Technique no. 8081 as defined in EPA SW-846.

2.2 COLOURS

.1 Departmental Representative will provide Colour Schedule after Contract award.

.2 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. On-site tinting of painting materials is allowed only with Departmental Representative's written permission.

.2 Mix paste, powder or catalyzed paint mixes in accordance with manufacturer's written instructions.

.3 Add thinner to paint manufacturer's recommendations. Do not use kerosene or organic solvents to thin water-based paints.

.4 Thin paint for spraying according in accordance with paint manufacturer's instructions. If directions are not on container, obtain instructions in writing from manufacturer and provide copy of instructions to Departmental Representative.

.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: defined as sheen rating of applied paint, in accordance with following values:

Gloss Level Category/	Units @ 60 Degrees/	Units @ 85 Degrees/
G1 - matte finish	0 to 5	max. 10
G2 - velvet finish	0 to 10	10 to 35
G3 - eggshell finish	10 to 25	10 to 35
G4 - satin finish	20 to 35	min. 35
G5 - semi-gloss finish	35 to 70	
G6 - gloss finish	70 to 85	
G7 - high gloss finish	> 85	

.2 Gloss level ratings of painted surfaces as specified.

2.5 EXTERIOR PAINTING SYSTEMS

.1 Structural Steel and Metal Fabrications:

.1 EXT 5.1D – Alkyd, gloss level G1 finish.

.2 Galvanized Metal: not chromate passivated (new doors, frames):

.1 EXT 5.3B – Alkyd, gloss level G5 finish.

.3 Galvanized Metal: not chromate passivated (existing doors, frames, fencing, brick lintels):

.1 REX 5.3B – Alkyd, gloss level G5 finish

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 EXAMINATION

.1 Exterior repainting work: inspected by MPI Accredited Paint Inspection Agency (inspector) acceptable to specifying authority and local Painting Contractor's Association. Painting contractor to notify Paint Inspection Agency minimum of one week prior to commencement of work and provide copy of project repainting specification and Finish Schedule.

.2 Exterior surfaces requiring repainting: inspected by both painting contractor and Paint Inspection Agency who will notify Departmental Representative in writing of defects or problems, prior to commencing repainting work, or after surface preparation if unseen substrate damage is discovered.

.3 Where assessed degree of surface degradation of DSD-1 to DSD-3 before preparation of surfaces for repainting is revealed to be DSD-4 after preparation, repair or replacement of such unforeseen defects discovered are to be corrected, as mutually agreed, before repainting is started.

.4 Where "special" repainting or recoating system applications (i.e. elastomeric coatings) or non-MPI listed products or systems are to be used, paint or coating manufacturer to provide as part of work, certification of surfaces and conditions for specific paint or coating system application as well as on site supervision, inspection and approval of their paint or coating system application as required at no additional cost to Departmental Representative.

3.3 PREPARATION

.1 Perform preparation and operations for exterior painting in accordance with MPI Maintenance Repainting Manual except where specified otherwise.

.2 Apply paint materials in accordance with paint manufacturer's written application instructions.

.3 Clean and prepare exterior surfaces to be repainted in accordance with MPI Maintenance Repainting Manual requirements. Refer to the MPI Manual in regard to specific requirements and as follows:

.1 Remove dust, dirt, and surface debris by vacuuming, wiping with dry, clean cloths or compressed air.

.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. Allow sufficient drying time and test surfaces using electronic moisture meter before commencing work.

.5 Use water-based cleaners in place of organic solvents where surfaces will be repainted using water based paints.

.6 Many water-based paints cannot be removed with water once dried. Minimize use of kerosene or such organic solvents to clean up water-based paints.

.4 Clean metal surfaces to be repainted by removing rust, dirt, oil, grease and foreign substances in accordance with MPI requirements. Remove such contaminates from surfaces, pockets and corners to be repainted by brushing with clean brushes, blowing with clean dry compressed air, or brushing/vacuum cleaning as required.

.5 Prevent contamination of cleaned surfaces by salts, acids, alkalis, other corrosive chemicals, grease, oil and solvents before priming and between applications of remaining coats. Touch-up, spot prime, and apply primer, paint, or pretreatment as soon as possible after cleaning and before deterioration occurs.

.6 Do not apply paint until prepared surfaces have been accepted by Departmental Representative.

.7 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.

3.4 EXISTING CONDITIONS

.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 a properly calibrated electronic moisture meter, except test concrete floors for moisture using a simple "cover patch test" and report findings to Departmental Representative. Do not proceed with work until conditions fall within acceptable range as recommended by manufacturer.

.3 Maximum moisture content as follows:

.1 Stucco: 12%.

.2 Concrete: 12%.

.3 Clay and Concrete Block/Brick: 12%.

.4 Wood: 15%.

.4 No repainting work to commence until such adverse conditions and defects have been corrected and surfaces and conditions are acceptable to Painting Subcontractor and Inspection Agency.

.5 Degree of surface deterioration (DSD) to be assessed using MPI Identifiers and Assessment criteria indicated in the MPI Maintenance Repainting Manual. MPI DSD ratings and descriptions are as follows:

Condition	Description
DSD-0	Sound Surface (includes visual

(aesthetic) defects that do not affect film's protective properties).

DSD-1 Slightly Deteriorated Surface (indicating fading; gloss reduction, slight surface contamination, minor pin holes and scratches).

DSD-2 Moderately Deteriorated Surface (small areas of peeling, flaking, slight cracking, and staining).

DSD-3 Severely Deteriorated Surface (heavy peeling, flaking, cracking, checking, scratches, scuffs, abrasion, small holes and gouges).

DSD-4 Substrate Damage (repair or replacement of surface required).

3.5 PROTECTION

.1 Protect existing building surfaces and adjacent structures from paint spatters, markings and other damage by suitable non-staining covers or masking. If damaged, clean and restore such 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.

.4 Protect passing pedestrians and general public in and about building.

.5 Remove light fixtures, surface hardware on doors, and other surface mounted equipment, fittings and fastenings prior to undertaking painting operations. Store items and re-install after painting is completed.

.6 Move and cover exterior furniture and portable equipment as necessary to carry out painting operations. Replace as painting operations progress.

.7 As painting operations progress, place "WET PAINT" signs in pedestrian and vehicle traffic areas to approval of Departmental Representative.

3.6 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 a uniform layer using brush and/or roller of types 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 shall be free of roller tracking and heavy stipple unless approved by Departmental Representative.

.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 properly 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 a uniform layer, with overlapping at edges of spray pattern.

.4 Brush out immediately runs and sags.

.5 Use brushes to work paint into cracks, crevices and places which are not adequately painted by spray.

.4 Use dipping, sheepskins or daubers when no other method is practical in places of difficult access and when specifically authorized by Departmental Representative.

.5 Apply coats of paint as 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 projecting ledges.

.9 Finish top, bottom, edges and cutouts of doors after fitting as specified for door surfaces.

3.7 MECHANICAL/ELECTRICAL EQUIPMENT

.1 Unless otherwise specified, paint exterior exposed conduits, piping, hangers, duct work and other mechanical and electrical equipment with colour and finish to match adjacent surfaces, except as noted otherwise.

.2 Touch up scratches and marks on factory painted finishes and equipment with paint as supplied by manufacturer of equipment.

.3 Do not paint over nameplates.

.4 Paint fire protection piping red.

.5 Paint steel electrical light standards. Do not paint outdoor transformers and substation equipment.

3.8 FIELD QUALITY CONTROL

.1 Inspection:

.1 Field inspection of exterior painting operations to be carried out be independent inspection firm as designated by Departmental Representative.

.2 Advise Departmental Representative when each surface and applied coating is ready for inspection. Do not proceed with subsequent coats until previous coat has been approved.

.3 Co-operate with inspection firm and provide access to areas of work.

.2 Manufacturer's Field Services:

.1 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.

3.9 CLEANING

.1 Proceed in accordance with Section 01 74 11.

.1 Remove paint where spilled, splashed, splattered or sprayed as work progresses using means and materials that are not detrimental to affected surfaces.

3.10 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

Part 1 GENERAL

1.1 RELATED SECTIONS

Section 04 22 00 – Concrete Unit Masonry

Section 09 21 16 – Gypsum Board Assemblies

1.2 REFERENCES

.1 Canada Green Building Council (CaGBC)

.1 LEED Canada-NC 2009, LEED (Leadership in Energy and Environmental Design): Green Building Rating System Reference Package for New Construction and Major Renovations.

.2 The Master Painters Institute (MPI)

.1 Maintenance Repainting Manual 2015, Master Painters Institute (MPI), including Identifiers, Evaluation, Systems, Preparation and Approved Product List.

.3 Environmental Protection Agency (EPA)

.1 Test Method for Measuring Total Volatile Organic Compound Content of Consumer Products, Method 24 (for Surface Coatings).

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

.1 Material Safety Data Sheets (MSDS).

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

.1 SCAQMD Rule 1113-04, Architectural Coatings.

1.3 QUALITY ASSURANCE

.1 Qualified journeymen shall be engaged in painting work. Apprentices may be employed provided they work under the direct supervision of a qualified journeyman in accordance with trade regulations.

.2 Conform to latest MPI requirements for interior painting work including preparation and priming.

.3 Materials (primers, paints, coatings, varnishes, stains, lacquers, fillers, thinners, solvents, etc.) shall be in accordance with MPI Painting Specification Manual "Approved Product" listing and shall be from a single manufacturer for each system used.

.4 Other paint materials such as linseed oil, shellac, turpentine, etc. shall be the highest quality product of an approved manufacturer listed in MPI Painting Specification Manual and shall be compatible with other coating materials as required.

.5 Retain purchase orders, invoices and other documents to prove conformance with noted MPI requirements when requested by Departmental Representative.

.6 Standard of Acceptance:

.1 Walls: No defects visible from a distance of 1000 mm at 90° to surface.

.2 Ceilings: No defects visible from floor at 45° to surface when viewed using final lighting source.

.3 Final coat to exhibit uniformity of colour and uniformity of sheen across full surface area.

1.4 ENVIRONMENTAL PERFORMANCE REQUIREMENTS

.1 Provide paint products meeting MPI "Environmentally Friendly" E1 ratings based on VOC (EPA Method 24) content levels.

.2 Where indoor air quality (odour) is a problem, use only MPI listed materials having a minimum E2 rating.

1.5 INSPECTION REQUIREMENTS

.1 Interior painting and decorating work shall be inspected by a Paint Inspection Agency (inspector) acceptable to the specifying authority and local Painting Contractor's Association. Painting contractor shall notify Paint Inspection Agency a minimum of one week prior to commencement of work and provide a copy of project painting specification, plans and elevation drawings (including pertinent details) as well as a Finish Schedule.

.2 Interior surfaces requiring painting shall be inspected by Paint Inspection Agency who shall notify Departmental Representative and Contractor in writing of defects or problems, prior to commencing painting work, or after prime coat shows defects in substrate.

.3 Where "special" painting, coating or decorating system applications (i.e. elastomeric coatings) or non-MPI listed products or systems are to be used, paint or coating manufacturer shall provide as part of this work, certification of surfaces and conditions for specific paint or coating system application as well as on site supervision, inspection and approval of their paint or coating system application as required at no additional cost to Departmental Representative.

1.6 SCHEDULING OF WORK

.1 Submit work schedule for various stages of painting to Departmental Representative for approval. Submit schedule minimum of 48 hours in advance of proposed operations.

.2 Obtain written authorization from Departmental Representative for any changes in work schedule.

.3 Schedule painting operations to prevent disruption of occupants in and about the building.

1.7 SUBMITTALS

.1 Submit product data and manufacturer's installation/application instructions for each paint and coating product to be used in accordance with Section 01 33 00.

.2 Submit WHMIS MSDS - Material Safety Data Sheets in accordance with Section 01 33 00.

.3 Upon completion, submit records of products used. List products in relation to finish system and include the following:

.1 Product name, type and use.

.2 Manufacturer's product number.

.3 Colour numbers.

.4 MPI Environmentally Friendly classification system rating.

.5 Manufacturer's Material Safety Data Sheets (MSDS).

.4 LEED Submittals: in accordance with Section 01 35 21.

1.8 SAMPLES

.1 Submit full range colour sample chips in accordance with Section 01 33 00. 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 Painting Specification Manual standards submitted on the following substrate materials:

.1 50 mm concrete block for finishes over concrete or concrete masonry surfaces.

.2 13 mm gypsum board for finishes over gypsum board and other smooth surfaces.

.3 When approved, sample panels shall become acceptable standard of quality for appropriate on-site surface with one of each sample retained on-site.

1.9 EXTRA MATERIALS

.1 Submit maintenance materials in accordance with Section 01 33 00.

.2 Submit 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 Deliver to Contractor and store where directed.

1.10 DELIVERY, HANDLING AND STORAGE

.1 Deliver, store and handle materials in accordance with Section 01 33 00.

.2 Labels shall clearly indicate:

.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.

.3 Remove damaged, opened and rejected materials from site.

.4 Provide and maintain dry, temperature controlled, secure storage.

.5 Observe manufacturer's recommendations for storage and handling.

.6 Store materials and supplies away from heat generating devices.

.7 Store materials and equipment in a well ventilated area with temperature range 7°C to 30°C.

.8 Store temperature sensitive products above minimum temperature as recommended by manufacturer.

.9 Keep areas used for storage, cleaning and preparation, clean and orderly to approval of Departmental Representative. After completion of operations, return areas to clean condition to approval of Departmental Representative.

.10 Remove paint materials from storage only in quantities required for same day use.

.11 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling storage, and disposal of hazardous materials.

.12 Fire Safety Requirements:

.1 Provide one 9 kg Type ABC 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 the National Fire Code of Canada.

1.11 SITE REQUIREMENTS

.1 Heating, Ventilation and Lighting:

.1 Ventilate enclosed spaces in accordance with Section 01 35 29.

.2 Perform no painting work unless adequate and continuous ventilation and sufficient heating facilities are in place to maintain ambient air and substrate temperatures above 10°C for 24 hours before, during and after paint application until paint has cured sufficiently.

.3 Where required, 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 Perform no painting work unless a minimum lighting level of 323 Lux is provided on surfaces to be painted. Adequate lighting facilities shall be provided by General Contractor.

.2 Temperature, Humidity and Substrate Moisture Content Levels:

.1 Unless specifically pre-approved by the specifying body, Paint Inspection Agency and the applied product manufacturer, perform no painting work when:

.1 Ambient air and substrate temperatures are below 10°C.

.2 Substrate temperature is over 32°C unless paint is specifically formulated for application at high temperatures.

.3 Substrate and ambient air temperatures are expected to fall outside MPI or paint manufacturer's prescribed limits.

.4 The relative humidity is above 85% or when the dew point is less than 3°C variance between the air/surface temperature.

.5 Rain or snow are forecast to occur before paint has thoroughly cured or when it is foggy, misty, raining or snowing at site.

.2 Perform no painting work when the maximum moisture content of the substrate exceeds:

.1 12% for concrete and masonry (clay and concrete brick/block).

.2 15% for wood.

.3 12% for plaster and gypsum board.

.3 Conduct moisture tests using a properly calibrated electronic Moisture Meter, except test concrete floors for moisture using a simple "cover patch test".

.4 Test concrete, masonry and plaster surfaces for alkalinity as required.

.3 Surface and Environmental Conditions:

.1 Apply paint finish only 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 only to adequately prepared surfaces and to surfaces within moisture limits noted herein.

.3 Apply paint only when previous coat of paint is dry or adequately cured.

.4 Additional Interior Application Requirements:

.1 Apply paint finishes only when temperature at location of installation can be satisfactorily maintained within manufacturer's recommendations.

.2 Apply paint in occupied facilities during silent hours only. Schedule operations to approval of Departmental Representative such that painted surfaces will have dried and cured sufficiently before occupants are affected.

1.12 WASTE MANAGEMENT AND DISPOSAL

.1 Paint, stain and wood preservative finishes and related materials (thinners, solvents, etc.,) 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.

.2 Material which cannot be reused must be treated as hazardous waste and disposed of in an appropriate manner.

.3 Place materials defined as hazardous or toxic waste, including used sealant and adhesive tubes and containers, in containers or areas designated for hazardous waste.

.4 To reduce the amount of contaminants entering waterways, sanitary/storm drain systems or into ground the following procedures shall be strictly adhered to:

.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 an approved legal manner in accordance with hazardous waste regulations.

.5 Empty paint cans are to be dry prior to disposal or recycling (where available).

.5 Where paint recycling is available, collect waste paint by type and provide for delivery to recycling or collection facility.

.6 Set aside and protect surplus and uncontaminated finish materials; deliver to or arrange collection by employees, individuals, or organizations for verifiable re-use or re-manufacturing.

.7 Close and seal tightly partly used sealant and adhesive containers and store protected in well ventilated fire-safe area at moderate temperature.

Part 2 PRODUCTS

2.1 MATERIALS

.1 Paint materials listed in the MPI Approved Products List (APL) are acceptable for use on this project.

.2 Paint materials for paint systems shall be products of a single manufacturer.

.3 Only qualified products with E2 "Environmentally Friendly" rating are acceptable for use on this project.

.4 Paints, coatings, adhesives, solvents, cleaners, lubricants, and other fluids, shall:

.1 be manufactured without compounds which contribute to ozone depletion in the upper atmosphere.

.2 be manufactured without compounds which contribute to smog in the lower atmosphere.

.3 do not contain methylene chloride, chlorinated hydrocarbons, toxic metal pigments.

.5 Water-borne surface coatings must be manufactured and transported in a manner that steps of process, including disposal of waste products arising therefrom, will meet requirements of applicable governmental acts, by-laws and regulations including, for facilities located in Canada, Fisheries Act and Canadian Environmental Protection Act (CEPA).

.6 Water-borne surface coatings must not be formulated or manufactured with aromatic solvents, formaldehyde, halogenated solvents, mercury, lead, cadmium, hexavelant chromium or their compounds.

.7 Water-borne surface coatings and recycled water-borne surface coatings must have a flash point of 61.0°C or greater.

.8 Both water-borne surface coatings and recycled water-borne surface coatings must be made by a process that does not release:

.1 Matter in undiluted production plant effluent generating a 'Biochemical Oxygen Demand' (BOD) in excess of 15 mg/L to a natural watercourse or a sewage treatment facility lacking secondary treatment.

.2 Total Suspended Solids (TSS) in undiluted production plant effluent in excess of 15 mg/L to a natural watercourse or a sewage treatment facility lacking secondary treatment.

.9 Water-borne paints and stains, recycled water-borne surface coatings and water borne varnishes must meet a minimum "Environmentally Friendly" E2 rating.

.10 Recycled water-borne surface coatings must contain 50% post-consumer material by volume.

.11 Recycled water-borne surface coatings must not contain:

.1 Lead in excess of 600.0 ppm weight/weight total solids.

.2 Mercury in excess of 50.0 ppm weight/weight total product.

.3 Cadmium in excess of 1.0 ppm weight/weight total product.

.4 Hexavelant chromium in excess of 3.0 ppm weight/weight total product.

.5 Organochlorines or polychlorinated biphenyls (PCBS) in excess of 1.0 ppm weight/weight total product.

.12 The following must be performed on each batch of consolidated post-consumer material before surface coating is reformulated and canned. These tests must be performed at a laboratory or facility which has been accredited by the Standards Council of Canada.

.1 Lead, cadmium and chromium are to be determined using ICP-AES (Inductively Coupled Plasma - Atomic Emission Spectroscopy) technique no. 6010 as defined in EPA SW-846.

.2 Mercury is to be determined by Cold Vapour Atomic Absorption Spectroscopy using Technique no. 7471 as defined in EPA SW-846.

.3 Organochlorines and PCBs are to be determined by Gas Chromatography using Technique no. 8081 as defined in EPA SW-846.

2.2 COLOURS

.1 Departmental Representative will provide Colour Schedule after Contract award.

.2 Colour schedule will be based upon the selection of two base colours and three accent colours. No more than five colours will be selected for the entire project.

.3 Selection of colours will be from manufacturer’s full range of colours.

.4 Where specific products are available in a restricted range of colours, selection will be based on the limited range.

.5 Second coat in a 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. On-site tinting of painting materials is allowed only with Departmental Representative's written permission.

.2 Paste, powder or catalyzed paint mixes shall be mixed in strict accordance with manufacturer's written instructions.

.3 Where thinner is used, addition shall not exceed paint manufacturer's recommendations. Do not use kerosene or any such organic solvents to thin water-based paints.

.4 Thin paint for spraying according in strict accordance with paint manufacturer's instructions. If directions are not on container, obtain instructions in writing from manufacturer and provide copy of instructions to Departmental Representative.

.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 shall be defined as the sheen rating of applied paint, in accordance with the following values:

Gloss Level Category	Units @ 60°	Units @ 85°
G1 – matte finish	0 to 5	max. 10
G2 – velvet finish	0 to 10	10 to 35
G3 – eggshell finish	10 to 25	10 to 35
G4 – satin finish	20 to 35	min. 35
G5 - semi-gloss finish	35 to 70	
G6 – gloss finish	70 to 85	
G7 - high gloss finish	> 85	

.2 Gloss level ratings of painted surfaces as specified.

2.5 INTERIOR PAINTING SYSTEMS

.1 Concrete Masonry Units (smooth and split face block and brick):

.1 INT 4.2D – High Performance Architectural Latex; LEED® Compliant

.2 Structural Steel and Metal Fabrications:

.1 INT 5.1B – W.B. Light Industrial Coating gloss level G3; LEED® Compliant

.3 Galvanized Metal: new doors, frames, railings, misc. steel, pipes, overhead decking, ducts, etc.:

.1 INT 5.3B – W.B. Light Industrial Coating gloss level G3; LEED® Compliant

.4 Galvanized Metal: existing doors, frames, railings, misc. steel, pipes, overhead decking, ducts, etc.:

.1 Maximum VOC limit 250 g/L to SCAQMD Rule 1113.

.2 RIN 5.3B – W.B. Light Industrial Coating gloss level G3; LEED® Compliant

.5 Gypsum Board: gypsum wallboard:

.1 INT 9.2B High performance architectural latex finish; LEED® Compliant

Part 3 EXECUTION

3.1 GENERAL

.1 Perform preparation and operations for interior painting in accordance with MPI Painting Specifications Manual except where specified otherwise.

.2 Apply paint materials in accordance with paint manufacturer's written application instructions.

3.2 EXISTING CONDITIONS

.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 a properly calibrated electronic moisture meter, except test concrete floors for moisture using a simple "cover patch test" and report findings to Departmental Representative. Do not proceed with work until conditions fall within acceptable range as recommended by manufacturer.

.3 Maximum moisture content as follows:

.1 Concrete and Masonry: 12%

.2 Stucco, Plaster and Gypsum Board: 12%

.3 Wood: 15%

3.3 PROTECTION

.1 Protect existing building surfaces and adjacent structures from paint spatters, markings and other damage by suitable non-staining covers or masking. If damaged, clean and restore such 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.

.4 Protect building occupants and general public in and about the building.

.5 Removal of electrical cover plates, light fixtures, surface hardware on doors, bath accessories and other surface mounted equipment, fittings and fastenings shall be done prior to undertaking any painting operations by Contractor. Items shall be securely stored and re-installed after painting is completed by Contractor.

.6 Move and cover furniture and portable equipment as necessary to carry out painting operations. Replace as painting operations progress.

.7 As painting operations progress, place "WET PAINT" signs in occupied areas to approval of Departmental Representative.

3.4 CLEANING AND PREPARATION

.1 Clean and prepare surfaces in accordance with MPI 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.

.2 Wash surfaces with a biodegradable detergent 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. However, minimize the use of kerosene or any such organic solvents to clean up water-based paints.

.2 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.

.3 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.

.4 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.

.5 Touch up of shop primers with primer as specified in applicable section. Major touch-up including cleaning and painting of field connections, welds, rivets, nuts, washers, bolts, and damaged or defective paint and rusted areas, shall be by supplier of fabricated material.

.6 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, or air sprayer. Conform to manufacturer's application instructions unless specified otherwise.

.2 Brush and Roller Application:

.1 Apply paint in a uniform layer using brush and/or roller of types 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 shall be free of roller tracking and heavy stipple unless approved by Departmental Representative.

.5 Remove runs, sags and brush marks from finished work and repaint.

.3 Use dipping, sheepskins or daubers only when no other method is practical in places of difficult access and only when specifically authorized by Engineer.

.4 Apply coats of paint as a continuous film of uniform thickness. Repaint thin spots or bare areas before next coat of paint is applied.

.5 Allow surfaces to dry and properly cure after cleaning and between subsequent coats for minimum time period as recommended by manufacturer.

.6 Sand and dust between coats to remove visible defects.

.7 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.

.8 Finish closets and alcoves as specified for adjoining rooms.

.9 Finish top, bottom, edges and cutouts of doors after fitting as specified for door surfaces.

3.6 MECHANICAL/ ELECTRICAL EQUIPMENT

.1 Unless otherwise specified, paint finished area exposed conduits, piping, hangers, ductwork and other mechanical and electrical equipment with colour and finish to match adjacent surfaces, except as noted otherwise.

.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 matt 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 natural gas piping yellow.

.11 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.

.12 Do not paint interior transformers and substation equipment.

3.7 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 Co-operate with inspection firm and provide access to areas of work.

3.8 RESTORATION

.1 Clean and re-install all 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

Part 1 General

1.1 SECTION INCLUDES

.1 This Section includes requirements for supply and installation of thin film intumescent fire resistive coatings.

1.2 RELATED REQUIREMENTS

.1 Section 07 48 00 – Firestopping

1.3 REFERENCE STANDARDS

.1 American Society for Testing and Materials (ASTM):

.1 ASTM D3960-05, Standard Practice for Determining Volatile Organic Compound (VOC) Content of Paints and Related Coatings

.2 ASTM E84-12c, Standard Test Method for Surface Burning Characteristics of Building Materials

.2 Association of the Wall and Ceiling Industries - International (AWCI):

.1 AWCI Technical Manual 12-B, Standard Practice for the Testing and Inspection of Field Applied Thin-Film Intumescent Fire-Resistive Materials; an Annotated Guide

.3 Underwriters Laboratories Inc. (ULI):

.1 Fire Resistance Directory, Volume 1, current edition

.4 Intertek Testing Services/Warnock Hersey International, Inc. (ITS/WH):

.5 Underwriters' Laboratories of Canada (ULC):

.1 List of Equipment and Materials, Fire Resistance, current edition

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

1.4 ADMINISTRATIVE REQUIREMENTS

.1 Sequencing and Scheduling: Sequence work in conjunction with mechanical and electrical work; steel surfaces with less than 1.0 meter clear working access may necessitate applying material to inaccessible surfaces prior to erection of the finished steel members, either at the point of fabrication or on-site.

1.5 SUBMITTALS

.1 Provide required information in accordance with Section 01 33 00.

.2 Action Submittals: Provide the following submittals before starting any work of this Section:

.1 Product Data: Submit product data indicating product characteristics, performance and limitation criteria including copies of fire test reports of fireproofing application to substrate materials required and manufacturer's installation instructions.

.3 LEED Submittals: in accordance with Section 01 35 21.

1.6 EXTRA MATERIALS

.1 Submit maintenance materials in accordance with Section 01 33 00.

.2 Submit 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 Deliver to Contractor and store where directed.

1.7 QUALITY ASSURANCE

.1 Regulatory Requirements: Conform to applicable building code for fire resistance rating; submit certification of acceptability of fireproofing materials to Authority Having Jurisdiction.

.2 Qualifications: Provide proof of qualifications when requested by Departmental Representative:

.1 Manufacturer: Company specializing in manufacturing products of this Section.

.2 Product: Manufactured under ULC Follow up Program. Each container or package shall bear ULC label.

1.8 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 33 00.

.2 Labels shall clearly indicate:

.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.

.3 Remove damaged, opened and rejected materials from site.

.4 Provide and maintain dry, temperature controlled, secure storage.

.5 Observe manufacturer's recommendations for storage and handling.

.6 Store materials and supplies away from heat generating devices.

.7 Store materials and equipment in a well ventilated area with temperature range 7°C to 30°C.

.8 Store temperature sensitive products above minimum temperature as recommended by manufacturer.

.9 Keep areas used for storage, cleaning and preparation, clean and orderly to approval of Departmental Representative. After completion of operations, return areas to clean condition to approval of Departmental Representative.

.10 Remove paint materials from storage only in quantities required for same day use.

.11 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling storage, and disposal of hazardous materials.

1.9 SITE CONDITIONS

.1 Ambient Conditions: Do not apply sprayed intumescent fireproofing when temperature of substrate and surrounding air is below 5°C and as follows:

.1 Do not apply intumescent fireproofing until concrete toppings and roofing applications have been installed.

.2 Provide ventilation in areas to receive work of this Section, during and 24 hours after application.

.3 Relative humidity must not exceed 75% throughout the total period of application and drying for the intumescent fireproofing, and must not exceed 65% throughout the application and drying for the protection decorative finish coat.

Part 2 Products

2.1 DESIGN REQUIREMENTS

.1 Delegated Design Requirements: Design thickness of intumescent coatings required by the Contract Documents to withstand fire ratings indicated and in accordance with requirements of the Building Code, and as described in Section 07 05 53.

.2 Performance Requirements: Manufacturer shall design proprietary coating systems to withstand the listed fire resistance ratings in accordance with the Building Code, Underwriters Laboratories Canada, and Authority Having Jurisdiction.

.3 Intumescent coatings applied to existing laminated timber decking, beams, purlins, and columns in ceiling plenums shall provide a flame spread rating not more than 25 and a smoke developed classification of not more than 50 in accordance with Article 8.15.1.2.1 of NFPA 13.

2.2 MATERIALS

.1 Intumescent Fireproofing: Single component, spray applied, water based, thin film intumescent fire resistive coating system specifically manufactured for coating interior wood substrates at interior locations to limit flame spread; standard off white colour and as follows:

.1 Class A fire hazard classification in accordance with ASTM E84.

.2 Maximum VOC Value: 126 g/l in accordance with ASTM D3960.

Part 3 Execution

3.1 EXAMINATION

.1 Examine surfaces to receive work of this Section and report any defects which may affect the Work of this Section. Identification marking of the steel components must be by way crayon to facilitate ease of removal prior to application of the intumescent fireproofing.

.2 Verify the substrate surfaces are ready to receive work.

.3 Verify that all clips, hangers, sleeves and similar devices have been attached.

.4 Confirm compatibility of surfaces to receive fireproofing materials; beginning of installation means acceptance of existing surfaces.

3.2 PREPARATION

.1 Clean substrate free of dust, dirt, grease or other foreign matter which would impair bond of fire resistance materials.

.2 Protect adjacent surfaces and equipment from over-spray of sprayed materials.

3.3 APPLICATION

.1 Thoroughly mix the intumescent fireproofing in accordance with manufacturer's instructions and apply in sufficient thickness to achieve rating with as may passes as necessary to cover with, uniformed in texture.

.2 Apply intumescent fireproofing directly to wood substrates in accordance with manufacturer’s printed instructions, to film thicknesses recommended by manufacturer.

3.4 CLEANING

.1 Remove fireproofing from materials and surfaces not specifically required to be fireproofed.

.2 Remove excess material, overspray, droppings and debris.

END OF SECTION

Part 1 GENERAL

1.1 REFERENCES

.1 ASTM International

.1 ASTM A167-99(2009), Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.

.2 ASTM A240/A240M-16, Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.

.3 ASTM A480/A480M-16b, Standard Specification for General Requirements for Flat-Rolled Stainless and Heat Resisting Steel Plate, Sheet, and Strip.

.4 ASTM A653/A653M-15e1, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

.2 Canada Green Building Council (CaGBC)

.1 LEED Canada 2009 for Design and Construction, LEED Canada 2009 for Design and Construction Leadership in Energy and Environmental Design Green Building Rating System Reference Guide.

.3 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-1.81-M90, Air Drying and Baking Alkyd Primer for Vehicles and Equipment.

.2 CAN/CGSB-1.88-92, Gloss Alkyd Enamel Air Drying and Baking.

.3 CAN/CGSB-1.104M-91, Semigloss Alkyd, Air Drying and Baking Enamel.

.4 CSA International

.1 CSA B651-12, Accessible Design for the Built Environment.

.5 Green Seal Environmental Standards (GS)

.1 GS-11-15, Standard for Paints and Coatings.

.2 GS-36-13, Standard for Commercial Adhesives.

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

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

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for metal toilet compartments and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Installation Drawings:

.1 Submit drawings stamped and signed by professional engineer registered or licensed in Ontario, Canada.

.2 Indicate fabrication details, plans, elevations, hardware, and installation details.

.4 Samples:

.1 Submit duplicate 300 x 300 mm samples of panel showing finished edge and corner construction and core construction.

.2 Submit duplicate representative samples of hardware items, including brackets, fastenings and trim.

.5 Sustainable Design Submittals:

.1 LEED Canada submittals: in accordance with Section 01 35 21.

.2 Construction Waste Management:

.1 Submit project Waste Management Plan highlighting recycling and salvage requirements.

.2 Submit calculations on end-of-project recycling rates, salvage rates, and landfill rates demonstrating that 75% of construction wastes were recycled or salvaged.

.3 Recycled Content:

.1 Submit listing of recycled content products used, including details of required percentages or recycled content materials and products, showing their costs and percentages of post-consumer and post-industrial content, and total cost of materials for project.

.4 Regional Materials: submit evidence that project incorporates required percentage 20 % of regional materials and products, showing their cost, distance from project to furthest site of extraction or manufacture, and total cost of materials for project.

.5 Low-Emitting Materials:

.1 Submit listing of adhesives and sealants and paints and coatings used in building, comply with VOC and chemical component limits or restriction requirements.

.2 Submit listing of composite wood products used in building, stating that they contain no added urea-formaldehyde resins.

1.3 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.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 and with manufacturer's written instructions.

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

.3 Storage and Handling Requirements:

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

.2 Store and protect metal toilet compartments from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

.4 Develop Construction Waste Management Plan related to Work of this Section and in accordance with Section 01 35 21.

.5 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding and packaging materials as specified in Construction Waste Management Plan in accordance with Section Section 01 35 21.

Part 2 PRODUCTS

2.1 MATERIALS

.1 Type: Stainless steel, floor mounted overhead braced toilet partitions.

.2 Doors, Panels, and Pilasters: Stainless steel premium quality, Type 304 in accordance with ASTM A167, bonded to each side of paper honeycomb core with returned and sealed edges.

.3 Pilaster support: Adjustable bolts with stainless steel collar to ASTM A167.

.4 Pilaster Shoes: 100 mm high; Stainless Steel.

.5 Anchor Hardware: Wall and panel brackets, 1 473 mm long “U” channel mounting bracket stainless steel finish. Full length door stop 1 473 mm long - fits over the edge of door stainless steel finish.

.6 Finish Hardware: Hinge housing, surface mounted, coat hook and bumper, and pull handles for barrier free doors, door stop and keeper, to manufacturer’s standard bright finish.

.7 Latch Set: Built-in, with emergency access feature to manufacturer’s standard bright finish.

.8 Exposed Fasteners: Cadmium plated steel, vandal resistant type

.9 Concealed Fasteners: Steel, hot dipped galvanized.

2.2 COMPONENTS

.1 Hinges:

.1 Heavy duty, non-lubricating nylon bushings.

.2 Material/finish: stainless steel casting.

.3 Swing: as shown on Drawings.

.4 Return movement: gravity

.5 Adjustable to hold door open at any angle up to 90 degrees.

.6 Emergency access feature.

.2 Latch set: surface mounted combination latch, door-stop, keeper and bumper, stainless steel, emergency access feature.

.3 Wall and connecting brackets: stainless steel extrusion or casting.

.4 Coat hook: combination hook and rubber door bumper, stainless steel.

.5 Door pull: barrier-free type suited for out swinging doors, stainless steel.

2.3 FABRICATION

.1 Fabricate standard access stall doors a minimum 610 mm wide inward swinging and barrier free access stall doors a minimum 815 mm wide outward swinging with stall widths to minimum dimensions indicated on Drawings and in accordance with CAN/CSA B651.

.2 Fabricate formed doors, panels and pilasters with closed edges; mitre and weld corners to make a smooth and tight hygienic joint.

.3 Provide internal reinforcement for accessory attachment.

2.4 FINISHES

.1 Manufacturer’s standard stainless steel finish.

Part 3 EXECUTION

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for metal toilet compartment 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 PREPARATION

.1 Ensure supplementary anchorage, if required, is in place.

3.4 ERECTION

.1 Do work in accordance with CSA B651.

.2 Partition erection.

.1 Install partitions secure, plumb and square.

.2 Leave 12 mm space between wall and panel or end pilaster.

.3 Anchor mounting brackets to masonry/concrete surfaces using screws and shields: blocking/backing must be provided to hollow walls using bolts and toggle type anchors, to steel supports with threaded rods nuts and washers.

.4 Attach panel and pilaster to brackets with self-drilling screws with through type sleeve bolt and nut.

.5 Allow for adjustment of floor-braced pilasters with screw jack through steel saddles made integral with pilaster.

.1 Conceal floor fixings with stainless steel shoes.

.6 Equip doors with hinges, latch set, and each stall with coat hook mounted on partition wall, mounting heights in accordance with ADA requirements.

.1 Adjust and align hardware for easy, proper function. Set door open position at 30 degrees to front.

.2 Install door bumper wall.

.7 Equip outswinging doors with door pulls on inside and outside of door in accordance with CSA B651.

.8 Install hardware grab bars.

.3 Ceiling hung partition erection.

.1 Secure pilasters to supporting structural framing using pilaster hangers.

.2 Ensure pilaster hangers do not transmit load to finished ceiling.

.3 Secure pilaster shoe in position.

.4 Set bottoms of doors level with bottom of pilasters when doors are in closed position.

.4 Floor supported and overhead braced partition erection.

.1 Attach pilasters to floor with pilaster supports and level, plumb, and tighten installation with levelling device.

.1 Secure pilaster shoes in position.

.2 Secure headrail to pilaster face with not less than two fasteners per face.

.3 Set tops of doors parallel with overhead brace when doors are in closed position.

.2 Floor supported partition erection.

.1 Secure pilasters to floor with pilaster supports anchored with minimum 50 mm penetration in structural floor.

.2 Level, plumb and tighten installation with levelling device.

.3 Secure pilaster shoes in position.

.4 Set tops of doors level with tops of pilasters when doors are in closed position.

3.5 ADJUSTING

.1 Adjust doors and locks for optimum, smooth operating condition.

.2 Lubricate hardware and other moving parts.

3.6 CLEANING

.1 Perform cleaning after installation to remove construction and accumulated environmental dirt.

.2 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

3.7 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11.

.1 Clean surfaces after installation using manufacturer's recommended cleaning procedures.

.2 Clean aluminum with damp rag and approved non-abrasive cleaner.

.3 Clean and polish hardware and stainless components.

.3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 20.

.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.8 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by metal toilet compartment installation.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 This Section includes requirements for supply and installation of manually operated folding panel partition system with all components required for fully functioning and operable system described for the project.

1.2 RELATED REQUIREMENTS

.1 Section 09 21 16 – Gypsum Board Assemblies, ceiling storage pockets and bulkheads

1.3 REFERENCE STANDARDS

.1 American Society for Testing and Materials (ASTM):

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

.2 ASTM E336-11, Standard Method for Measurement of Airborne Sound Insulation in Buildings

.3 ASTM E557-12 (2006), Standard Guide for Architectural Design and Installation Practices for Sound Isolation between Spaces Separated by Operable Partitions

.2 Underwriters Laboratories Canada (ULC):

.1 CAN/ULC S102-07, Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies

1.4 ADMINISTRATIVE REQUIREMENTS

.1 Coordination: Coordinate stacking depths with manufacturer's requirements and confirm depth of pocket provided for project installation, revise dimensions in advance of installation with affected work to ensure a proper fit, and as follows:

.1 Floor Flatness: Coordinate manufacturer's requirements for floor flatness and level required to obtain airtight contact between acoustic seal and floor immediately under the folding panel partition with other sections relating to concrete floor preparation and installation.

.2 Support Structure: Coordinate manufacturer's requirements for size and configuration of miscellaneous steel support beam required for attachment of track suspension system.

.3 Above Track Construction: Coordinate manufacturer's requirements for sound rated ceilings and plenums with other sections relating to ceiling construction; install sound barrier construction above partition track to maintain sound rating performance specified in this Section.

.2 Pre-Construction Meetings: Conduct pre-installation meeting in sufficient time before starting work of this Section with Contractor's representative, Departmental Representative, installing Subcontractor and manufacturer's representative in accordance with Section 01 31 19 to verify project requirements and clearances.

1.5 SUBMITTALS

.1 Provide required information in accordance with Section 01 33 00.

.2 Action Submittals: Provide the following submittals before starting any work of this Section:

.1 Product Data: Submit manufacturer's printed product literature for folding partitions or components, and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Shop Drawings: Submit drawings indicating location and extent of partitions including; but not limited to, the following:

.1 Plans, elevations, sections, details, and attachments to other construction

.2 Head and jamb details, opening sizes, anchorage clearances, stack depths, hardware and track including floor tolerances required and direction of travel, finish pattern and colour location of electrical connections, and accessories required for complete installation

.3 Dimensions, weights, conditions at openings and storage areas

.4 Installation requirements for storage areas and operating clearances

.5 Indicate blocking specifically provided and coordinated by other sections of work

.3 Samples for Verification: Submit duplicate 300 x 200 mm samples of specified covering in same thickness and material indicated for the work for each folding partition cover to Departmental Representative for confirmation of selection.

.3 Informational Submittals: Provide the following submittals during the course of the work:

.1 Setting Drawings: Submit setting drawings in advance of work of other sections affected by this Section indicating:

.1 Items embedded or cast into adjacent construction

.2 Cut outs and punching template in support structures and beams

.3 Other work required by other sections to complete their work

.2 Source Quality Control: Submit certified test reports for sound transmission from approved independent testing laboratories indicating compliance with specifications for specified performance characteristics and physical properties.

.3 Site Quality Control Submissions: Submit written report prepared by manufacturer verifying compliance with specified performance requirements of installed materials and products.

.4 Manufacturer's Installation Instructions: Submit manufacturer's installation instructions and special handling criteria, installation sequence, and cleaning procedures.

.4 Sustainable Design Submittals: Coordinate project sustainable design requirements with Section 01 35 21 – Sustainability Certification Project Requirements; in addition, provide information for following specific requirements of this Section:

.1 MR Credit 4 – Recycled Content:

.1 Content: Total value of building materials must contain a minimum weighted average of 20% of post consumer + ½ pre-consumer recycled content; preference will be given to materials that provide a positive contribution towards the total recycle content for the project over materials that provide less of a contribution.

.2 Compliance Requirement: Submit product cut sheet indicating post consumer and post industrial recycled content contained in products proposed for this project meeting requirements of ISO 14021 – Environmental Labels and Declarations, Self Declared Claims (Type II Environmental Labelling) or certificate from independent laboratory acceptable to LEED® documentation requirements.

1.6 PROJECT CLOSEOUT SUBMITTALS

.1 Operation and Maintenance Data: Submit manufacturer's written instructions for operations and maintenance procedures, include name of original installer and contact information in accordance with Section 01 78 23 and as follows:

.1 Panel finish facings and finishes for exposed trim and accessories; include precautions for cleaning materials and methods that could be detrimental to finishes and performance

.2 Seals, hardware, track, carriers, and other operating components

1.7 QUALITY ASSURANCE

.1 Regulatory Requirements: Provide materials and assemblies tested and labelled indicating flame spread and smoke developed ratings and compliance with Canadian Electrical Code acceptable to the Authority Having Jurisdiction.

.2 Qualifications: Provide proof of qualifications when requested by Departmental Representative:

.1 Supplier: Obtain materials from a supplier capable of maintaining a stock of parts and components necessary to repair and maintain installed materials and products, and able to respond within a two (2) hour time period.

1.8 DELIVERY, STORAGE, AND HANDLING

.1 Delivery and Acceptance Requirements:

.1 Package and sequence folding partition materials matching order of installation.

.2 Clearly mark packages with numbering system used on shop drawings; do not use permanent markings on folding partitions.

1.9 SITE CONDITIONS

.1 Site Measurements: Verify dimensions by site measurements before fabrication and indicate measurements on shop drawings where folding panel partitions are indicated to fit between or around other construction; coordinate fabrication schedule with construction progress to avoid delaying the Work.

.2 Established Dimensions: Establish dimensions and proceed with fabricating folding panel partitions without site measurements where site measurements cannot be made without delaying the Work; coordinate construction to ensure that actual site dimensions correspond to established dimensions; allow for trimming and fitting.

Part 2 Products

2.1 FOLDING PANEL PARTITION

.1 Description: Manually operated, top supported folding partitions as follows:

.1 Performance Requirements:

.1 Acoustic: 50 minimum nominal STC in accordance with ASTM E90

.2 Flame Spread/Smoke Developed: 25/50 when tested in accordance with CAN/ULC S102

.2 Partition Construction: Manufacturer's standard twin wall vinyl finished panels laminated to engineered core connected with hinge and steel rods with vinyl seals between panels to provide sight and acoustic privacy and as follows:

.1 Finish: As selected from manufacturer's standard range of finishes for designated materials.

.3 Suspension System: Manufacturer's standard suspension track, yokes and carriers including curves, switches and multiple meeting posts as required to meet project requirements, and as follows:

.1 Track: Flush ceiling mounted architectural grade aluminum track designed to support weight of partition and horizontal ceiling trim to match track system.

.2 Trolley Yokes and Frame: Bearing mounted steel alloy trolley yoke functioning as a hinge pin at intervals supporting frame assembly.

.3 Carriers: Four wheel units positioned at lead post and two wheel units at each support point with 25 mm steel wheels and self lubricating nylon tires with carrier spacing at a nominal maximum of 280 mm.

.4 Operating Hardware: Manufacturer's standard pull bar, draw latches, screws and installation hardware selected from manufacturer's standard finishes and as follows:

.1 Hand Pulls: Manufacturer's standard satin chrome finished grip with integral latching hardware; extruded aluminum rods or plastic hand pulls are not acceptable.

.2 Locking Hardware: Cylinder lock from both sides.

2.2 ACCESSORIES

.1 Sweeps: Vinyl strips at head to conceal track.

.2 Sound Seals: Vinyl or rubber gaskets at jambs with double sweep strips at top and bottom.

.3 Air Release: Provide series of 10 mm holes in lead post moulding to assist with release of air trapped with partition during operation.

.4 Jamb Panels: Provide sliding jamb panels, finished to match partition as required by installation.

Part 3 Execution

3.1 EXAMINATION

.1 Verify that substrate conditions and work installed by other sections match manufacturer's requirements as discussed during coordination and pre-installation meetings; starting work is denoted as acceptance of conditions.

3.2 INSTALLATION

.1 Install folding panel partitions in accordance with requirements of ASTM E577 to achieve sound ratings required and in accordance with manufacturer's written instructions and as follows:

.1 Level tracks and fasten securely to header.

.2 Install partition in accordance with manufacturer's printed instructions.

.3 Touch up damaged finishes, repair damage to partitions to match original finish.

.4 Clean folding partition system and protect from damage.

.5 Adjust and leave partitions in smooth operating conditions.

3.3 SITE QUALITY CONTROL

.1 Site Testing: Perform acoustical testing after installation of folding panel partitions in accordance with ASTM E336 using a third party testing agency acceptable to the Departmental Representative; include cost of site testing as a part of the work of this Section.

.2 Manufacturer’s Site Services: Schedule site visits to comment on and provide direction to installer at following stages of construction, to ensure that work of this Section is installed in accordance with manufacturer’s instructions:

.1 After delivery and storage of products, and when preparatory Work is complete but before installation begins

.2 Twice during progress of Work at 25% and 60% complete

.3 Upon completion of Work, after cleaning is carried out

.3 Reporting: Prepare a report describing observations and any corrective measures undertaken to install folding panel partitions required to meet specified performance requirements; submit results of acoustical testing confirming specified performance requirements.

3.4 CLOSEOUT ACTIVITIES

.1 Cleaning: On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment and perform cleaning as required by Section 01 74 23 – Final Cleaning.

END OF SECTION

Part 1 GENERAL

1.1 REFERENCES

.1 ASTM International

.1 ASTM A123/A123M-13, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

.2 ASTM A167-99(2009), Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.

.3 ASTM B456-11e1, Standard Specification for Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium.

.4 ASTM A653/A653M-13, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

.5 ASTM A924/A924M-13, Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.

.2 Canadian General Standards Board (CGSB)

.1 CGSB 31-GP-107MA-90, Non-inhibited Phosphoric Acid Base Metal Conditioner and Rust Remover.

.3 CSA International

.1 CSA B651-12, Accessible Design for the Built Environment.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00.

.2 Product Data:

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

.3 Shop Drawings:

.1 Indicate size and description of components, base material, surface finish inside and out, hardware and locks, attachment devices, description of rough-in-frame, building-in details of anchors for grab bars.

.4 Samples:

.1 Submit 1 sample for each accessory specified.

.2 Samples will be returned for inclusion into work.

1.3 CLOSEOUT SUBMITTALS

.1 Provide maintenance data for toilet and bath accessories for incorporation into manual specified in Section 01 78 00.

1.4 MAINTENANCE MATERIAL SUBMITTALS

.1 Tools:

.1 Provide special tools required for assembly, disassembly or removal for toilet and bath accessories in accordance with requirements specified in Section 01 78 00.

.2 Deliver special tools to Departmental Representative.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 and with manufacturer's written instructions.

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

.3 Storage and Handling Requirements:

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

.2 Store and protect toilet and bathroom accessories from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

.4 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding and packaging materials in accordance with Section 01 74 20.

Part 2 PRODUCTS

2.1 MATERIALS

.1 Sheet steel: to ASTM A653/A653M with ZF001 designation zinc coating, minimum 30% recycled content.

.2 Stainless steel sheet metal: to ASTM A167, Type 304, with satin finish, minimum 75% recycled content.

.3 Sustainability Characteristics:

.1 Laminate Adhesives.

.1 Urea Formaldehyde Free.

.4 Stainless steel tubing: Type 304, commercial grade, seamless welded, 1.2 mm wall thickness, minimum 75% recycled content.

.5 Fasteners: concealed screws and bolts hot dip galvanized, exposed fasteners to match face of unit. Expansion shields fibre, lead or rubber as recommended by accessory manufacturer for component and its intended use.

2.2 COMPONENTS

.1 Toilet tissue dispenser: double jumbo roll type, surface mounted, stainless steel frame, concealed mounting, capacity of two 255 mm diameter rolls, with sliding access panel for exposing one roll at a time.

.2 Combination towel dispenser/waste receptacle: surface mounted wall unit, approximately 430 mm wide, 1430 mm high, 190 mm deep. Interior of 0.8 mm galvanized steel, exterior of 0.8 mm stainless steel. Suitable for dispensing folded or roll paper towels. Removable galvanized steel waste receptacle, lockable access door with continuous full height stainless steel hinge.

.3 Soap dispenser: liquid push-in valve, self contained 1.14 L tank, stainless steel piston and valve assembly, tamper proof filler lock, surface mounted, exposed metal components chrome plated.

.4 Feminine napkin disposal bin: stainless steel, surface mounted unit, continuous hinged door, self closing, embossed with universally accepted symbol, removable stainless steel receptacles fitted with spring clip for deodorizer block.

.5 Straight Grab Bars: Standard duty 32 mm Ø satin finished type 304 stainless steel tube having nominal 1.2 mm wall thickness and slip resistant grip, concealed mounting plate and anchors with stainless steel cap secured using vandal resistant set screws, lengths as follows:

.1 GB1: 600 mm.

.2 GB2: 900 mm.

.6 Frameless Mirrors: As specified in Section 08 80 50.

2.3 FABRICATION

.1 Weld and grind joints of fabricated components flush and smooth. Use mechanical fasteners only where approved.

.2 Wherever possible form exposed surfaces from one sheet of stock, free of joints.

.3 Brake form sheet metal work with 1.5 mm radius bends.

.4 Form surfaces flat without distortion. Maintain flat surfaces without scratches or dents.

.5 Back paint components where contact is made with building finishes to prevent electrolysis.

.6 Hot dip galvanize concealed ferrous metal anchors and fastening devices to ASTM A123/A123M.

.7 Shop assemble components and package complete with anchors and fittings.

.8 Deliver inserts and rough-in frames to job site at appropriate time for building-in. Provide templates, details and instructions for building in anchors and inserts.

.9 Provide steel anchor plates and components for installation on studding and building framing.

Part 3 EXECUTION

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrates and surfaces to receive toilet and bathroom accessories previously installed under other Sections or Contracts are acceptable for product installation in accordance with manufacturer's instructions prior to toilet and bathroom accessories installation.

.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval from Departmental Representative.

3.2 INSTALLATION

.1 Install and secure accessories rigidly in place as follows:

.1 Stud walls: install steel back-plate to stud prior to plaster or drywall finish. Provide plate with threaded studs or plugs.

.2 Hollow masonry units, existing plaster or drywall: use toggle bolts drilled into cell or wall cavity.

.3 Solid masonry, marble, stone or concrete: use bolt with lead expansion sleeve set into drilled hole.

.4 Toilet and shower compartments: use male to female through bolts.

.2 Install grab bars on built-in anchors provided by bar manufacturer to OBC and CSA B651.

.3 Use tamper proof screws/bolts for fasteners.

.4 Fill units with necessary supplies shortly before final acceptance of building.

3.3 ADJUSTING

.1 Adjust toilet and bathroom accessories components and systems for correct function and operation in accordance with manufacturer's written instructions.

.2 Lubricate moving parts to operate smoothly and fit accurately.

3.4 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11.

.3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 20.

.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 toilet and bathroom accessories installation.

3.6 SCHEDULE

.1 Locate accessories where indicated on Drawings. Exact locations determined by Departmental Representative.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 06 10 00 – Rough Carpentry

1.2 REFERENCES

.1 CAN/CGSB-44.40-92, Steel Clothing Locker.

1.3 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Section 01 33 00.

.2 Indicate type and class of locker, thicknesses of metal, fabricating and assembly methods, assembled banks of lockers, tops rods hooks shelves bases, trim, numbering, filler panels, end/back panels, doors, handles, locking method, ventilation method and finishes.

1.4 SAMPLES

.1 Submit samples in accordance with Section 01 33 00.

.2 Submit duplicate 50 x 50 mm samples of colour and finish on actual base metal.

1.5 WASTE MANAGEMENT AND DISPOSAL

.1 Collect and separate plastic, paper packaging and corrugated cardboard in accordance with Waste Management Plan.

.2 Fold up metal banding, flatten and place in designated area for recycling.

Part 2 Products

2.1 MANUFACTURED UNITS

.1 Lockers: to CAN/CGSB-44.40, Type 1-Single full height locker, Class 2 - A bank of two or more lockers, freestanding.

.1 Size: 381 mm wide x 457 mm deep x 1524 mm high, steel thickness No.20 MSG.

.2 Assembly: welded construction.

.3 Top: sloped.

.4 Doors: one piece, double wall, envelope construction, steel thickness No.20 MSG.

.5 Door handle: recessed handle steel with nickel plated finish.

.6 3 hooks.

.7 1 shelf.

.8 Colour: to be selected by Departmental Representative from manufacturer’s complete range.

2.2 ACCESSORIES

.1 Locking system: padlocks supplied by locker manufacturer.

.2 Options: to CAN/CGSB-44.40, steel end panels, steel trim including corner angles jamb trim fillers, number plates manufacturer's standards coat hooks, metal zinc-plated finish.

Part 3 Execution

3.1 INSTALLATION

.1 Assemble and install lockers in accordance with manufacturer's written instructions.

.2 Securely fasten lockers to grounds and nailing strips.

.3 Install wall trim around recessed locker banks.

.4 Install filler panels (false fronts) where indicated and where obstructions occur.

.5 Install finished end panels to exposed ends of locker banks.

.6 Install locker numbers and locks.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 This Section includes provisions for motorized interior roller shades, recessed mounted in window bulkhead, and integrated with building Lighting Control System.

1.2 RELATED REQUIREMENTS

.1 Section 06 10 00 – Rough Carpentry: Miscellaneous carpentry for wood blocking and grounds for mounting roller shades and accessories.

.2 Section 26 09 23 – Lighting Control Equipment

1.3 REFERENCE STANDARDS

.1 American Architectural Manufacturer's Association (AAMA):

.1 AAMA 611-98, Voluntary Specification for Architectural Anodized Aluminum

.2 American National Standards Institute (ANSI)/Window Covering Manufacturers Association (WCMA):

.1 ANSI/ WCMA A100.1-2010, Safety of Corded Window Covering Products

.3 American Society for Testing and Materials (ASTM):

.1 ASTM B429-02, Standard Specification for Aluminum-Alloy Extruded Structural Pipe and Tube

.4 Underwriters Laboratories Canada (ULC):

.1 CAN/ULC S109-03 Flame Tests of Flame Resistant Fabrics and Films

1.4 ADMINISTRATIVE REQUIREMENTS

.1 Coordination:

.1 Coordinate with electrical and mechanical trades to connect motorized roller shades to electrical supply.

.2 Coordinate with lighting control system supplier and provide all required equipment to integrate lighting and shade control.

1.5 SUBMITTALS

.1 Provide required information in accordance with Section 01 33 00.

.2 Action Submittals: Provide the following submittals before starting any work of this Section:

.1 Product Data: Submit information for each type of product indicated including, but not limited to, the following:

.1 Styles, material descriptions, construction details, dimensions of individual components and profiles, features, and finishes.

.2 and mounting arrangements.

.3 Operating instructions

.2 Shop Drawings: Submit shop drawings indicating location and extent of roller shades including, but not limited to, the following:

.1 Elevations, sections, details, and dimensions not shown in submitted product data.

.2 Installation details, mountings, attachments to other work, operational clearances, and relationship to adjoining work.

.3 Samples:

.1 Verification Samples: Submit samples for verification of selected products as follows:

.1 Complete, full-size operable unit x 400 mm long minimum for each type of roller shade indicated.

.2 Single sample of shade material not less than 300 mm square, with specified treatments applied; mark top face of material.

.4 Schedule: Submit window shade schedule using same room designations as indicated on Drawings.

.3 Informational Submittals: Provide the following submittals when requested by the Departmental Representative:

.1 Coordination Drawings: Submit coordination drawings comprised of reflected ceiling plans drawn to scale and coordinating penetrations and ceiling mounted items including, but not limited to, the following:

.1 Ceiling suspension system members and attachment to building structure.

.2 Ceiling mounted or penetrating items including light fixtures; air outlets and inlets; speakers; sprinklers; recessed shades; and special mouldings at walls, column penetrations, and other junctures of acoustical ceilings using joining construction.

.3 Shade mounting assembly and attachment.

.4 Minimum Drawing Scale: 1:100

.2 Certificates: Submit product certificates for each type of roller shade product, signed by product manufacturer stating that materials installed match performance requirements specified in this Section.

1.6 PROJECT CLOSEOUT SUBMISSIONS

.1 Operation and Maintenance Data: Submit manufacturer's written instructions for operations and maintenance procedures, include name of original installer and contact information in accordance with Section 01 78 00 and as follows:

.1 Methods for maintaining roller shades and finishes.

.2 Precautions about cleaning materials and methods that could be detrimental to fabrics, finishes, and performance.

.3 Operating hardware.

.2 Submit manufacturer's standard maintenance contract for review and consideration by Departmental Representative.

1.7 QUALITY ASSURANCE

.1 Regulatory Requirements:

.1 Flame Spread Rating: Provide roller shade panel materials with flame spread and smoke developed characteristics required by Authority Having Jurisdiction, as determined by testing identical products in accordance with CAN/ULC S109.

.2 Qualifications:

.1 Installer: Installer experienced and that has completed installations of roller shades similar in material, design, and extent to that indicated in this Section; submit proof of capabilities when requested by Departmental Representative.

.2 Supplier: Obtain roller shades through one source from a single manufacturer, from a manufacturer approved supplier.

1.8 DELIVERY, STORAGE AND HANDLING

.1 Delivery and Acceptance Requirements: Deliver shades in factory packages, marked with manufacturer and product name, fire test response characteristics, and location of installation using same room designations indicated on Drawings and in a window shade schedule.

1.9 SITE CONDITIONS

.1 Site Measurements: Verify dimensions by site measurements before fabrication and indicate measurements on shop drawings where roller shades are indicated to fit between other construction; coordinate fabrication schedule with construction progress to avoid delaying the work, and as follows:

.1 Allow clearances for operable glazed units' operation hardware throughout the entire operating range.

.2 Notify Departmental Representative of discrepancies.

.2 Established Dimensions: Establish dimensions and proceed with fabricating roller shades without site measurements where site measurements cannot be made without delaying the Work; coordinate construction to ensure that actual site dimensions correspond to established dimensions; allow for trimming and fitting.

Part 2 Products

2.1 DESCRIPTION

.1 Mounting: Bulkhead, as indicated on Drawings, mounting permitting easy removal and replacement without damaging roller shade or adjacent surfaces and finishes.

.2 Direction of Roll: Regular, from back of roller or regular, from back of roller, and reverse, from front of roller, as indicated on Drawings for double roller shades.

2.2 PERFORMANCE REQUIREMENTS

.1 Roller window shade when lowered has fabric taught and without sagging, with bottom of shade fabric straight and level.

2.3 ASSEMBLIES

.1 Motorized Roller Shade Operators:

.1 General: Provide factory-assembled motorized shade operation systems designed for lifting shades of type, size, weight, construction, use, and operation frequency indicated. Provide operation systems of size and capacity and with features, characteristics, and accessories suitable for Project conditions and recommended by shade manufacturer, complete with electric motors and factory-prewired motor controls, remote-control stations, remote-control devices, power disconnect switches, enclosures protecting controls and all operating parts, and accessories required for reliable operation without malfunction. Include wiring from motor controls to motors. Coordinate operator wiring requirements and electrical characteristics with the building electrical system.

.2 Comply with NFPA 70.

.3 Control Equipment: Comply with NEMA ICS 1, NEMA ICS 2, and NEMA ICS 6.

.4 Electric Motors: UL-approved or -recognized, asynchronous, totally enclosed, insulated, capacitor-start motors, complying with NEMA MG 1, with thermal overload protection, brake, permanently lubricated bearings, and limit switches; sized by shade manufacturer to start and operate size and weight of shade considering service factor or considering Project's service conditions without exceeding nameplate ratings.

.1 Service Factor: According to NEMA MG 1, unless otherwise indicated.

.2 Motor Mounting: Within manufacturer's standard roller enclosure.

.5 Integration:

.1 Roller shades shall provide interface ready relay system to be controlled by Building Management System.

.2 Motors must connect to control system power panel.

.2 Materials

.1 Solar Shade Fabric: PVC-coated polyester and as follows:

.1 Material Width: To suit shades
.2 Fabric Openness Factor: 3 % openness
.3 Colour: To be selected by Departmental Representative from manufacturer’s complete range.

.2 Blackout Fabric: PVC-coated polyester and as follows:

.1 Material Width: To suit shades
.2 Fabric Openness Factor: 0 % openness
.3 Colour: To be selected by Departmental Representative from manufacturer’s complete range.

.3 Roller Components:

.1 Roller Tubes: One piece, extruded aluminum, 6061-T6 or 6063-T6, meeting the requirements of ASTM B429, or steel with galvanized or epoxy finish, and as follows:

.1 Protective Finish: AA-M12C22A21, medium matte anodic coating; clear coating 0.025 mm minimum in accordance with AMA 611. Roller tubes with mill finish are not acceptable.

.2 Tube Diameter and Thickness: As recommended by manufacturer for maximum allowable deflection of L/700.

.3 Tube Configuration: Tube profile with provision for mechanical engagement with the operator and drive assembly; and having channels to accept fabric spline attachment.

.4 Removable from brackets without hardware removal; non-metal components and self-lubricating.

.4 Fabric Spline: Extruded vinyl profile, welded to fabric panel, allowing removal and re-installation of shade fabric without removing the roller tube or hardware and having the following characteristics:

.1 Fabric bands or panels must be replaceable on site.

.2 Attachment of the fabric to the tube with double-sided adhesive tapes, adhesives, staples or rivets is not acceptable.

.5 Hem Bars and Hem Bar Pockets:

.1 Flat steel or aluminum profile; nominal 40 mm high having wall thickness engineered to suit loading requirements; slide hem bar into welded hem bar pocket with closed ends.

.3 Finishes: Anodized aluminum

.1 Colour: Clear anodized

.2 Metal Components Concealed From View:

.1 Aluminum: Mill finish

.2 Steel: Galvanized. Stainless steel acceptable.

.4 Fascia: L-shaped, formed-steel sheet or extruded aluminum; long edges returned or rolled; continuous panel concealing front and bottom of shade roller, brackets, and operating hardware and operators; length as indicated on Drawings; removable design for access.

.5 Mounting Brackets: Designed for continuous front or rear roll fascia across multiple shades without exposed fasteners, galvanized or zinc-plated steel fascia end caps, fabricated from steel finished to match fascia.

.6 Accessories:

.1 Fasteners: Non-corrosive fasteners as recommended by manufacturer.

Part 3 Execution

3.1 INSTALLATION

.1 Install roller shades level, plumb, square, true and according to manufacturer's written instructions. Allow clearances for window operation hardware.

.2 Install wiring from motor location to Power Panel and complete all Low Voltage connections at both motor location and power panel.

3.2 SITE QUALITY CONTROL

.1 Replace damaged roller shades that cannot be repaired, to appear new before time of Substantial Completion.

3.3 ADJUSTING

.1 Adjust and balance roller shades to operate smoothly, easily, safely, and free from binding or malfunction throughout entire operational range.

.2 Adjust and set roller shade travel length of operator assembly on-site without disassembly of hardware to suit travel length of shade panel.

3.4 CLOSEOUT ACTIVITIES

.1 Cleaning: Clean roller shade surfaces after installation, following manufacturer's written instructions.

3.5 PROTECTION

.1 Raise roller shades fully until Substantial Completion to protect fabric from construction related activities.

END OF SECTION

Part 1 GENERAL

1.1 DESIGN CRITERIA

.1 Comply with requirements of CSA B651-12, Accessible Design for the Built Environment.

.2 Design load: 9.5 kPa.

1.2 PRODUCT DATA SHEETS

.1 Submit product data sheets in accordance with Section 01 33 00.

1.3 SHOP DRAWINGS

.1 Submit shop drawings of each item specified, in accordance with Section 01 33 00.

1.4 SAMPLES

.1 Submit 100 x 100 mm sample of each mat type and edge frame.

Part 2 PRODUCTS

2.1 MATERIAL

.1 J-Frame: extruded aluminium to Aluminium Association Designation AA 6063-T5, clear anodized finish to DAF 45-2003(R2009).

.2 Tread rails: extruded aluminium to Aluminium Association Designation AA 6063-T52, mill finish.

.3 Key lock bars: extruded aluminium to Aluminium Association Designation AA 6061-T6, mill finish.

.4 Tread: two part epoxy, aluminum oxide grit, colour to be selected by Departmental Representative from manufacturer’s complete range.

.5 Tread: flexible 100% solid PVC open grid matt, one piece welded construction, dark grey.

.6 Aluminum pan: 1.5 mm thick aluminum sheet, waterproof pan.

.7 Stainless steel screws: #14.

.8 Primer and isolation coating: bituminous paint, acid and alkali resistant to CAN/CGSB-1.105-M91, Type 1 or 2, Ecologo certified.

.9 Sealing compound: high solids, polymer modified sealing compound, asphalt type to CAN/CGSB- 37.29-M89, Ecologo certified, recommended as caulking or bedding compound.

.10 Rubber: moulded, 30 to 40 durometer hardness.

.11 Cushion: continuous, vinyl.

2.2 RECESSED FOOT GRILLE

2.3 FABRICATION

.1 Fabricate work square, true, straight, level and free of distortion with joints closely fitted and properly secured. Provide adequate reinforcing and anchorage.

.2 Fabricate mats and frames in largest practical sized units to suit conditions.

.3 Where mat area exceeds manufacturer's recommended maximum mat size, provide 'T' style dividers to suit.

.4 Isolate dissimilar metals and metal to concrete or masonry with 2 coats of bituminous paint.

.5 Ream drill holes and leave exposed edges and surfaces clean and smooth.

.6 Include lead anchors and stainless steel fastenings necessary to anchor work.

.7 Provide frame around entire perimeter.

Part 3 EXECUTION

3.1 INSTALLATION

.1 Supply components and instructions for recesses and items built into work of other sections.

.2 Vacuum clean floor recesses prior to installing entrance mats.

.3 Inspect surface over which work is to be installed for irregularities detrimental to the application and performance of the work.

.4 Apply primer or isolation coating to aluminum in contact with concrete or masonry.

.5 Mitre aluminum mat frame corners.

.6 Set mat frames in continuous bead of sealing compound.

.7 Unroll entrance matting to allow matting to "relax" and store in room to be installed for 24 hours prior to installation.

.8 Install matting with slip resistant rib surface perpendicular to traffic flow.

.9 Avoid excessive stretching of mats while installing or repositioning mats.

.10 Install items plumb, straight and level to a tolerance of 1:500 in accordance with manufacturers written instructions.

END OF SECTION

Part 1 GENERAL

1.1 RELATED REQUIREMENTS

.1 Section 03 30 00 - Cast-In-Place Concrete: Elevator pit, elevator motor and pump foundation, and grouting thresholds.

.2 Section 05 50 01 – Metal Fabrications: Support for entrances and rails, hoisting beam at top of hoistway.

.3 Section 05 51 29 – Metal Stairs and Ladders: Pit ladder.

.4 Section 07 16 16 – Crystalline Waterproofing: Cementitious waterproofing of elevator pit walls and slab.

.5 Section 09 30 13 – Ceramic Tiling: Finish flooring in elevator car.

.6 Division 21 – Fire Suppression: Provision of pre-action sprinkler heads wired to shut off power to elevator equipment before activation of sprinklers.

.7 Division 22 – Plumbing: Provision of floor drain elevator pit connected to sump and oil separator outside of elevator pit.

.8 Division 23 – HVAC: Ventilation and temperature control of elevator equipment room.

.9 Section 26 05 08 – Elevator Equipment Connections

- .1 Electrical service to main disconnect for controller inside the hoistway.
- .2 Electrical service for controller inside the hoistway.
- .3 Controller and pit receptacles with ground fault current protection.
- .4 Communications wiring between the elevator room and the main telephone terminal board.

.10 Division 26 – Electrical:

- .1 Electrical power for elevator installation and testing.
- .2 Electrical disconnecting device to elevator equipment prior to activation of sprinkler system.
- .3 Lighting for controller inside the hoistway and in pit.

.11 Section 28 13 00 – Access Control: Provided by Departmental Representative

- .1 Access control module for elevator cab control panel and wiring to hoistway.

.12 Division 28 – Electronic Safety and Security:

- .1 Smoke detection sensors for top of elevator shaft and placement in machine room.

1.2 REFERENCES

.1 American National Standards Institute (ANSI)/National Electrical Manufacturers Association (NEMA)

- .1 ANSI/NEMA MG 1-2011, Motors and Generators.

.2 American Society for Testing and Materials (ASTM):

.1 ASTM A167-99(2009), Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.

.2 ASTM A276-10, Specification for Stainless and Heat-Resisting Steel Bars and Shapes.

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

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

.5 ASTM A1008/A1008M-12, Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High Strength Low-Alloy, High Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable.

.6 ASTM B221-08, Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.

.3 Canada Green Building Council (CaGBC)

.1 LEED Canada 2009 for Design and Construction- 2010, LEED Canada 2009 for Design and Construction Leadership in Energy and Environmental Design Green Building Rating System Reference Guide.

.4 CSA International (CSA):

.1 ASME A17.1/CSA B44-2013, Safety Code for Elevators and Escalators (Bi-national Standard, with ASME A17.1.

.2 CSA B651-12, Accessible Design for the Built Environment.

.3 CSA C22.1-09, Canadian Electrical Code Part l, Safety Standards for Electrical Installations.

.4 CSA C22.2 No.45-M1981 (R2008), Rigid Metal Conduit.

.5 CSA C22.2 No.56-04, Flexible Metal Conduit and Liquid-Tight Flexible Metal Conduit.

.6 CSA C22.2 No.141-02(R2007), Unit Equipment for Emergency Lighting.

.5 Underwriters' Laboratories of Canada Underwriters Laboratories Canada (ULC):

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

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

.3 CAN/ULC-S104-10, Standard Method for Fire Tests of Door Assemblies.

1.3 ADMINISTRATIVE REQUIREMENTS

.1 Pre-installation Meetings:

.1 Convene pre-installation meeting a minimum of 4 weeks prior to beginning on-site installation, with contractor's representative and Departmental Representative in accordance with Section 01 31 19 to:

.1 Verify project requirements.

.2 Review installation and substrate conditions.

.3 Co-ordination with other building construction subtrades.

.4 Review manufacturer's written installation instructions and warranty requirements.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for passenger elevator 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 Indicate on drawings project layout, including details and information as follows:

.1 Size and location of pumping unit, controller and other components.

.2 Size and location of car, hoisting beam, guide rails, buffers stands and other components in hoistway.

.3 Rail bracket spacing and maximum loads on guide rails.

.4 Reactions at points of support.

.5 Weights of principal components.

.6 Outside diameter and wall thickness of cylinder, plunger and piping, and working pressure.

.7 Length of plunger and cylinder.

.8 Top and bottom clearance and over travel of car.

.9 Wiring diagrams with location of circuit breaker, switchboard panel or disconnect switch, light switch and feeder extension points in machine room.

.10 Location in hoistway for connection of travelling cables for car light and telephone.

.11 Location and size of access doors.

.12 Loads on hoisting beams.

.13 Expected heat generation of equipment in shaftway.

.14 Seismic design data and detailed calculations.

.15 Include on general arrangement drawings:

.1 Type, size, location of hoistway entrances showing details of fastening to hoistway structure.

.4 Provide product data for:

.1 Operating fixtures, operating panels, signal fixtures and indicators.

.2 Doors and frame details.

.5 Samples:

.1 Submit duplicate 150 x 150 mm size samples, complete with colour schemes, for each as follows: floor material, car interior, car ceiling, car door, hoistway entrance door and frame finishes.

.6 Test Reports: submit certified test reports from approved independent testing laboratories indicating compliance with specifications for specified performance characteristics and physical properties.

.7 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.8 Manufacturer's Instructions: submit manufacturer’s installation instructions.

.9 Manufacturer's Site Services: submit copies of manufacturer's site reports.

.10 Sustainable Design Submittals:

.1 LEED Canada submittals: in accordance with Section 01 35 21.

.2 Construction Waste Management:

.1 Submit project Waste Management Plan highlighting recycling and salvage requirements.

.2 Submit calculations on end-of-project recycling rates, salvage rates, and landfill rates demonstrating that 75% of construction wastes were recycled or salvaged.

.3 Recycled Content:

.1 Submit listing of recycled content products used, including details of required percentages or recycled content materials and products, showing their costs and percentages of post-consumer and post-industrial content, and total cost of materials for project.

.4 Regional Materials: submit evidence that project incorporates required percentage 20% of regional materials and products, showing their cost, distance from project to furthest site of extraction or manufacture, and total cost of materials for project.

1.5 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00.

.2 Project Record Documents:

.1 Record actual locations of equipment, names of equipment manufacturers and suppliers, concealed conduit and boxes, concealed devices, disconnects and relays.

.3 Operation and Maintenance Data: submit operation and maintenance data for passenger elevators for incorporation into manual.

.1 Include description of elevator system's method of operation and control including motor control system, door operation, signals and special or non-standard features provided.

.2 Provide parts catalogues with complete list of equipment replacement parts with equipment description and identifying numbers.

.3 Legible schematic wiring diagrams covering electrical equipment installed, including changes made in final work, with symbols listed corresponding to identity or markings on controller and hoistway apparatus.

.4 Instruct Departmental Representative in maintenance of special finishes.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 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 Store and protect elevator components from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

.4 Develop Construction Waste Management Plan related to Work of this Section and in accordance with Section 01 35 21.

.5 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding and packaging materials as specified in Construction Waste Management Plan in accordance with Section 01 74 20 and Section 01 35 21.

1.7 ELEVATOR MAINTENANCE

.1 Include complete maintenance of elevator equipment for a period of 24 months from the date of the Certificate of Completion.

.2 Regularly, systematically, monthly examine, clean adjust and lubricate equipment.

.3 Repair or replace electrical and mechanical parts of elevator equipment as required due to defect and normal wear and tear.

.1 Departmental Representative assumes responsibility for cleaning, repairs or replacements of car enclosure, hoistway enclosure, hoistway doors and door frames due to other than defect and normal wear and tear.

.4 Perform work by competent personnel under supervision and in direct employ of elevator manufacturer or manufacturer's licensed agent.

.1 Do not assign or transfer maintenance service to any agent or subcontractor without prior written consent of Departmental Representative.

.5 Dress maintenance personnel in uniforms. Register with designated building personnel at time of inspections.

.6 Use only genuine standard parts produced by manufacturer of equipment.

.1 Maintain locally adequate stock of parts for replacement or emergency purposes and provide qualified mechanics to ensure fulfillment of this service without undue loss of time in reaching job site.

.7 Perform work during regular trade working hours to approved schedule.

.8 Include call-back service due to elevator stoppage or malfunction at all times at no additional cost.

1.8 WARRANTY

.1 For Work of this Section 14 24 23 – Hydraulic Passenger Elevators the 12 months warranty period prescribed in GC3.13 of General Conditions is extended to 24 months.

.1 Extended warranty period must include warranty against:

.1 Blistering, spalling or peeling of paint due to improper surface preparation or material application.

.2 Opening of joints due to improper design or use of ineffective fastening devices.

.3 Separation, cracking or splitting of plastic laminate due to improper application to core material, or to method of fabrication which gives rise to areas of high stress concentration or which restricts normal expansion or contraction of plastic laminate.

.2 Manufacturer’s Warranty: submit, for Departmental Representative's acceptance, manufacturer's standard warranty document executed by authorized company official.

Part 2 PRODUCTS

2.1 SYSTEM DESCRIPTION

.1 Design and construct elevator in accordance with CAN/CSA including Update #1 and all adopted supplements or revisions at time of bid, local codes and regulations.

2.2 ELEVATOR CHARACTERISTICS

.1 Select and install hydraulic passenger elevator components to form complete, operating elevator system meeting the following performance characteristics:

.1 Service: general purpose.

.2 Application: holeless dual piston.

.3 Quantity: 1.

.4 Rated net capacity: 1585 kg.

.5 Rated speed: 0.64 m/sec.

.6 Travel distance (nominal): 4.3 m.

.7 No. of stops: 2.

.8 No. of openings: 2 front.

.9 Inside car dimensions (nominal): 1965 mm wide x 1985 mm front to back.

.10 Cab Height: 2362 mm.

.11 Entrance Height: 2134 mm.

.12 Door size: 1067 mm x 2134 mm.

.13 Door type: single.

.14 Door operation: side opening in single speed.

2.3 ELEVATOR CONTROL OPERATION

.1 Two-Stop Automatic Operation: Include two-stop automatic elevator operation, as follows:

.1 Provide travelling cables and termination point on Car Operating Panel for card reader in accordance with Section 28 13 00. Car must remain inoperable until initiation of service by valid security card.

.2 Provide flush mounted operating device in car with stainless steel faceplate containing pushbuttons marked to correspond with two landings served, emergency stop switch, light switch arranged for restricted operation, door open button and alarm button.

.3 Provide single pushbutton with stainless steel faceplate at each landing.

.4 Arrange operation so that momentary pressure of car button for opposite terminal dispatches car to that terminal.

.5 Allow call registered by momentary pressure of landing buttons at any time to remain registered until car stops in response to that call at that landing.

.6 If car gate or hoistway door is not opened with short interval after car has stopped at terminal, arrange car to respond to call from other terminal.

.2 Car Stall Protective Circuit: Automatically return car to bottom landing and open power operated doors if cars should stall as result of relay failure, valve failure or low oil in system while ascending. Restore service by opening and reclosing main line switch.

.3 Two-Way Leveling:

.1 Include automatic two-way leveling device. Approach landing stops at reduced speed from either direction of travel.

.2 Level with accuracy of 10 mm under varying load conditions.

.3 Maintain car floor within 10 mm level with landing floor with two-way automatic maintaining leveling device.

.4 Emergency Operation: Include means to automatically return the elevator to the lowest landing upon failure of normal power supply. Include door operation.

.5 Hall Calls:

.1 Elevator to answer hall calls during working day; within following times:

.1 95% of calls within 10 seconds maximum.

.2 Include smooth acceleration and deceleration of car without perceptible steps so adjusted as not to cause passenger discomfort.

.3 Elevator to travel between typical floors in not more than 6 seconds.

.1 Measure time from instant doors start to close until car has stopped level with next floor.

.4 Permit doors to start opening in advance of stop at floor level such that doors are at least 3/4 open when car is stopped level with floor.

.6 Automatic Self Levelling Feature: install self-levelling feature which will automatically bring car to floor landings. Correct for over-travel, independent of operating device.

.1 Maintain car floor level within 10 mm of landing floor with two-way automatic maintaining levelling device.

.7 Tolerances: car movement on guide rails: smooth movement, with no perceptible lateral or oscillating movement or vibration.

.8 Seismic Design Criteria: design and assemble elevator equipment and components to withstand earthquake forces in accordance with NBC, Zone 1 requirements.

.1 Include adjustable seismic trigger switches to operate elevators whenever predetermined level of seismic acceleration is detected:

.1 Stop elevator at next available stop.

.9 Controller location: in hoistway wall.

2.4 SYSTEM DESCRIPTION

.1 Holeless Hydraulic general purpose passenger elevator, machine-room less application.

.1 Holeless hydraulic compact machine located at bottom of hoistway.

.1 The hydraulic system with hydraulic-fluid storage tank, power component and valves located in the hoistway pit and accessible for maintenance either in the pit or through an access door in the hoistway wall.

.2 Double compartment operation.

.3 Accessible Design in accordance with CSA B651.

.4 Bilingual Markings: include identification and instructions on operating panels and on signal equipment in English and French except where design is such that inference is obvious and readily understood.

.2 Design and construct elevator in accordance with ASME A17.1/CSA B44, local codes and regulations.

2.5 PERFORMANCE REQUIREMENTS

.1 Select and install hydraulic passenger elevator components to form complete, operating elevator system meeting the following performance characteristics:

.1 Service: general purpose.

.2 Application: holeless dual piston.

.3 Quantity: 1.

.4 Rated net capacity: 1585 kg.

.5 Rated speed: 0.64 m/sec.

.6 Travel distance (nominal): 4.3 m.

.7 No. of stops: 2.

.8 No. of openings: 2 front.

.9 Inside car dimensions (nominal): 1965 mm wide x 1985 mm front to back.

.10 Cab Height: 2362 mm.

.11 Entrance Height: 2134 mm.

.12 Door size: 1067 mm x 2134 mm.

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.2 Hall Calls:

.1 Elevator to answer hall calls during working day; within following times:

.1 95% of calls within 10 seconds maximum.

.2 Include smooth acceleration and deceleration of car without perceptible steps so adjusted as not to cause passenger discomfort.

.3 Elevator to travel between typical floors in not more than 6 seconds.

.1 Measure time from instant doors start to close until car has stopped level with next floor.

.4 Permit doors to start opening in advance of stop at floor level such that doors are at least 3/4 open when car is stopped level with floor.

.3 Light Intensity: 215 lx maximum measured 0.75 m above floor.

.4 Ventilation: ventilate by 2 speed 90 cfm exhaust air handling unit through roof and through concealed perforations at base.

.1 Limit total fan noise to 55dB on "A" scale of General Radio Sound Level meter type 1551A from reading 0.9 m above floor with fan on high speed.

2.6 MATERIALS AND COMPONENTS

.1 Materials: as required to achieve specified performance requirements; functionally compatible with adjacent materials and components.

.1 Use major elevator components from standard product line of one manufacturer unless otherwise approved by Departmental Representative.

.2 Use components only which have performed satisfactorily together under conditions of normal use in not less than two other elevator installations of similar design and for a period of at least one year. Furnish names and addresses of Engineers or managers of buildings, in which proposed combination of major components has so performed.

.2 Steel sheet metal: to ASTM A1008/A1008M. Cold-rolled sheet, commercial quality; to ASTM A653/A653M, minimum 25% recycled content.

.3 Stainless steel sheet metal: to ASTM A167, Type 304 with satin finish, minimum 25% recycled content.

.4 Stainless steel bars, wire and shapes: to ASTMA276, Type 304 with satin finish.

.5 Provide fastenings concealed from public view designed to withstand normal use.

.6 Include telephone wiring within elevator hoistway.

.7 Include access control /security module wiring within elevator cab and hoistway.

.1 Access control module: Division 28.

2.7 CAR PLATFORM

.1 Include car platforms as follows:

.1 Provide structural steel car platform frame filled with 38 mm plywood subflooring.

2.8 CAR CAB

.1 Enclose car sides except entrances suitable for removing or resurfacing for maintenance purposes.

.2 Panels: removable, retained securely with hidden fastenings. Design for removal of panels from inside car.

.1 Face panels with materials of flame spread rating of 25 or less and trim edges.

.3 Floor and ceiling: Manufacturer’s standard.

.1 Attach with flush mechanical fasteners.

.4 Floor to accept ceramic tile and setting bed specified in Section 09 30 13, flush with sill.

.5 Walls: finish stainless steel with No. 4 (satin) finish panels.

.6 Ceiling: Manufacturer’s standard flat steel ceiling with four downlights.

.1 Lighting: Integrated LED fixtures with trim to match ceiling finish.

.2 Finish: Manufacturer’s standard brushed steel finish.

.7 Doors: Manufacturer’s standard satin finished stainless steel

.8 Bumper rail: 13 mm x 50 mm flat stainless steel with No. 4 (satin) finish.

.9 Pad hooks: Stainless steel buttons; Manufacturer’s standard layout.

.10 Wall mats: one set canvas covered, padded with fill material and sewn.

.11 Where required by enforcing authority furnish license holders in each elevator car to suit certificate issued by enforcing authority.

.1 Design holder with hidden or tamper proof fastening.

.12 Car doors and frames: doors of sandwich panel construction. Frames of rolled sections, rigid construction.

.13 Clear height under car ceiling: 2165 mm.

.14 Clear car entrance height: 2.1 m.

.15 Signal devices and fixtures:

.1 Indicator panel: above operating panel with illuminated position indicators.

.2 Car operating panel: Manufacturers standard operating panel containing push buttons, key switches, and message indicators for elevator operation, with satin finished stainless steel.

.3 Fixtures: Stainless steel, satin finish operating buttons hinged swing car operating panel containing a bank of round metal mechanical illuminated buttons; flush mounted to panel; illuminate buttons with white LED halo illumination with flat flush targets with satin stainless steel finish.

.4 Equip car operating panel with the following:

.1 Raised markings and Braille to left hand side of each push button, marked to correspond to landings served.

.2 Illuminated floor buttons.

.3 Door open and door close buttons.

.4 Rough-in for Access control / security device module.

.1 Device supplied by Section 28 13 00.

.5 Light key switch.

.6 Fan key switch.

.7 Inspection key switch.

.8 Elevator data plate marked with elevator capacity and car number.

.9 Illuminated alarm button with raised markings.

.10 Help button that initiates two-way communication between car and a location inside the building, switching over to another location if call is unanswered, where personnel are available who can take appropriate action; include visual indicators for call initiation and call acknowledgement.

.1 Identify name of building on panel cover.

.11 Landing signal, sounding a chime bell in car to signal that car is stopping at served floor.

.16 Emergency lighting: Provide battery operated emergency lighting equipment, to CSA C22.2 No.141, to provide general illumination and 10 lx minimum illumination in car at operating panels and telephone cabinet for 4 hours minimum.

.1 Key operated switch for manual testing of unit from within car.

.2 Battery unit of sufficient strength to support 90 kg person without causing malfunction or damage.

.3 Means to contain leakage or spillage of electrolyte.

2.9 CARTOP CONTROLS

.1 Provide car top operation station, complete with guarded light, 110 volt 15 amp. receptacle, INSPECTION and STOP control buttons, as well as car direction buttons.

.1 Fixture shall be mounted to car crosshead, and be readily accessible from landing side of hoistway.

.2 Receptacle shall be GFCI type.

2.10 PIT

.1 Install a switched guarded light fixture in the pit. Locate switch in the hoistway near and easily reachable from jamb side of door.

.2 Install a GFCI receptacle in the pit.

.3 Install stop switch.

2.11 HOIST WAY ENTRANCE COMPONENTS

.1 Car and hoistway door operator:

.1 Operate car and hoistway doors at each hoistway entrance simultaneously, quietly and smoothly, without vibration, slam or shock, by electric operator located on car.

.2 Open doors automatically as car is levelling.

.2 Door protective devices:

.1 Include door protective device extending full height of clear opening and projecting beyond leading edge of each door panel.

.2 Should this device touch person or object while car door is closing, return car and hoistway doors to open position.

.3 Arrange to retract noiselessly at both limits of travel.

.4 Design and adjust device to cause doors to stop and reopen before doors contact object or person.

.5 Light ray device: Include additional door protection by means of two horizontal infra-red light rays projected across elevator car entrance approximately 125 mm and 740 mm respectively above threshold.

.6 After stop is made, hold doors open for predetermined adjustable interval, unless closing is initiated sooner by registration of car call.

.3 Car and hoistway door hangers and gibs:

.1 Include two-point suspension door hangers for each door panel with resilient sound absorbing wearing surfaces and replaceable hanger tracks.

.2 Use ball or roller bearings sealed to retain grease lubrication and wipers to maintain rollers and track in clean condition.

.3 Absorb upthrust with adjustable eccentric rollers equipped with ball or roller bearings.

.4 Design for replacement of gibs without removing door from hanger tracks.

.4 Metal entrances: Provide at all floors, elevator entrances as shown on plan.

.1 Assume complete and undivided responsibility for entire installation including doors, frames, structural supporting angles, headers, fasciae or toeguards, hangers, and sills.

.2 Cushion opening doors with rubber bumpers and closing doors with rubber bumpers on strike jambs.

.5 Flush type hoistway doors:

.1 Construct doors of flush type steel sheets for typical floors. Use stainless steel for lobby side of hoistway doors on both floors.

.2 Reinforce doors to receive attachments and to withstand strains due to power operation.

.3 Include sight guards.

.6 Fire rated entrances: Provide fire protection rated elevator closures, produced under label service program of ULC or other agency acceptable to authorities having jurisdiction.

.1 Fire Rating: 1 Hr.

.2 Affix ULC or other acceptable agency label to elevator closures.

2.12 SILLS

.1 Include extruded aluminum sills with anti-slip wearing surfaces to ASTM B221 alloy 6351-T6.

.2 Grout sills in position providing up to 50 mm in thickness as required.

.3 Include sill supports, where required and design for class of loading.

.4 Do not use exposed fastenings.

2.13 FASCIAE OR TOEGUARDS

.1 Include steel fasciae or toeguards 1.5 mm thick minimum where necessary to reduce running clearance to 30 mm.

.2 Extend fasciae and toeguards at least 75 mm beyond clear entrance.

2.14 GUIDE RAILS AND BRACKETS

.1 Erect guide rails plumb and parallel within maximum deviation of 3 mm.

.2 Use metal shims only and provide lockwashers under all nuts and tapped bolts.

.3 Compensate for expansion and contraction of guide rails.

.4 Use splice plates and guide rails with contact surfaces accurately machined to form smooth joints.

.5 In steel structures, bolt or weld brackets directly to steel hoistway framing.

.6 Where Departmental Representative considers any masonry fastener improperly installed, either replace fastener or demonstrate stability of fastener by performing on site test under which fastener is subjected to four times manufacturer's safe pullout or working load.

.7 Anchor guide rails in pit so as not to reduce effectiveness of waterproofing.

.8 Include steel reinforcement and backing for car guide rails where necessary.

2.15 GUIDE RAIL LUBRICATORS

.1 Include guide rail lubricators to distribute oil evenly.

.2 Include oil tight drip pan beneath each guiderail in pit.

2.16 ROLLER GUIDES

.1 Equip car with roller guides mounted on top and bottom of car frame.

.2 Provide each guide with, durable oil resistant resilient tired ball bearing rollers running on three finished rail surfaces.

.3 Do not lubricate guide rails. Maintain each roller on its respective guide in uniform contact with rail surface at all times by means of substantial springs or by resilient mountings.

.4 Provide guide operation which is inaudible to passengers in car or outside hoistway with car operating at rated speed and car fan turned off.

.5 Use tire material which will not develop flatspots after standing idle for 24 h under average environmental conditions.

.6 Balance car.

2.17 GUIDE SHOES

.1 Use swivel type guide shoes for car. Assemble on metal base to permit self-alignment.

.2 Equip each shoe with renewable, non-metallic wearing gibs or inserts and spring take up for side play between guide rails.

.3 Include renewable wearing gibs made of durable non-metallic material having low coefficient of friction and long wearing qualities when operated on guide rails receiving infrequent light applications of rail lubricant.

.4 Do not use gibs containing graphite or extreme pressure type lubricants which may adversely affect performance of safety.

.5 Use solid type guide shoes for car, of metal construction, fitted with renewable cast-iron wearing gibs or inserts.

2.18 CYLINDER AND PLUNGER

.1 Construct plunger of selected steel tubing machined true and finished to surface finish of 0.0008 mm roughness height rating or better.

.2 Design and install cylinder and plunger plumb. Operate with minimum friction.

.3 Do not use a plunger follower guide.

2.19 PUMPING UNIT

.1 Design pumping unit as an integral unit combining motor, pump, valves and reservoir in one enclosure.

.2 Reduce airborne noise with sound deadening material on inside of enclosure or submerge pump and motor in oil reservoir.

.3 Provide swing panels or panels equipped with quick release fasteners for convenient access to parts of equipment requiring adjustment.

.4 Use positive displacement screw-type pump, with multiple V-belt connection to drive motor or with direct connection between drive motor and pump through flexible coupling, specially designed for quiet service.

.5 Install thermostatically controlled heaters if required, or other means to maintain fluid viscosity within limits necessary to provide consistent, reliable operation at all times.

.6 Install thermostatic protection for high oil temperature in reservoir where pump or motor is submerged in reservoir.

.7 Muffler: Minimize transmission of fluid pulsations in pipeline between pumping unit and cylinder head with blow-out proof muffler.

.8 Piping:

.1 Use threaded couplings or mechanical couplings which mechanically prevent separation of adjoining members.

.2 Welding is permitted providing interior of pipe is thoroughly cleaned after welding or where welding method prohibits introduction of foreign material into interior of pipe.

.3 Provide sound isolation couplings in pipeline between pump and cylinder.

.4 Locate piping where it can be serviced.

.9 Muffler: Minimize transmission of fluid pulsations in pipeline between pumping unit and cylinder head with blow-out proof muffler.

.10 Low oil control: Provide low oil control feature designed to automatically cause up-travelling car to descend to lower terminal landing if reservoir oil level is insufficient.

.1 Arrange control so that oil reservoir is refilled before elevator can be returned to service.

.2 Open car and hoistway doors automatically at lower terminal landing. Inactivate control buttons in car operating panel, except door-open button, and close hoistway doors.

2.20 CONTROLLERS AND CABINETS

.1 Enclose controllers in enameled ventilated sheet steel cabinets. Include hinged doors for easy access to CSA C22.2 No.14.

.2 Include direct current operating and control circuits.

.3 Provide similar switch and relay units of the same manufacturer and clearly identify controller components and terminal connections to agree with wiring diagrams.

.4 Use two main line contractors to avoid possibility of continued operation of pump if one switch should fail.

2.21 HOISTWAY ACCESS

.1 Provide cartop access by means of a keyed access system. Locate access switch in or near top floor door frames. Access switch shall be enabled from keyed switch within the car. The access switch shall be of continuous-pressure spring-return type with the key removable only when in the off position. Car speed not to exceed 0.75 m/sec.

.2 Provide pit access by means of lunar key or approved equivalent.

.3 Provide mechanical unlocking devices on all entrances, including those with access key switch.

2.22 HALLWAY FIXTURES LATERNS AND CHIMES

.1 Hall Fixtures: Stainless steel, satin finish round operating buttons having necessary push buttons; flat flush illuminated with white LED on activation; with satin stainless steel finish.

.2 Hall Lantern and Chime: Directional lantern visible from corridor mounted at each hall entrance that indicates direction car is travelling with chime sound when car stops and doors are opening.

2.23 WELDING

.1 Where welding is used for cylinder and pressure piping, prepare joints and weld in approved manner using welders fully qualified for pressure vessel welding.

.2 Where directed, subject welds to radiographic or other non-destructive inspection.

.3 Identify field welds with welder's identification stamp.

2.24 POWER SUPPLY

.1 Equipment Power: 600 V, 50 A, 3 phase, #6 wire, 60 Hz, alternating current.

.2 Lighting: 120 V, 15 A, single phase, #12 wire, 60 Hz, alternating current.

2.25 ELECTRICAL COMPONENTS

.1 Motor:

.1 Do not exceed EEMAC design B locked rotor current.

.2 Design for minimum locked rotor torque of 150% and minimum breakdown torque of 200% at normal voltage.

.3 Provide data plate on motor showing motor connections.

.4 Where reduced voltage starting is provided, switch to full voltage not more than 1.5 seconds after interlock circuit is established.

.5 Limit starting current of elevator motor to not more than 4 times full load running current.

.6 Include class B motor insulation.

.7 Include manually reset integral overheating protection to CSA C22.2 NO.77.

.2 Conductors and Travelling Cables: Include minimum 10% spare conductors and two pairs of shielded audio cables in travelling cable.

.1 Travelling cable will terminate in machine room and at underside of car platform, there will be no halfway box. Travelling cable to meet CSA designation "EO" to maintain flexibility in extreme weather conditions.

.2 Provide a separate insulated bonding wire in every conduit or raceway and bond all metal enclosures to ground. Do not use armoured flexible metal conduit as grounding conductor.

.3 Do not parallel conductors to increase current carrying capacity unless individually fused.

.4 Provide additional wiring as required, to suit machine room layout.

.3 Conduits:

.1 Rigid metal conduit: to CSA C22.2 No.45, galvanized steel or hot dipped galvanized steel threaded.

.2 Flexible metal conduit: to CSA C22.2 No.56, liquid-tight flexible metal.

.3 Fittings: manufactured for use with conduit specified. Coating: same as conduit.

.1 Use steel compression type fittings where electrical metallic tubing is used. Fittings with set screws are not acceptable unless a separate identified grounding conductor is also installed inside raceway.

.2 Watertight connectors and couplings for EMT. Set-screws are not acceptable.

Part 3 EXECUTION

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for elevator 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 MANUFACTURER'S INSTRUCTIONS

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

3.3 INSTALLATION

.1 Install hoistway, machine room, and other elevator materials and components in accordance with ASME A17.1/CSA B44, local codes, regulations and manufacturer's written instructions.

3.4 SITE QUALITY CONTROL

.1 Manufacturer's Site 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 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.

3.5 SITE TESTS

.1 Perform and meet all tests and inspections required by TSSA and or ASME A17.1/CSA B44 Safety Code for Elevators and Escalators.

.2 Supply instruments and execute specific tests.

.3 Furnish test and approval certificates issued by jurisdictional authorities.

.4 Conduct tests at agreed time during 24 month warranty period, and with building normally occupied using normal building traffic, conduct tests to verify performance. Furnish event recording of hall call registrations, time initiated, and response time throughout entire normal working day.

3.6 CLEANING

.1 Remove protective coverings from finished surfaces and components.

.2 Clean surfaces and components ready for inspection.

3.7 ADJUSTING

.1 Adjust door opening and closing times to suit handicapped users in accordance with Departmental Representative instructions.

.2 Adjust control system to cause elevators to answer hall calls during working day within performance criteria specified.

.3 Adjust for smooth acceleration and deceleration of car so as not to cause passenger discomfort.

.4 Adjust automatic floor levelling feature at each floor.

3.8 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11.

.1 Remove protective coverings from finished surfaces and components.

.2 Clean surfaces and components ready for inspection.

.3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 20.

.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.9 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by passenger elevator installation.

3.10 MAINTENANCE

.1 Systematically; monthly examine, clean, adjust, and lubricate equipment as per planned maintenance tasks and frequencies.

.1 Repair or replace electrical and mechanical parts of elevator equipment as required due to defect and normal wear and tear.

.2 Use genuine parts produced by the manufacturer of specific equipment.

.2 Provide call-back service due to elevator stoppage or malfunction at all times at no additional cost.

.1 Repair or replace electrical and mechanical parts of elevator equipment as required due to defect and normal wear and tear.

.2 Use genuine parts produced by the manufacturer of specific equipment.

.3 Submit maintenance reports to Departmental Representative.

END OF SECTION

Part 1 GENERAL

1.1 REFERENCES

.1 Canada Green Building Council (CaGBC)

.1 LEED Canada 2009 for Design and Construction-2010, LEED Canada 2009 for Design and Construction Leadership in Energy and Environmental Design Green Building Rating System Reference Guide.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00.

.2 Submit for approval within 4 weeks after Award of Contract.

.3 Shop drawings to show:

.1 Mounting arrangements.

.2 Operating and maintenance clearances.

.3 Performance information.

.4 Wiring diagrams.

.5 Installation details.

.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: 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.

.2 Operation and maintenance manual approved by, and final copies deposited with, Departmental Representative before final inspection.

.3 Operation data to include:

.1 Control schematics for systems including environmental controls.

.2 Description of systems and their controls.

.3 Description of operation of systems at various loads together with reset schedules and seasonal variances.

.4 Operation instruction for systems and component.

.5 Description of actions to be taken in event of equipment failure.

.6 Valves schedule and flow diagram.

.7 Colour coding chart.

.4 Maintenance data to include:

.1 Servicing, maintenance, operation and trouble-shooting instructions for each item of equipment.

.2 Data to include schedules of tasks, frequency, tools required and task time.

.5 Performance data to include:

.1 Equipment manufacturer's performance datasheets with point of operation as left after commissioning is complete.

.2 Equipment performance verification test results.

.3 Special performance data as specified.

.4 Testing, adjusting and balancing reports as specified in Section 23 05 93.

.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 reproducible mechanical drawings. Provide sets of white prints as required for each phase of work. Mark changes as work progresses and as changes occur. Include changes to existing mechanical systems, control systems and low voltage control wiring.

.2 Transfer information weekly to reproducibles, revising reproducibles to show work as actually installed.

.3 Use different colour waterproof ink for each service.

.4 Make available for reference purposes and inspection.

.9 As-built drawings and specifications:

.1 Prior to start of Testing, Adjusting and Balancing for HVAC, finalize production of as-built drawings.

.2 Identify each drawing in lower right hand corner in letters at least 12 mm high as follows: - "AS BUILT DRAWINGS: THIS DRAWING HAS BEEN REVISED TO SHOW MECHANICAL SYSTEMS AS INSTALLED" (Signature of Contractor) (date).

.3 Submit to Departmental Representative for approval and make corrections as directed.

.4 Perform testing, adjusting and balancing for HVAC using as-built drawings and specifications.

.5 Submit completed reproducible as-built drawings and specifications with Operating and Maintenance Manuals.

.10 Submit copies of as-built drawings and specifications for inclusion in final TAB report.

.11 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.

.12 In addition to transmittal letter referred to in Section 01 33 00: use MCAC "Shop Drawing Submittal Title Sheet". Identify section and paragraph number.

.7 Sustainable Design Submittals:

.1 LEED Canada submittals: in accordance with Section 01 35 21.

.2 Construction Waste Management:

.1 Submit project Waste Management Plan highlighting recycling and salvage requirements.

.2 Submit calculations on end-of-project recycling rates, salvage rates, and landfill rates demonstrating that 75% of construction wastes were recycled or salvaged.

.3 Building Energy and Water Consumption: submit Measurement and Verification Plan following IPMVP:

.1 Lighting systems and controls.

.2 Constant and variable motor loads.

.3 Variable frequency drive (VFD) operation.

.4 Chiller efficiency at variable loads (kW/ton).

.5 Cooling load.

.6 Air and water economizer and heat recovery cycle.

.7 Air distribution static pressures and ventilation air volumes.

.8 Boiler efficiencies.

.9 Building-related process energy systems and equipment.

.10 Indoor water risers and outdoor irrigation systems.

.4 Recycled Content:

.1 Submit listing of recycled content products used, including details of required percentages or recycled content materials and products, showing their costs and percentages of post-consumer and post-industrial content, and total cost of materials for project.

.5 Regional Materials: submit evidence that project incorporates required percentage 20% of regional materials and products, showing their cost, distance from project to furthest site of extraction or manufacture, and total cost of materials for project.

1.3 HALOCARBONS

.1 Comply with Federal Halocarbon Regulations 2003 under the Canadian Environmental Protection Act 1999, EPAM and PWGSC Ontario Region Halocarbon Information Sheet dated March 2010.

1.4 QUALITY ASSURANCE

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

.2 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 35 29.

1.5 MAINTENANCE

.1 Furnish spare parts in accordance with Section 01 78 00 as follows:

.1 One set of packing for each pump.

.2 One casing joint gasket for each size pump.

.3 One glass for each gauge glass.

.4 One filter cartridge or set of filter media for each filter or filter bank in addition to final operating set.

.2 Provide one set of special tools required to service equipment as recommended by manufacturers and in accordance with Section 01 78 00.

.3 Furnish one commercial quality grease gun, grease and adapters to suit different types of grease and grease fittings.

1.6 DELIVERY, STORAGE, AND HANDLING

.1 Waste Management and Disposal:

.1 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse and recycling in accordance with Section 01 74 20.

1.7 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00.

.2 Operation and Maintenance Data: submit operation and maintenance data for incorporation into manual.

.1 Operation and maintenance manual approved by, and final copies deposited with, Departmental Representative before final inspection.

.2 Operation data to include:

.1 Control schematics for systems including environmental controls.

.2 Description of systems and their controls.

.3 Description of operation of systems at various loads together with reset schedules and seasonal variances.

.4 Operation instruction for systems and component.

.5 Description of actions to be taken in event of equipment failure.

.6 Valves schedule and flow diagram.

.7 Colour coding chart.

.3 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.

.4 Performance data to include:

.1 Equipment manufacturer's performance datasheets with point of operation as left after commissioning is complete.

.2 Equipment performance verification test results.

.3 Special performance data as specified.

.4 Testing, adjusting and balancing reports as specified in Section 23 05 93.

.5 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.

.6 Additional data:

.1 Prepare and insert into operation and maintenance manual additional data when need for it becomes apparent during specified demonstrations and instructions.

.7 Site records:

.1 Departmental Representative will provide 1 set of reproducible mechanical drawings. Provide sets of white prints as required for each phase of work. Mark changes as work progresses and as changes occur.

.2 Transfer information weekly to reproducibles, revising reproducibles to show work as actually installed.

.3 Use different colour waterproof ink for each service.

.4 Make available for reference purposes and inspection.

.8 As-Built drawings:

.1 Prior to start of Testing, Adjusting and Balancing for HVAC, finalize production of as-built drawings.

.2 Identify each drawing in lower right hand corner in letters at least 12 mm high as follows: "AS BUILT DRAWINGS: THIS DRAWING HAS BEEN REVISED TO SHOW MECHANICAL SYSTEMS AS INSTALLED" (Signature of Contractor) (Date).

.3 Submit to Departmental Representative for approval and make corrections as directed.

.4 Perform testing, adjusting and balancing for HVAC using as-built drawings.

.5 Submit completed reproducible as-built drawings with Operating and Maintenance Manuals.

.9 Submit copies of as-built drawings for inclusion in final TAB report.

1.8 MAINTENANCE MATERIAL SUBMITTALS

.1 Submit in accordance with Section 01 78 00.

.2 Furnish spare parts as follows:

.1 One set of packing for each pump.

.2 One casing joint gasket for each size pump.

.3 One head gasket set for each heat exchanger.

.4 One glass for each gauge glass.

.5 One filter cartridge or set of filter media for each filter or filter bank in addition to final operating set.

.3 Provide one set of special tools required to service equipment as recommended by manufacturers.

.4 Furnish one commercial quality grease gun, grease and adapters to suit different types of grease and grease fittings.

1.9 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 and with manufacturer's written instructions.

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

.3 Storage and Handling Requirements:

.1 Store materials indoors, 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 Develop Construction Waste Management Plan related to Work of this Section and in accordance with Section 01 35 21.

.5 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding and packaging materials as specified in Construction Waste Management Plan in accordance with Section 01 74 20.

Part 2 PRODUCTS

2.1 MATERIALS

.1 Complete list of equipment and materials to be used on this project and forming part of bid documents by adding manufacturer's name, model number and details of materials, and submit for approval.

Part 3 EXECUTION

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Departmental Representative.

.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 PAINTING REPAIRS AND RESTORATION

.1 Do painting in accordance with Section 09 91 23.

.2 Prime and touch up marred finished paintwork to match original.

.3 Restore to new condition, finishes which have been damaged.

3.3 SYSTEM CLEANING

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

3.4 FIELD QUALITY CONTROL

.1 Manufacturer's Field Services:

.1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS.

.2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.

3.5 DEMONSTRATION

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

.2 Supply tools, equipment and personnel to demonstrate and instruct operating and maintenance personnel in operating, controlling, adjusting, trouble-shooting and servicing of all systems and equipment during regular work hours, prior to acceptance.

.3 Use operation and maintenance manual, as-built drawings, and audio visual aids as part of instruction materials.

.4 Instruction duration time requirements as specified in appropriate sections.

.5 Departmental Representative will record these demonstrations on video tape for future reference.

3.6 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11.

.3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 20.

.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

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 REFERENCES

.1 Canada Green Building Council (CaGBC)

.1 LEED Canada For New Construction and Major Renovations 2009.

.2 National Fire Prevention Association (NFPA)

.1 NFPA 13-2013, Standard for the Installation of Sprinkler Systems.

.2 NFPA 20-2013, Standard for the Installation of Stationary Pumps for Fire Protection.

.3 NFPA 24-2013, Standard for the Installation of Private Fire Service Mains and Their Appurtenances.

.4 NFPA 25-2014, Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems.

.3 Underwriter's Laboratories of Canada (ULC)

.1 CAN/ULC-S543-09, Standard for Internal Lug Quick Connect Coupling for Fire Hose.

.2 CAN/ULC-S543-09-AM1, Amendment 1 to Standard for Internal Lug Quick Connect Coupling for Fire Hose.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00.

.2 Product Data:

.1 Provide manufacturer's printed product literature and data sheets, 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 Indicate:

.1 Materials.

.2 Finishes.

.3 Method of anchorage

.4 Number of anchors.

.5 Supports.

.6 Reinforcement.

.7 Assembly details.

.8 Accessories.

.4 Samples:

.1 Submit samples of following:

.1 Each type of sprinkler head.

.2 Signs.

.5 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.

.6 Certificates:

.1 Submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.7 Manufacturers' Instructions:

.1 Provide manufacturer's installation instructions.

.8 Field Quality Control Submittals:

.1 Manufacturer's Field Reports: manufacturer's field reports specified.

.9 Sustainable Design Submittals:

.1 LEED Canada-NC Submittals: in accordance with Section 01 35 21.

1.3 CLOSEOUT SUBMITTALS

.1 Provide operation, maintenance and engineering data for incorporation into manual specified in Section 01 78 00 in accordance with NFPA 20.

.2 Manufacturer's Catalog Data, including specific model, type, and size for:

.1 Pipe and fittings.

.2 Alarm valves.

.3 Valves, including gate, check, and globe.

.4 Water motor alarms.

.5 Sprinkler heads.

.6 Pipe hangers and supports.

.7 Pressure or flow switch.

.8 Fire department connections.

.9 Excess pressure pump.

.10 Mechanical couplings.

.3 Drawings:

.1 Sprinkler heads and piping system layout.

.1 Prepare 760 mm by 1050 mm 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.

.4 Show piping schematic of systems supply, devices, valves, pipe, and fittings. Show point to point electrical wiring diagrams.

.2 Electrical wiring diagrams.

.4 Design Data:

.1 Calculations of sprinkler system design.

.2 Indicate type and design of each system and certify that each system has performed satisfactorily in the manner intended for not less than 18 months.

.5 Field Test Reports:

.1 Preliminary tests on piping system.

.6 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 760 mm by 1050 mm drawings on reproducible Mylar film with title block similar to full size contract drawings.

.3 As-built drawings to be stamped by a Professional Engineer registered in the Province of Ontario.

.7 Operation and Maintenance Manuals:

.1 Provide detailed hydraulic calculations including summary sheet, and Sprinkler Contractors Material and Test Certificate for aboveground and other documentation for incorporation into manual in accordance with NFPA 13. Hydraulic calculations, as-built drawings, and Sprinkler Contractors Material and Test Certificate to be stamped by a Professional Engineer registered in the Province of Ontario.

1.4 QUALITY ASSURANCE

.1 Qualifications:

.1 Installer: company or person specializing in wet sprinkler systems approved by manufacturer.

.2 Supply grooved joint couplings, fittings, valves, grooving tools and specialties from a single manufacturer. Use date stamped castings for coupling housings, fittings, valve bodies, for quality assurance and traceability.

1.5 MAINTENANCE MATERIAL SUBMITTALS

.1 Extra Materials:

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

.2 Provide spare sprinklers and tools in accordance with NFPA 13.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 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 Storage and Protection:

.1 Store materials indoors in dry location.

.2 Store and protect materials from exposure to harmful weather conditions and at temperature and humidity conditions recommended by manufacturer.

.4 Packaging Waste Management: remove for reuse of pallets, crates, padding, and packaging materials in accordance with Section 01 74 20.

Part 2 PRODUCTS

2.1 DESIGN REQUIREMENTS

.1 Design automatic wet pipe fire suppression sprinkler systems in accordance with required and advisory provisions of NFPA 13, by hydraulic calculations for uniform distribution of water over design area.

.2 Include with each system materials, accessories, and equipment inside and outside building to provide each system complete and ready for use.

.3 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.

.4 Locate sprinkler heads in consistent pattern with ceiling grid, lights, and air supply diffusers.

.5 Devices and equipment for fire protection service: ULC approved for use in wet pipe sprinkler systems.

.6 Location of Sprinkler Heads:

.1 Locate heads in relation to ceiling and spacing of sprinkler heads not to exceed that permitted by NFPA 13 for the hazard classification of the space.

.2 Space sprinklers on branch to suit architectural layout or ceiling components.

.7 Water Distribution:

.1 Make distribution uniform throughout the area in which sprinkler heads will open.

.2 Discharge from individual heads in hydraulically most remote area to be 100% of specified density.

.8 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 sized as per NFPA 13 density/area curves for hydraulically most remote area.

.9 Sprinkler Discharge Area:

.1 Area: hydraulically most remote area as defined in NFPA 13.

.10 Outside Hose Allowances:

.1 Include allowance in hydraulic calculations of 189 lpm for outside hose streams.

.11 Friction Losses:

.1 Calculate losses in piping in accordance with Hazen-Williams formula with 'C' value of 120 for steel piping, 150 for copper tubing, and 140 for cement-lined ductile-iron piping.

.12 Water Supply:

.1 Fire protection contractor to conduct flow test in vicinity of site to obtain current static and residual flow pressure measurements required for calculations.

2.2 SUSTAINABLE REQUIREMENTS

.1 Grooved couplings and fittings made from minimum 90% recycled metal.

2.3 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, bushings will not be permitted.

.2 Perform welding in shop; field welding will not be permitted.

.3 Conceal piping in areas with suspended ceiling.

2.4 PIPE, FITTINGS AND VALVES

.1 Pipe:

.2 Ferrous: to NFPA 13.

.3 Copper tube: to NFPA 13.

.2 Fittings and joints to NFPA 13:

.1 Ferrous: screwed, welded, flanged or roll grooved.

.1 Grooved joints designed with two ductile iron housing segments, pressure responsive gasket, and zinc-electroplated steel bolts and nuts. Cast with offsetting angle-pattern bolt pads for rigidity and visual pad-to-pad offset contact.

.2 Copper tube: screwed, soldered, brazed, grooved.

.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 gasketted 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 gasketted fittings are not permitted.

.9 Sprinkler pipe and fittings: metal.

.3 Valves:

.1 ULC listed for fire protection service.

.2 Gate valves: open by counterclockwise rotation.

.3 Provide rising stem OS & Y valve beneath each alarm valve in each riser when more than one alarm valve is supplied from same water supply pipe.

.4 Check valves: flanged clear opening swing or spring actuated check type with flanged inspection and access cover plate for sizes 10 cm and larger.

.5 Provide gate valve in piping protecting elevator hoistways, machine rooms, and machinery spaces.

.4 Pipe hangers:

.1 ULC listed for fire protection services in accordance with NFPA.

2.5 SPRINKLER HEADS

.1 General: to NFPA 13 and ULC listed for fire services.

.2 Sprinkler Head Type:

.1 Upright: chrome deflector in finished areas, bronze in unfinished areas. Glass bulb type.

.2 Pendant: chrome glass bulb type.

.3 Recessed: chrome, glass bulb type with ring and cup

.4 Concealed: chrome, glass bulb type with ring and cup. Cover to match ceiling finish.

.3 Provide nominal 1.2 cm orifice sprinkler heads.

.1 Release element of each head to be of temperature rating as suitable for specific application.

.2 Provide polished chromium-plated finish on copper alloy ceiling plates, and chromium-plated pendent sprinklers below suspended ceilings.

.3 Provide corrosion-resistant sprinkler heads and sprinkler head guards in accordance with NFPA 13.

.4 Deflector: not more than 75 mm below suspended ceilings.

.5 Ceiling plates: not more than 25 mm deep.

.6 Ceiling cups: not permitted.

2.6 ALARM CHECK VALVE

.1 Alarm check valve to NFPA 13 and ULC listed for fire service.

.2 Provide variable pressure type alarm valve complete with retarding chamber, alarm test valve, alarm shutoff valve, drain valve, pressure gages, accessories, and appurtenances for proper operation of system.

.3 Provide valve complete with internal components that are replaceable without removing the valve from the installed position.

2.7 SUPERVISORY SWITCHES

.1 General: to NFPA 13 and ULC listed for fire service.

.2 Valves:

.1 Mechanically attached to valve body, with normally open and normally closed contacts and supervisory capability.

.3 Pressure or flow switch type:

.1 With normally open and normally closed contacts and supervisory capability.

.2 Provide switch with circuit opener or closer for automatic transmittal of alarm over facility fire alarm system.

.3 Connect into building fire alarm system.

.4 Connection of switch: Section 28 31 00.

.5 Alarm actuating device: mechanical diaphragm controlled retard device adjustable from 10 to 60 seconds and instantly recycle.

.4 Pressure alarm switch:

.1 With normally open and normally closed contacts and supervisory capability.

2.8 FIRE DEPARTMENT CONNECTION

.1 Provide connections approximately 1.5 m above finish grade, location as indicated.

.2 To NFPA 13 and CAN/ULC-S543 listed, Siamese type.

.3 Polished chrome plated exposed of approved two-way type with 2.5 inch National Standard female hose threads with plug, chain, and identifying fire department connection escutcheon plate.

.4 Thread specifications: compatible with local fire department.

.5 Install a 90-degree elbow with drain connection at the low-point near each fire department connection to allow for system drainage to prevent freezing.

2.9 EXCESS PRESSURE PUMP

.1 Provide pumps on each sprinkler piping riser.

.2 Pumps:

.1 Pumps: positive displacement, gear type rated at 1 lpm, integrally mounted with motor.

.2 Double acting displacement type, open cylinder design, direct drive, ULC listed, complete with relief valve.

.3 Pump and motor unit:

.1 Approved for automatic wet pipe fire extinguishing sprinkler systems; complete with pilot light panel, differential motor control switch, high pressure switch, and low pressure switch.

.2 EEMAC Class B squirrel cage induction 1725 rpm, continuous duty, drip proof, ball bearing, maximum temperature rise 50 degrees C, 0.25 kW, 120/1/60.

.3 Capacity: 7.6 L/min.

.4 Provide electrical power supply connections for pump and pilot light panel at supply side of building service panel.

.5 Provide separate fused safety-type switch with locked lever for each connection.

.6 Pump operation switch: to operate excess pressure pump with pressure differential of 103 kPa.

.7 Shut-off valve and strainer on pump inlet. Relief valve, check valve and shut-off valve on discharge connections.

2.10 PRESSURE GAUGES

.1 ULC listed and to Section 23 05 19.01.

.2 Maximum limit of not less than twice normal working pressure at point where installed.

2.11 PIPE SLEEVES

.1 Provide pipe sleeves where piping passes through walls, floors.

.2 Secure sleeves in position and location during construction.

.3 Provide sleeves of sufficient length to pass through entire thickness of walls, floors.

.4 Provide 2.5 cm minimum clearance between exterior of piping and interior of sleeve or core-drilled hole.

.1 Firmly pack space with mineral wool insulation.

.2 Seal space at both ends of sleeve or core-drilled hole with plastic waterproof cement which will dry to firm but pliable mass.

.3 In fire walls and fire floors, seal both ends of pipe sleeves or core-drilled holes with ULC listed fill, void, or cavity material.

.5 Sleeves in Masonry and Concrete Walls, Floors, and Roofs:

.1 Provide hot-dip galvanized steel.

.2 Core drilling of masonry and concrete may be provided in lieu of pipe sleeves when cavities in core-drilled hole are completely grouted smooth.

.6 Sleeves in Other Than Masonry and Concrete Walls, Floors, and Roofs:

.1 Provide 0.61mm thick galvanized steel sheet.

2.12 ESCUTCHEON PLATES

.1 Provide one piece type metal plates for piping passing through walls, floors, and ceilings in exposed spaces.

.2 Provide polished chromium-plated finish on copper alloy plates in finished spaces.

.3 Provide paint finish on metal plates in unfinished spaces.

2.13 INSPECTOR'S TEST CONNECTION

.1 Locate inspector's test connection at hydraulically most remote part of each system, provide test connections approximately 3m above floor for each sprinkler system or portion of each sprinkler system equipped with alarm device.

.2 Provide test connection piping to location where discharge will be readily visible and where water may be discharged without property damage.

.3 Provide discharge orifice of same size as corresponding sprinkler orifice.

2.14 SIGNS

.1 Attach properly lettered Bilingual and approved metal signs to each valve and alarm device to NFPA 13.

.2 Permanently fix hydraulic design data nameplates to riser of each system.

2.15 SPARE PARTS CABINET

.1 Provide metal cabinet with extra sprinkler heads and sprinkler head wrench adjacent to each alarm valve. 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 NFPA 13 and NFPA 25.

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 cleaned of water and foreign matter.

.3 Keep piping systems clean 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 placing into position.

3.4 ELECTRICAL CONNECTIONS

.1 Provide electrical work associated with this section under Section 26 05 00.

.2 Provide fire alarm system under Section 28 31 00.

.3 Provide control and fire alarm wiring, including connections to fire alarm systems, in accordance with National Electrical Code.

.4 Provide wiring in rigid metal conduit or intermediate metal conduit.

3.5 DISINFECTION

.1 Disinfect new piping prior to connecting to existing piping system.

.2 Fill piping systems with solution containing minimum of 50 parts per million of chlorine and allow solution to stand for minimum of 24 hours.

.3 Flush solution from systems with clean water until maximum residual chlorine content is not greater than 0.2 part per million or residual chlorine content of domestic water supply.

.4 Obtain at least two consecutive satisfactory bacteriological samples from piping, analyzed by certified laboratory, and submit results prior to piping being placed into service.

3.6 CONNECTIONS TO EXISTING WATER SUPPLY SYSTEMS

.1 Notify Contracting Officer in writing at least 15 days prior to connection date.

.2 Use tapping or drilling machine valve and mechanical joint type sleeves for connections to be made under pressure.

.3 Bolt sleeves around main piping.

.4 Bolt valve to branch connection. Open valve, attach drilling machine, make tap, close valve, and remove drilling machine, without interruption of service.

.5 Furnish materials required to make connections into existing water supply systems, and perform excavating, backfilling, and other incidental labour as required.

3.7 BURIED PIPING SYSTEM

.1 Bury tape with printed side up at depth of 30 cm below the top surface of earth or top surface of subgrade under pavements.

3.8 FIELD PAINTING

.1 Clean, pretreat, prime, and paint new systems including valves, piping, conduit, hangers, supports, miscellaneous metalwork, and accessories.

.2 Apply coatings to clean, dry surfaces, using clean brushes.

.3 Clean surfaces to remove dust, dirt, rust, and loose mill scale.

.4 Immediately after cleaning, provide metal surfaces with 1 coat of pretreatment primer applied to minimum dry film thickness of 0.3 ml, and one coat of zinc chromate primer applied to minimum dry film thickness of 1.0 ml.

.5 Shield sprinkler heads with protective covering while painting is in progress.

.6 Upon completion of painting, remove protective covering from sprinkler heads.

.7 Remove sprinkler heads which have been painted and replace with new sprinkler heads.

.8 Provide primed surfaces with following:

.1 Piping in Finished Areas:

.1 Provide primed surfaces with 2 coats of paint to match adjacent surfaces.

.2 Provide valves and operating accessories with 1 coat of red alkyd gloss enamel applied to minimum dry film thickness of 1.0 mil.

.3 Provide piping with 50 mm wide red enamel bands spaced at maximum of 6 m intervals throughout piping systems.

.2 Piping in Unfinished Areas:

.1 Provide primed surfaces with one coat of red alkyd gloss enamel applied to minimum dry film thickness of 1.0 mil in spaces above suspended ceilings, pipe chases, mechanical equipment room, and spaces where walls or ceiling are not painted or not constructed of a prefinished material.

.2 Provide piping with 50 mm wide red enamel bands self-adhering red plastic bands spaced at maximum of 6 m intervals.

3.9 FIELD QUALITY CONTROL

.1 Site Test, Inspection:

.2 Perform test to determine compliance with specified requirements in presence of Departmental Representative.

.3 Test, inspect, and approve piping before covering or concealing.

.4 Preliminary Tests:

.1 Hydrostatically test each system at 200 psig 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.

.6 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 15 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.

.6 Authority of Jurisdiction, will witness formal tests and approve systems before they are accepted.

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

.6 Site Tests:

.1 Testing to be witnessed by Fire Commissioner of Canada and the authority having jurisdiction.

.2 Develop, with Departmental Representative assistance, detailed instructions for O & M of this installation.

3.10 CLEANING

.1 Clean in accordance with Section 01 74 11.

.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 74 20.

END OF SECTION

Part 1 GENERAL

1.1 REFERENCES

.1 Fire Commissioner of Canada (FC)

.2 National Fire Prevention Association (NFPA)

.1 NFPA 10-07, Standard for Portable Fire Extinguishers.

.3 Ontario Fire Code - 2007

.4 National Fire Code - 2010

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for fire extinguishers and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Provide ULC listed maintenance data for incorporation into manual specified in Section 01 78 00.

.3 Shop Drawings:

.1 Submit shop drawings for fire extinguishers and fire extinguisher cabinets noting:

.1 Size, Capacity, ULC rating

.2 Colour

.3 Bracket detail and construction

1.3 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00.

.2 Operation and Maintenance Data: submit operation and maintenance data for fire protection extinguishers for incorporation into manual.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 and with manufacturer's written instructions.

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

.3 Storage and Handling Requirements:

.1 Store materials indoors in dry location and in accordance with manufacturer's recommendations .

.2 Store and protect fire extinguishers from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

.4 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding and packaging material as specified in Construction Waste Management Plan in accordance with Section 01 74 20.

Part 2 PRODUCTS

1 Products

1.1 PORTABLE FIRE EXTINGUISHERS

1.1.1 Multi-Purpose Dry Chemical (Type 1):

1.1.1.1 Operation: Stored pressure rechargeable type with hose and shut-off nozzle.
1.1.1.2 Construction: Manufacturer’s standard tank construction; with manufacturer’s heavy duty wall bracket.
1.1.1.3 Sizes: 2.25 kg and 4.5 kg.
1.1.1.4 ULC Label: Class A B C Protection.
1.1.1.5 ULC Classification Rating: 1-A:10-B:C

1.2 FIRE EXTINGUISHER BRACKETS

1.2.1 Mounting Brackets:

1.2.1.1 Manufacturer's heavy duty, galvanized steel, designed to secure fire extinguisher to wall or structure.
1.2.1.2 Sizes required for types and capacities of fire extinguishers indicated, with plated or baked-enamel finish.
1.2.1.3 Colour: Red.

1.2.2 Identification:

1.2.2.1 Identify extinguishers in accordance with recommendations of ULC S508.
1.2.2.2 Attach tag or label to extinguishers, indicating month and year of installation; include space for service dates.
1.2.2.3 Location: As directed by the Departmental Representative.
1.2.2.4 Identify bracket-mounted fire extinguishers with the words FIRE EXTINGUISHER in red letter decals applied to mounting surface.

1.3 FIRE EXTINGUISHER CABINETS:

1.3.1 Cabinet Type: Suitable for fire extinguisher.

1.3.2 Cabinet Construction: Non-rated.

1.3.3 Cabinet Material: Nominal 1.5 mm thickness enamelled steel.

1.3.4 Fully Recessed Cabinet Mounting (Type 1):

1.3.4.1 Cabinet box recessed in walls of sufficient depth to suit style of trim.

1.3.4.2 Exposed Flat Trim: One piece combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbend) of 6 mm to 8 mm.

1.3.5 Semi-Recessed Cabinet Mounting (Type 20):

1.3.5.1 Cabinet box partially recessed in walls of shallow depth to suit style of trim indicated; with one piece combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbend).

1.3.5.2 Trim: Square edge trim; 32 mm to 38 mm backbend depth.

1.3.6 Surface Mounted Cabinet (Type 3): Cabinet box fully exposed and mounted directly on wall; with no trim.

1.3.7 Cabinet Trim Material: Same material and finish as door.

1.3.8 Doors: Nominal 1.9 mm thickness Nominal 2 mm thickness aluminum sheet and as follows:

1.3.8.1 Door Style: Fully glazed panel with frame.

1.3.8.2 Door Glazing: Clear, 6 mm nominal thickness tempered float glass (clear).

1.3.9 Door Hardware: Manufacturer's standard door operating hardware of proper type for cabinet type, trim style, door material and style, and as follows:

1.3.9.1 Closing Mechanism: Projecting lever handle with cam-action latch.

1.4 FINISHES

1.4.1 Manufacturer's standard baked enamel paint for the following:

1.4.1.1 Exterior of cabinet trim, except for those surfaces indicated to receive another finish.

1.5 FABRICATION

1.5.1 Cabinets:

1.5.1.1 Provide manufacturer's standard box (tub), with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated; having welded joints and ground smooth.

1.5.1.2 Provide factory drilled mounting holes.

1.5.2 Cabinet Doors:

1.5.2.1 Fabricate doors according to manufacturer's standards, from materials indicated and coordinated with cabinet types and trim styles selected.

1.5.2.2 Fabricate door frames with tubular stiles and rails with hollow metal sections, minimum 13 mm thick.

1.5.2.3 Mitre and weld perimeter door frames.

1.5.3 Cabinet Trim:

1.5.3.1 Fabricate cabinet trim in one piece with corners mitred, welded, and ground smooth.

2 Execution

2.1 EXAMINATION

2.1.1 Examine roughing-in for cabinets to verify actual locations of piping connections before cabinet installation.

2.1.2 Examine walls and partitions for suitable framing depth and blocking where recessed and semi-recessed cabinets are indicated for installation; notify Departmental Representative where wall depth or blocking is not sufficient for installation of cabinets.

2.1.3 Examine fire extinguishers for proper charging and tagging; remove and replace damaged, defective, or undercharged units.

2.1.4 Proceed with installation only after unsatisfactory conditions have been corrected.

2.2 INSTALLATION

2.2.1 Install extinguishers and cabinets in accordance with manufacturer’s written instructions and to meet specified standards and requirements of the Authorities Having Jurisdiction.

2.2.2 Install extinguishers and cabinets so that the top of extinguisher is no more than 1530 mm with the bottom of the extinguisher mounted a minimum of 100 mm above floor in accordance with NFPA 10.

2.2.3 Cabinets: Fasten cabinets to structure, square and plumb; fasten mounting brackets to inside surface of cabinets, square and plumb.

2.2.4 Mounting Brackets: Fasten mounting brackets to surfaces, square and plumb, at locations indicated.

2.3 ADJUSTING AND CLEANING

2.3.1 Remove temporary protective coverings and strippable films as fire protection specialties are installed, unless otherwise indicated in manufacturer's written installation instructions.

2.4 SCHEDULE

2.4.1 Provide extinguishers as indicated in the following schedule:

Fire Extinguisher		Cabinet		
Location	**Type**	**Type**	**Size**	**Rating**
Offices	1	1	2.25 kg	4-A:60-B:C
Public Areas	1	1	4.50 kg	4-A:60-B:C
Electrical Rooms	2	3	2.25 kg	5-B:C
Mechanical Rooms	1	3	4.50 kg	4-A:60-B:C

END OF SECTION

Part 1 GENERAL

1.1 SUMMARY

.1 Section Includes:

.1 Materials and installation for plumbing pumps.

1.2 RELATED SECTIONS:

.1 Section 21 05 01 – Common Work Results – For Mechanical

.2 Section 25 90 01 – EMCS: Site Requirements, Applications and System Sequences of Operation

1.3 REFERENCES

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

.1 Material Safety Data Sheets (MSDS).

1.4 SUBMITTALS

.1 Submittals in accordance with Section 01 33 00.

.2 Product Data:

.1 Submit manufacturer's printed product literature, specifications and data sheet for fixtures and equipment.

.2 Submit WHMIS MSDS in accordance with Section 01 33 00. Indicate VOC's for adhesive and solvents during application and curing.

.3 Shop Drawings.

.1 Submit shop drawings to indicate:

.1 Equipment, including connections, fittings, control assemblies and ancillaries. Identify whether factory or field assembled.

.2 Wiring and schematic diagrams.

.3 Dimensions and recommended installation.

.4 Pump performance and efficiency curves.

.5 Electrical disconnects and starters.

.6 Control diagram.

.4 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.5 Instructions: submit manufacturer's installation instructions.

.6 Manufacturers' Field Reports: manufacturers' field reports specified.

.7 Closeout submittals: submit maintenance and engineering data for incorporation into manual specified in Section 01 78 00, include:

.1 Manufacturers name, type, model year, capacity and serial number.

.2 Details of operation, servicing and maintenance.

.3 Recommended spare parts list with names and addresses.

1.5 QUALITY ASSURANCE

.1 Pre-Installation Meeting:

.2 Convene pre-installation meeting two weeks prior to beginning work of this Section and on-site installations in accordance with Section 01 31 19.

.1 Verify project requirements.

.2 Review installation conditions.

.3 Co-ordination with other building subtrades.

.4 Review manufacturer's installation instructions and warranty requirements.

.2 Health and Safety:

.1 Do construction occupational health and safety in accordance with Section 01 35 29.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Waste Management and Disposal:

.1 Remove from site and dispose of packaging materials at appropriate recycling facilities.

.2 Collect and separate for disposal paper, plastic, polystyrene, corrugated cardboard packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.

.3 Divert unused metal materials from landfill to metal recycling facility as approved by Departmental Representative.

.4 Unused sealant materials must not be disposed of into sewer system, into streams, lakes, onto ground or in other location where it will pose health or environmental hazard.

.5 Fold up metal and plastic banding, flatten and place in designated area for recycling.

Part 2 PRODUCTS

2.1 ELEVATOR SUBMERSIBLE SUMP PUMP

.1 Capacity: as indicated on mechanical schedules.

.2 Construction: simplex CSA approved, housing epoxy coated cast iron, carbon steel shaft, non-clog engineered glass fiber thermoplastic impeller, mechanical shaft seal.

.3 Motor: as indicated, hermetically sealed, with automatic overload protection and automatic reset.

.4 Control: Complete with NEMA 4x controller and oil sensing system. The system shall be capable of pumping water while containing oil. The control panel shall include a high decibel warning horn buzzer complete with alarm silencing switch.

.5 Oil sensor probe: hermetically sealed, heavy duty, stainless steel with low voltage self-cleaning technology. Oil sensing systems using optical lenses subject to dirt contamination and false alarms are not considered equal.

.6 Floats: single float switch for pump activation and an additional high water alarm float.

.7 Local alarms and remote dry contacts:

.1 Presences of oil in the sump

.2 High liquid level in the sump

.3 High amps or locked motor rotor.

.8 Sump pump to be capable of passing 20mm sphere.

.9 The power cord shall be of length to suit installation condition.

Part 3 EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION

.1 Make piping and electrical connections to pump and motor assembly and controls as indicated.

.2 Ensure pump and motor assembly do not support piping.

.3 Align vertical pit mounted pump assembly after mounting and securing cover plate.

3.3 FIELD QUALITY CONTROL

.1 Site Tests/Inspection:

.2 Check power supply.

.3 Check starter protective devices.

.2 Start-up, check for proper and safe operation.

.3 Check settings and operation of hand-off-auto selector switch, operating, safety and limit controls, audible and visual alarms, over-temperature and other protective devices.

.4 Adjust flow from water-cooled bearings.

.5 Adjust impeller shaft stuffing boxes, packing glands.

3.4 START-UP

.1 General:

.1 In accordance with Section 01 91 00: General Requirements, supplemented as specified herein.

.2 Procedures:

.1 Check power supply.

.2 Check starter O/L heater sizes.

.3 Start pumps, check impeller rotation.

.4 Check for safe and proper operation.

.5 Check settings, operation of operating, limit, safety controls, over-temperature, audible/visual alarms, other protective devices.

.6 Test operation of hands-on-auto switch.

.7 Adjust leakage through water-cooled bearings.

.8 Adjust shaft stuffing boxes.

.9 Adjust leakage flow rate from pump shaft stuffing boxes to manufacturer's recommendations.

.10 Check base for free-floating, no obstructions under base.

.11 Run-in pumps for 12 continuous hours.

.12 Check installation, operation of mechanical seals, packing gland type seals. Adjust as necessary.

.13 Adjust alignment of piping and conduit to ensure full flexibility.

.14 Eliminate causes of cavitation, flashing, air entrainment.

.15 Measure pressure drop across strainer when clean and with flow rates as finally set.

.16 Replace seals if pump used to degrease system or if pump used for temporary heat.

.17 Verify lubricating oil levels.

.3 Verify operation and control of over-temperature protection devices.

3.5 PV - SUMP PUMPS

.1 Application tolerances:

.2 Flow: plus 10%; minus 0%.

.3 Pressure: plus 10%; Minus 5%.

.2 PV Procedures:

.1 Fill sump at rate slower than capacity of pump.

.2 Record levels at which pump starts and stops. Determine flow rate by observing time taken to down water level.

.3 Adjust water level controls as necessary.

.4 Check level at which high water level alarm starts and stops. Adjust as necessary.

.3 Check removability of pumps for servicing without interfering with installation or operation of other equipment.

.4 Verify non-clog capability and maximum size of solids, using procedures recommended by manufacturer.

3.6 REPORTS

.1 In accordance with Section 01 91 00: reports, supplemented as specified.

.2 Include:

.1 PV results on approved PV Report Forms.

.2 Product Information report forms.

.3 Pump performance curves (family of curves) with final point of actual performance.

3.7 TRAINING

.1 In accordance with Section 01 91 00: Training of O&M Personnel, supplemented as specified.

END OF SECTION

Part 1 GENERAL

1.1 REFERENCES

.1 American National Standards Institute (ANSI)/American Society of Mechanical Engineers International (ASME).

.1 ANSI/ASME B16.24-2001(2006), Cast Copper Alloy Pipe Flanges and Flanged Fittings.

.2 American Society of Mechanical Engineers International (ASME)

.1 ASME B16.15-2013, Cast Copper Alloy Threaded Fittings: Classes 125 and 250.

.2 ASME B16.18-2012, Cast Copper Alloy Solder Joint Pressure Fittings.

.3 ASME B16.22-2001(R2005), Wrought Copper and Copper Alloy Solder Joint Pressure Fittings

.3 ASTM International Inc. (ASTM)

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

.2 ASTM B88M-13, Standard Specification for Seamless Copper Water Tube (Metric).

.4 American Water Works Association (AWWA)

.1 AWWA C111-12, Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.

.5 Canada Green Building Council (CaGBC)

.1 LEED Canada For New Construction and Major Renovations 2009.

.6 Canadian Standards Association (CSA International)

.1 CSA B242-05(R2011), Groove and Shoulder Type Mechanical Pipe Couplings.

.7 Department of Justice Canada (Jus)

.1 Canadian Environmental Protection Act, 1999, c. 33 (CEPA).

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

.1 Material Safety Data Sheets (MSDS).

.9 Manufacturer's Standardization Society of the Valve and Fittings Industry (MSS).

.1 MSS-SP-67-2011, Butterfly Valves.

.2 MSS-SP-70-2011, Gray Iron Gate Valves, Flanged and Threaded Ends.

.3 MSS-SP-71-2011, Gray Iron Swing Check Valves, Flanged and Threaded Ends.

.4 MSS-SP-80-2013, Bronze Gate, Globe, Angle and Check Valves.

.10 National Research Council (NRC)/Institute for Research in Construction

.1 NRCC 47668, National Plumbing Code of Canada (NPC) - 2010.

.11 Transport Canada (TC)

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

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00.

.2 Product Data:

.1 Provide manufacturer's printed product literature and datasheets for insulation and adhesives, and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Sustainable Design Submittals:

.1 LEED Submittals: in accordance with Section 01 35 21.

.4 Closeout Submittals:

.1 Provide maintenance data for incorporation into manual specified in Section 01 78 00.

1.3 DELIVERY, STORAGE AND HANDLING

.1 Store and manage hazardous materials in accordance with Section 01 35 45.

.2 Packaging Waste Management:

.1 Separate and recycle waste materials in accordance with Section 01 74 20.

.3 Place materials defined as hazardous or toxic in designated containers.

.4 Handle and dispose of hazardous materials in accordance with CEPA, TDGA, Regional and Municipal regulations.

Part 2 PRODUCTS

2.1 PIPING

.1 Domestic hot, cold and recirculation systems, within building.

.1 Above ground: copper tube, hard drawn, type L: to ASTM B88M.

.2 Buried or embedded: copper tube, soft annealed, type K: to ASTM B88M, in long lengths and with no buried joints.

2.2 FITTINGS

.1 Bronze pipe flanges and flanged fittings, Class 150: to ANSI/ASME B16.24.

.2 Cast bronze threaded fittings, Class 125: to ANSI/ASME B16.15.

.3 Cast copper, solder type: to ANSI/ASME B16.18.

.4 Wrought copper and copper alloy, solder type: to ANSI/ASME B16.22.

.5 NPS 2 and larger: roll grooved to CSA B242.

2.3 JOINTS

.1 Rubber gaskets, 1.6 mm thick: to AWWA C111.

.2 Bolts, nuts, hex head and washers: to ASTM A307, heavy series.

.3 Solder: 95/5 tin copper alloy.

.4 Teflon tape: for threaded joints.

.5 Grooved couplings: designed with angle bolt pads to provide rigid joint, complete with EPDM flush seal gasket.

.6 Dielectric connections between dissimilar metals: dielectric fitting, complete with thermoplastic liner.

2.4 GATE VALVES

.1 NPS 2 and under, soldered:

.1 Rising stem: to MSS-SP-80, Class 125, 860 kPa, bronze body, screw-in bonnet, solid wedge disc as specified Section 23 05 23.01.

.2 NPS 2 and under, screwed:

.1 Rising stem: to MSS-SP-80, Class 125, 860 kPa, bronze body, screw-in bonnet, solid wedge disc as specified Section 23 05 23.01.

.3 NPS 2-1/2 and over, in mechanical rooms, flanged:

.1 Rising stem: to MSS-SP-70, Class 125, 860 kPa, flat flange faces, cast-iron body, OS&Y bronze trim specified Section 23 05 23.02.

.4 NPS 2-1/2 and over, other than mechanical rooms, flanged:

.1 Non-rising stem: to MSS-SP-70, Class 125, 860 kPa, flat flange faces, cast-iron body, bronze trim, bolted bonnet specified Section 23 05 23.02.

2.5 GLOBE VALVES

.1 NPS2 and under, soldered:

.1 To MSS-SP-80, Class 125, 860 kPa, bronze body, renewable composition disc, screwed over bonnet as specified Section 23 05 23.01.

.2 Lockshield handles: all balancing valves.

.2 NPS 2 and under, screwed:

.1 To MSS-SP-80, Class 150, 1 MPa, bronze body, screwed over bonnet, renewable composition disc as specified Section 23 05 23.01.

.2 Lockshield handles: all balancing valves.

2.6 SWING CHECK VALVES

.1 NPS 2 and under, soldered:

.2 To MSS-SP-80, Class 125, 860 kPa, bronze body, bronze swing disc, screw in cap, regrindable seat as specified Section 23 05 23.01.

.2 NPS 2 and under, screwed:

.1 To MSS-SP-80, Class 125, 860 kPa, bronze body, bronze swing disc, screw in cap, regrindable seat as specified Section 23 05 23.01.

.3 NPS 2-1/2 and over, flanged:

.1 To MSS-SP-71, Class 125, 860 kPa, cast iron body, flat flange faces, renewable seat, bronze disc, bolted cap specified Section 23 05 23.02.

2.7 BALL VALVES

.1 NPS 2 and under, screwed:

.1 Class 150.

.2 Bronze body, stainless steel ball, PTFE adjustable packing, brass gland and PTFE seat, steel lever handle as specified Section 23 05 23.01.

.2 NPS 2 and under, soldered:

.1 To ANSI/ASME B16.18, Class 150.

.2 Bronze body, stainless steel ball, PTFE adjustable packing, brass gland and PTFE seat, steel lever handle, with NPT to copper adaptors as specified Section 23 05 23.01.

2.8 BUTTERFLY VALVES

.1 NPS 2-1/2 and over, wafer:

.2 To MSS-SP-67, Class 200.

.3 Cast iron body, ductile iron chrome plated disc, stainless steel stem, EPT liner.

.4 Lever operated, NPS8 and over, gear operated.

.2 NPS 2-1/2 and over, grooved ends:

.1 Class 300, bubble tight shut-off, bronze body.

.2 Operator:

.1 NPS 4 and under: lever handle.

.2 NPS 6 and over: gear operated.

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 INSTALLATION

.1 Install in accordance with NPC, and local authority having jurisdiction.

.2 Install pipe work in accordance with Section 23 05 05, supplemented as specified herein.

.3 Assemble piping using fittings manufactured to ANSI standards.

.4 Install DCW piping below and away from DHW and DHWR and other hot piping so as to maintain temperature of cold water as low as possible.

.5 Connect to fixtures and equipment in accordance with manufacturer's written instructions unless otherwise indicated.

.6 Buried tubing:

.1 Lay in well compacted washed sand in accordance with AWWA Class B bedding.

.2 Bend tubing without crimping or constriction. Minimize use of fittings.

3.3 VALVES

.1 Isolate equipment, fixtures and branches with gate or ball valves.

.2 Balance recirculation system using lockshield globe valves. Mark settings and record on as-built drawings on completion.

3.4 PRESSURE TESTS

.1 Conform to requirements of Section 21 05 01.

.2 Test pressure: greater of 1 times maximum system operating pressure or 860 kPa.

3.5 FLUSHING AND CLEANING

.1 Flush entire system for 8 h. Ensure outlets flushed for 2 h. Let stand for 24 h, then draw one sample off longest run. Submit to testing laboratory to verify that system is clean to Federal potable water guidelines. Let system flush for additional 2 h, then draw off another sample for testing.

.2 Submit laboratory test samples to Departmental Representative and receive written approval to connect new piping system to existing domestic water system prior to final tie-ins.

3.6 PRE-START-UP INSPECTIONS

.1 Systems to be complete, prior to flushing, testing and start-up.

.2 Verify that system can be completely drained.

.3 Ensure that air chambers, expansion compensators are installed properly.

3.7 DISINFECTION

.1 Flush out, disinfect and rinse system to approval of Departmental Representative.

.2 Upon completion, provide laboratory test reports on water quality for Departmental Representative approval.

3.8 START-UP

.1 Timing: Start up after:

.1 Pressure tests have been completed.

.2 Disinfection procedures have been completed.

.3 Certificate of static completion has been issued.

.4 Water treatment systems operational.

.2 Provide continuous supervision during start-up.

.3 Start-up procedures:

.1 Establish circulation and ensure that air is eliminated.

.2 Check pressurization to ensure proper operation and to prevent water hammer, flashing and/or cavitation.

.3 Bring DHWT storage tank up to design temperature slowly.

.4 Monitor piping DHW and DCW piping systems for freedom of movement, pipe expansion as designed.

.5 Check control, limit, safety devices for normal and safe operation.

.4 Rectify start-up deficiencies.

3.9 PERFORMANCE VERIFICATION

.1 Scheduling:

.2 Verify system performance after pressure and leakage tests and disinfection are completed, and Certificate of Completion has been issued by authority having jurisdiction.

.3 Procedures:

.1 Verify that flow rate and pressure meet Design Criteria.

.2 Adjust pressure regulating valves while withdrawal is maximum and inlet pressure is minimum.

.3 Sterilize DHW systems for Legionella control.

.4 Verify performance of temperature controls.

.5 Verify compliance with safety and health requirements.

.6 Check for proper operation of water hammer arrestors. Run three outlets for 10 seconds, then shut of water immediately. If water hammer occurs, replace water hammer arrestor or re-charge air chambers. Repeat for outlets and flush valves.

.7 Confirm water quality consistent with supply standards, and ensure no residuals remain as result of flushing or cleaning.

.4 Reports:

.1 In accordance with Section 01 91 00: Reports, using report forms as specified in Section 01 91 00: Report Forms and Schematics.

.2 Include certificate of water flow and pressure tests conducted on incoming water service, demonstrating adequacy of flow and pressure.

3.10 OPERATION REQUIREMENTS

.1 Co-ordinate operation and maintenance requirements including, cleaning and maintenance of specified materials and products with Section 21 05 01.

3.11 CLEANING

.1 Clean in accordance with Section 01 74 11.

.2 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 20.

END OF SECTION

END OF SECTION

Part 1 GENERAL

1.1 REFERENCES

.1 ASTM International Inc.

.1 ASTM B32-08(2014), Standard Specification for Solder Metal.

.2 ASTM B306-13, Standard Specification for Copper Drainage Tube (DWV).

.3 ASTM C564-14, Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings.

.2 Canada Green Building Council (CaGBC)

.1 LEED Canada For New Construction and Major Renovations 2009.

.3 Canadian Standards Association (CSA International).

.1 CSA B67-1972(R1996), Lead Service Pipe, Waste Pipe, Traps, Bends and Accessories. NOT ON CSA WEB SITE use another reference standard.

.2 CAN/CSA-B70-12, Cast Iron Soil Pipe, Fittings and Means of Joining.

.3 CSA B125.3-12, Plumbing Fittings.

.4 Green Seal Environmental Standards (GSES)

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

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

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

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00.

.2 Product Data:

.1 Provide manufacturer's printed product literature and datasheets for adhesives, and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Sustainable Design Submittals:

.1 LEED Submittals: in accordance with Section 01 35 21.

1.3 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle in accordance with Section 01 61 00.

.2 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

.3 Packaging Waste Management: remove for reuse of pallets, crates, and packaging materials in accordance with Section 01 74 20.

Part 2 PRODUCTS

2.1 COPPER TUBE AND FITTINGS

.1 Above ground sanitary and vent Type DWV to: ASTM B306.

.1 Fittings.

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

.2 Wrought copper: to CAN/CSA-B125.3.

.2 Solder: lead free, tin- copper alloy 95:5, to ASTM B 32.

2.2 CAST IRON PIPING AND FITTINGS

.1 Buried sanitary, storm, and vent minimum NPS 1.5, to: CSA B70

.1 Joints:

.1 Mechanical joints:

.1 Neoprene or butyl rubber compression gaskets: to CSA B70. ASTM C564 or

.2 Stainless steel clamps.

.2 Above ground sanitary, storm, and vent: to CSA B70.

.1 Joints:

.1 Mechanical joints:

.3 Neoprene or butyl rubber compression gaskets with stainless steel clamps.

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 INSTALLATION

.1 In accordance with Section 23 05 01.

.2 Install in accordance with National Plumbing Code, and local authority having jurisdiction.

3.3 TESTING

.1 Pressure test buried systems before backfilling.

.2 Hydraulically test to verify grades and freedom from obstructions.

3.4 PERFORMANCE VERIFICATION

.1 Cleanouts:

.1 Ensure accessible and that access doors are correctly located.

.2 Open, cover with linseed oil and re-seal.

.3 Verify that cleanout rods can probe as far as the next cleanout, at least.

.2 Test to ensure traps are fully and permanently primed.

.3 Storm water drainage:

.1 Verify domes are secure.

.2 Ensure weirs are correctly sized and installed correctly.

.3 Verify provisions for movement of roof system.

.4 Ensure that fixtures are properly anchored, connected to system and effectively vented.

.5 Affix applicable label (storm, sanitary, vent, pump discharge etc.) c/w directional arrows every floor or 4.5 m (whichever is less).

3.5 VERIFICATION

.1 Verification requirements in accordance with Section 01 47 17, include:

.1 Materials and resources.

.2 Storage and collection of recyclables.

.3 Construction waste management.

.4 Resource reuse.

.5 Local/regional materials.

.6 Low-emitting materials.

3.6 CLEANING

.1 Clean in accordance with Section 01 74 11.

.2 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 20.

END OF SECTION

Part 1 GENERAL

1.1 REFERENCES

.1 ASTM International Inc.

.1 ASTM D2235-04(2011), Standard Specification for Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings.

.2 ASTM D2564-12, Standard Specification for Solvent Cements for Poly (Vinyl-Chloride) (PVC) Plastic Piping Systems.

.2 Canada Green Building Council (CaGBC)

.1 LEED Canada For New Construction and Major Renovations 2009.

.3 Canadian Standards Association (CSA International)

.1 CSA B1800-15, Thermoplastic Nonpressure Piping Compendium.

.4 Green Seal Environmental Standards (GSES)

.1 Standard GS-36, Commercial Adhesives.

.5 Green Seal Environmental Standards (GSES)

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

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

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

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00.

.2 Product Data:

.1 Provide manufacturer's printed product literature and datasheets for piping and adhesives, and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Provide two copies WHMIS MSDS - Material Safety Data Sheets.

.3 Sustainable Design Submittals:

.1 LEED Submittals: in accordance with Section 01 35 21.

1.3 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle in accordance with Section 01 61 00.

.2 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

.3 Packaging Waste Management: remove for reuse of pallets, crates, and packaging materials in accordance with Section 01 74 20.

Part 2 PRODUCTS

2.1 MATERIAL

.1 Adhesives and Sealants: in accordance with Section 07 92 00.

.1 Maximum VOC limit 250 g/L to SCAQMD Rule 1168 and in accordance with Section 01 35 21.

2.2 PIPING AND FITTINGS

.1 For buried DWV piping to:

.1 CSA B1800.

2.3 JOINTS

.1 Solvent weld for PVC: to ASTM D2564.

.2 Solvent weld for ABS: to ASTM D2235.

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 INSTALLATION

.1 In accordance with Section 23 05 05.

.2 Install in accordance with National Plumbing Code, Provincial Plumbing Code and local authority having jurisdiction.

3.3 TESTING

.1 Pressure test buried systems before backfilling.

.2 Hydraulically test to verify grades and freedom from obstructions.

3.4 PERFORMANCE VERIFICATION

.1 Cleanouts:

.1 Ensure accessible and that access doors are correctly located.

.2 Open, cover with linseed oil and re-seal.

.3 Verify cleanout rods can probe as far as the next cleanout, at least.

.2 Test to ensure traps are fully and permanently primed.

.3 Storm water drainage:

.1 Verify domes are secure.

.2 Ensure weirs are correctly sized and installed correctly.

.3 Verify provisions for movement of roof system.

.4 Ensure fixtures are properly anchored, connected to system and effectively vented.

.5 Affix applicable label (storm, sanitary, vent, pump discharge) c/w directional arrows every floor or 4.5 m (whichever is less).

3.5 CLEANING

.1 Clean in accordance with Section 01 74 11.

.2 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 20.

END OF SECTION

Part 1 GENERAL

1.1 REFERENCES

.1 American National Standards Institute/Canadian Standards Association (ANSI/CSA)

.1 ANSI Z21.10.3A-2007/CSA 4.3-2007, Gas Water Heaters - Volume III - Storage Water Heaters, with Input Ratings Above 75,000 Btu Per Hour, Circulating and Instantaneous.

.2 Canada Green Building Council (CaGBC)

.1 LEED Canada For New Construction and Major Renovations 2009.

.3 Canadian Standards Association (CSA International)

.1 CSA B51-03(R2007), Boiler, Pressure Vessel, and Pressure Piping Code.

.2 CAN/CSA-B149.1-10, Natural Gas and Propane Installation Code.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00.

.2 Product Data:

.1 Provide manufacturer's printed product literature and datasheets for domestic water heater, and include product characteristics, performance criteria, physical size, finish, trim, and controls.

.3 Shop Drawings:

.1 Provide drawings stamped and signed by professional engineer registered or licensed in Province of Ontario, Canada.

.2 Indicate:

.1 Equipment, including connections, fittings, control assemblies and ancillaries, identifying factory and field assembled.

.2 Performance characteristics as indicated within mechanical schedules.

1.3 CLOSEOUT SUBMITTALS

.1 Provide maintenance and engineering data for incorporation into manual specified in Section 01 78 00.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle in accordance with Section 01 61 00.

.2 Deliver materials to site in original factory packaging, labeled with manufacturer's name, address.

.3 Packaging Waste Management: remove for reuse of pallets, crates, padding and packaging materials in accordance with Section 01 74 20.

1.5 WARRANTY

.1 Provide a 3-year limited tank warranty.

Part 2 PRODUCTS

2.1 DHW HEATER TANK

.1 General: Design-certified by CSA International, according to ANSI Z21.10.3 – CSA 4.3 standards governing storage-type water heaters, stamped for 1100 kPa working pressure. Meets or exceeds the thermal efficiency and standby loss requirements of ASHRAE 90.1 – 2010.

.2 Capacity: as indicated in mechanical schedules.

.3 Efficiency: at least 95%.

.4 Burner: To be capable of precise mixing of air and gas for optimum efficiency, requiring no special calibration on start-up

.5 Construction: To be seamless glasslined steel tank. Glass lining to be applied to all water-side surfaces after the tank has been assembled and welded. Domestic water heater to be approved for 0cm clearance installation to combustibles.

.6 Controls:

.1 Integrated solid-state temperature and ignition control device with integral diagnostics, graphic user interface, fault history display and shall have a digital temperature readout.

.2 Domestic hot water controls shall be capable of communicating with building management system using the BACnet communication protocol.

.1 The following points at minimum must have read/write capability:

.1 Temperature set point

.2 Enable/Disable

.2 The following points at minimum must have read capability:

.1 Tank temperature

.2 Status

.3 Run-Hours

.4 Current Fault

.3 Flow switch and low water cut out, interlocked with ignition system to prevent operation in event of low flow or low water level.

.3 Venting and Combustion Air: Domestic hot water heater shall be suitable for power direct venting. Provide domestic hot water heater with a concentric vent kit suitable for side-wall termination.

2.2 TRIM AND INSTRUMENTATION

.1 Drain valve: NPS 1 with hose end.

.2 Thermometer: 100 mm dial type with red pointer and thermowell filled with conductive paste.

.3 Pressure gauge: 75 mm dial type with red pointer, and shut-off cock.

.4 Thermowell filled with conductive paste for control valve temperature sensor.

.5 ASME rated temperature and pressure relief valve sized for full capacity of heater, having discharge terminating over floor drain and visible to operators.

.6 Maintenance free powered anode.

.7 Provide condensate neutralization kit, sized for peak condensate flow rate.

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 INSTALLATION

.1 Install in accordance with manufacturer's recommendations and authority having jurisdiction.

.2 Install natural gas fired domestic water heaters in accordance with CAN/CSA-B149.1.

3.3 FIELD QUALITY CONTROL

.1 Manufacturer's factory trained, certified Engineer to start up and assist in commissioning DHW heaters.

3.4 CLEANING

.1 Clean in accordance with Section 01 74 11.

.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 74 20.

END OF SECTION

Part 1 GENERAL

1.1 SUMMARY

.1 Section Includes:

.1 The supply and installation of Plumbing Fixtures and Trim.

.2 Products Installed but not Supplied Under this Section:

.1 Install rough-in for equipment supplied by others, complete with valves on hot and cold water supplies, waste and vent.

.2 Equipment installed by others.

.1 Connect with unions.

.3 Equipment not installed.

.1 Capped for future connection by others.

1.2 RELATED SECTIONS:

.1 Section 22 42 01 – Plumbing Specialties and Accessories.

1.3 REFERENCES

.1 Canadian Standards Association (CSA International).

.1 CAN/CSA-B45 Series-02(R2013), Plumbing Fixtures.

.2 CSA B125.3-12, Plumbing Fittings.

.3 CSA B651-12, Accessible Design for the Built Environment.

.2 American Society for Mechanical Engineers (ASME)/Canadian Standards Association (CSA International).

.1 ASME A112.18.1-2012/CSA B125.1-12, Plumbing Supply Fittings.

.2 ASME A112.18.2-2011/CSA B125.2-11, Plumbing Waste Fittings.

.3 Canada Green Building Council (CaGBC)

.1 LEED Canada For New Construction and Major Renovations 2009.

1.4 SUBMITTALS

.1 Submittals in accordance with Section 01 33 00.

.2 Product Data: submit WHMIS MSDS - Material Safety Data Sheets.

.1 Submit shop drawings and product data in accordance with Section 01 33 00.

.1 Indicate, for all fixtures and trim:

.1 Dimensions, construction details, certifications, roughing-in dimensions.

.2 Colour, mounting heights, and carriers.

.3 Water consumption and power requirements

.3 Closeout Submittals:

.1 Submit maintenance data in accordance with Section 01 78 00.

.2 Include:

.1 Description of fixtures and trim, giving manufacturer's name, type, model, year, capacity.

.2 Details of operation, servicing, maintenance.

.3 List of recommended spare parts.

1.5 QUALITY ASSURANCE

.1 Health and Safety:

.1 Do construction occupational health and safety in accordance with Section 01 35 29.

1.6 DELIVERY STORAGE AND DISPOSAL

.1 Waste Management and Disposal:

.1 Separate waste materials for reuse and recycling in accordance with Section 01 74 20.

.2 Collect and separate for disposal paper, plastic, polystyrene, corrugated cardboard, packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.

.3 Fold up metal and plastic banding, flatten and place in designated area for recycling.

Part 2 PRODUCTS

2.1 MANUFACTURED UNITS

.1 Fixtures: manufacture in accordance with CAN/CSA-B45 series.

.2 Trim, fittings: manufacture in accordance with CAN/CSA-B125.

.3 Exposed plumbing brass to be chrome plated.

.4 Number, locations: architectural drawings to govern.

.5 Fixtures in any one location to be product of one manufacturer and of same type.

.6 Trim in any one location to be product of one manufacturer and of same type.

.7 Commercial Plumbing Fixtures:

.1 As specified on mechanical drawings

.8 Fixture piping:

.1 Hot and cold water supplies to each fixture:

.1 Braided stainless steel flexible supply pipes each with screwdriver stop, reducers, escutcheon.

.2 Waste:

.1 Brass P trap with clean out on each fixture not having integral trap.

.2 Chrome plated in all exposed places.

.9 Chair carriers:

.1 Factory manufactured floor-mounted carrier systems for all wall-mounted fixtures.

Part 3 EXECUTION

3.1 INSTALLATION

.1 Mounting heights:

.1 Standard: to comply with manufacturer's recommendations unless otherwise indicated or specified.

.2 Wall-hung fixtures: as per architectural elevations, measured from finished floor.

.3 Physically handicapped: to comply with most stringent of either NBCC and CAN/CSA-B651.

3.2 ADJUSTING

.1 Conform to water conservation requirements specified this section.

.2 Adjustments:

.1 Adjust water flow rate to design flow rates.

.2 Adjust pressure to fixtures to ensure no splashing at maximum pressures.

.3 Checks:

.1 Aerators: operation, cleanliness.

.2 Vacuum breakers, backflow preventers: operation under all conditions.

.3 Wash fountains: operation of flow-actuating devices.

.4 Thermostatic controls:

.1 Verify temperature settings, operation of control, limit and safety controls.

END OF SECTION

Part 1 GENERAL

1.1 SUMMARY

.1 Section Includes:

.1 Materials and installation for plumbing specialties and accessories.

1.2 REFERENCES

.1 American Society for Testing and Materials International (ASTM).

.1 ASTM A126-04(2009), Standard Specification for Gray Iron Castings for Valves, Flanges and Pipe Fittings.

.2 ASTM B62-09, Standard Specification for Composition Bronze or Ounce Metal Castings.

.2 Canadian Standards Association (CSA International).

.1 CSA B64 Series-11, Backflow Preventers and Vacuum Breakers.

.2 CSA B356-00(R2005), Water Pressure Reducing Valves for Domestic Water Supply Systems.

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

.1 Material Safety Data Sheets (MSDS).

.4 Plumbing and Drainage Institute (PDI).

.1 PDI-WH201-92, Water Hammer Arresters Standard.

.5 Canada Green Building Council (CaGBC)

.1 LEED Canada 2009 for Design and Construction-2010, LEED Canada 2009 for Design and Construction Leadership in Energy and Environmental Design Green Building Rating System Reference Guide.

.6 CSA International

.1 CSA B64 Series-11, Backflow Preventers and Vacuum Breakers.

.2 CSA B79-08(R2013), Commercial and Residential Drains and Cleanouts.

.3 CAN/CSA-B356-10, Water Pressure Reducing Valves for Domestic Water Supply Systems.

1.3 SUBMITTALS

.1 Submittals in accordance with Section 01 33 00.

.2 Product Data:

.1 Submit manufacturer's printed product literature, specifications and datasheet for fixtures and equipment.

.2 Indicate dimensions, construction details and materials for specified items.

.3 Submit WHMIS MSDS. Indicate VOC's for adhesive and solvents during application and curing.

.3 Shop Drawings:

.1 Submit shop drawings to indicate materials, finishes, method of anchorage, dimensions construction and assembly details and accessories for following:

.1 Trap Primers

.2 PRV’s

.3 Wall Hydrants

.4 Floor Drains

.5 Roof Drains

.6 Cleanouts

.7 Strainers

.4 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.5 Instructions: submit manufacturer's installation instructions.

.6 Manufacturers' Field Reports: manufacturers' field reports specified.

.7 Closeout submittals: submit maintenance and engineering data for incorporation into manual specified in Section 01 78 00, include:

.1 Description of plumbing specialties and accessories, giving manufacturers name, type, model, year and capacity.

.2 Details of operation, servicing and maintenance.

.3 Recommended spare parts list.

1.4 QUALITY ASSURANCE

.1 Pre-Installation Meetings:

.2 Convene pre-installation meeting two weeks prior to beginning work of this Section and on-site installations in accordance with Section 01 31 19.

.1 Verify project requirements.

.2 Review installation conditions.

.3 Co-ordination with other building subtrades.

.4 Review manufacturer's installation instructions and warranty requirements.

.2 Health and Safety:

.1 Do construction occupational health and safety in accordance with Section 01 35 30.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Waste Management and Disposal:

.1 Separate waste materials for reuse and recycling in accordance with Section 01 74 20.

.2 Remove from site and dispose of packaging materials at appropriate recycling facilities.

.3 Collect and separate for disposal paper, plastic, polystyrene, corrugated cardboard, and packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.

.4 Divert unused metal materials from landfill to metal recycling facility as approved by Departmental Representative.

Part 2 PRODUCTS

2.1 FLOOR DRAINS

.1 Floor Drains: as specified in mechanical schedules.

2.2 ROOF DRAINS

.1 Roof Drains: as specified in mechanical schedules.

2.3 CLEANOUTS

.1 Cleanout Plugs: heavy cast iron male ferrule with brass screws and threaded brass or bronze plug. Sealing-caulked lead seat or neoprene gasket.

.2 Access Covers:

.1 Wall Access: face or wall type, polished nickel bronze round cover with flush head securing screws, bevelled edge frame complete with anchoring lugs.

.2 Floor Access: round cast iron body and frame with adjustable secured nickel bronze top cast box with anchor lugs and:

.1 Plugs: bolted bronze with neoprene gasket.

.2 Cover for Unfinished Concrete Floors: cast iron round, gasket, vandal-proof screws.

.3 Cover for Tile and Linoleum Floors: polished nickel bronze with recessed cover for linoleum or tile infill, complete with vandal-proof locking screws.

.4 Cover for Carpeted Floors: polished nickel bronze with deep flange cover for carpet infill, complete with carpet retainer vandal-proof locking screws.

2.4 NON-FREEZE WALL HYDRANTS

.1 Recessed with integral vacuum breaker, NPS 3/4 hose outlet, removable operating key. Polished bronze finish. Cover to be complete with lock and key.

2.5 WATER HAMMER ARRESTORS

.1 Stainless steel construction, bellows type: to PDI-WH201.

2.6 BACK FLOW PREVENTERS

.1 Preventers: to CSA B64 Series, as indicated, reduced pressure principle type or double check valve assembly as indicated on mechanical drawings.

2.7 VACUUM BREAKERS

.1 Breakers: to CSA B64 Series, vacuum breaker atmospheric.

2.8 PRESSURE REGULATORS

.1 Inlet pressure: as indicated on drawings.

.2 Outlet pressure: as indicated on drawings.

.3 Up to NPS1-1/2 bronze bodies, screwed: to ASTM B62.

.4 NPS 2 and over, semi-steel bodies, Class 125, flanged: to ASTM A126, Class B.

.5 Semi-steel spring chambers with bronze trim.

2.9 WATER MAKE-UP ASSEMBLY

.1 Complete with backflow preventer, pressure gauge on inlet and outlet, pressure reducing valve to CSA B356, pressure relief valve on low pressure side and gate valves on inlet and outlet.

2.10 TRAP SEAL PRIMERS

.1 Brass, with integral vacuum breaker, NPS1/2 solder ends, NPS1/2 drip line connection.

2.11 STRAINERS

.1 860 kPa, Y type with 20 mesh, monel, bronze or stainless steel removable screen.

.2 NPS 2 and under, bronze body, screwed ends, with brass cap.

.3 NPS2 1/2 and over, cast iron body, flanged ends, with bolted cap.

Part 3 EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION

.1 Install in accordance with National Plumbing Code of Canada, and local authority having jurisdiction.

.2 Install in accordance with manufacturer's instructions and as specified.

3.3 CLEANOUTS

.1 Install cleanouts at base of soil and waste stacks, and rainwater leaders, at locations required code, and as indicated.

.2 Bring cleanouts to wall or finished floor unless serviceable from below floor.

.3 Building drain cleanout and stack base cleanouts: line size to maximum NPS 4.

3.4 NON-FREEZE WALL HYDRANTS

.1 Install 600mm above finished grade unless otherwise indicated.

3.5 WATER HAMMER ARRESTORS

.1 Install on branch supplies to fixtures or group of fixtures.

3.6 BACK FLOW PREVENTORS

.1 Install in accordance with CSA B64 Series, where indicated and elsewhere as required by code.

.2 Pipe discharge to terminate over nearest drain and or service sink.

3.7 TRAP SEAL PRIMERS

.1 Install for floor drains and elsewhere, as indicated.

.2 Install on cold water supply to nearest frequently used plumbing fixture, in concealed space, to approval of Departmental Representative.

.3 Install plastic tubing to floor drain.

3.8 STRAINERS

.1 Install with sufficient room to remove basket.

3.9 WATER MAKE-UP ASSEMBLY

.1 Install complete with valved bypass.

.2 Pipe discharge from relief valve to nearest floor drain.

3.10 START-UP

.1 General:

.1 In accordance with Section 01 91 13: General Requirements, supplemented as specified herein.

.2 Timing: start-up only after:

.1 Pressure tests have been completed.

.2 Disinfection procedures have been completed.

.3 Certificate of static completion has been issued.

.4 Water treatment systems operational.

.3 Provide continuous supervision during start-up.

3.11 TESTING AND ADJUSTING

.1 General:

.2 In accordance with Section 01 91 00: General Requirements, supplemented as specified.

.2 Timing:

.1 After start-up deficiencies rectified.

.2 After certificate of completion has been issued by authority having jurisdiction.

.3 Application tolerances:

.1 Pressure at fixtures: +/- 70 kPa.

.2 Flow rate at fixtures: +/- 20%.

.4 Adjustments:

.1 Verify that flow rate and pressure meet design criteria.

.2 Make adjustments while flow rate or withdrawal is (1) maximum and (2) 25% of maximum and while pressure is (1) maximum and (2) minimum.

.5 Floor drains:

.1 Verify operation of trap seal primer.

.2 Prime, using trap primer. Adjust flow rate to suit site conditions.

.3 Check operations of flushing features.

.4 Check security, accessibility, removability of strainer.

.5 Clean out baskets.

.6 Vacuum breakers, backflow preventers, backwater valves:

.1 Test tightness, accessibility for O&M of cover and of valve.

.2 Simulate reverse flow and back-pressure conditions to test operation of vacuum breakers, backflow preventers.

.3 Verify visibility of discharge from open ports.

.7 Roof drains:

.1 Check location at low points in roof.

.2 Check security, removability of dome.

.3 Adjust weirs to suit actual roof slopes, meet requirements of design.

.4 Clean out sumps.

.5 Verify provisions for movement of roof systems.

.8 Access doors:

.1 Verify size and location relative to items to be accessed.

.9 Cleanouts:

.1 Verify covers are gas-tight, secure, yet readily removable.

.10 Water hammer arrestors:

.1 Verify proper installation of correct type of water hammer arrester.

.11 Wall hydrants:

.1 Verify complete drainage, freeze protection.

.2 Verify operation of vacuum breakers.

.12 Pressure regulators, PRV assemblies:

.1 Adjust settings to suit locations, flow rates, pressure conditions.

.13 Strainers:

.1 Clean out repeatedly until clear.

.2 Verify accessibility of cleanout plug and basket.

.3 Verify that cleanout plug does not leak.

.14 Hydronic system water Make-up Assembly:

.1 Adjust settings to suit location, flow rates, pressure conditions.

.2 Close by-pass valve after first fill.

.15 Commissioning Reports:

.1 In accordance with Section 01 91 00: Reports, supplemented as specified.

.16 Training:

.1 In accordance with Section 01 91 00: Training of O&M Personnel, supplemented as specified.

.2 Demonstrate full compliance with Design Criteria.

END OF SECTION

Part 1 GENERAL

1.1 RELATED SECTIONS

.1 Section 01 51 00 - Temporary Utilities.

1.2 USE OF SYSTEMS

.1 Use of new and or existing permanent heating and or ventilating systems for supplying temporary heat or ventilation is permitted only under the following conditions:

- .1 Entire system is complete, pressure tested, cleaned, flushed out.
- .2 Specified water treatment system has been commissioned, water treatment is being continuously monitored.
- .3 Building has been closed in, areas to be heated/ventilated are clean and will not thereafter be subjected to dust-producing processes.
- .4 There is no possibility of damage from any cause.
- .5 Supply ventilation systems are protected by MERV 8 filters, which shall be inspected daily, changed every 2 weeks or more frequently as required.
- .6 Return systems have approved filters over all openings, inlets, outlets.
- .7 All systems will be:
  - .1 operated as per manufacturer's recommendations or instructions.
  - .2 operated by Contractor.
  - .3 monitored continuously by Contractor.
- .8 Warranties and guarantees are not thereby relaxed.
- .9 Regular preventive and all other manufacturers recommended maintenance routines are performed by Contractor at his own expense and under supervision of Departmental Representative.
- .10 Before static completion, entire system to be refurbished, cleaned internally and externally, restored to "as- new" condition, filters in air systems replaced.

.2 Filters referred to herein are over and above those specified elsewhere in this specification.

.3 Exhaust systems are not included in any 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 REFERENCES

.1 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-1.181-99, Ready-Mixed Organic Zinc-Rich Coating.

.2 Canada Green Building Council (CaGBC)

.1 LEED Canada 2009 for Design and Construction-2010, LEED Canada 2009 for Design and Construction Leadership in Energy and Environmental Design Green Building Rating System Reference Guide.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00.

.2 Sustainable Design Submittals:

.1 LEED Submittals: in accordance with Section 01 35 21.

1.3 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle in accordance with Section 01 61 00.

.2 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

.3 Packaging Waste Management: remove for reuse of pallets, crates, paddling and packaging materials in accordance with Section 01 74 20.

Part 2 PRODUCTS

2.1 NOT USED

.1 Not Used.

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 CONNECTIONS TO EQUIPMENT

.1 In accordance with manufacturer's instructions unless otherwise indicated.

.2 Use valves and either unions or flanges for isolation and ease of maintenance and assembly.

.3 Use double swing joints when equipment mounted on vibration isolation and when piping subject to movement.

3.3 CLEARANCES

.1 Provide clearance around systems, equipment and components for observation of operation, inspection, servicing, maintenance and as recommended by manufacturer.

.2 Provide space for disassembly, removal of equipment and components as recommended by manufacturer or as indicated (whichever is greater) without interrupting operation of other system, equipment, components.

3.4 DRAINS

.1 Install piping with grade in direction of flow except as indicated.

.2 Install drain valve at low points in piping systems, at equipment and at section isolating valves.

.3 Pipe each drain valve discharge separately to above floor drain. Discharge to be visible.

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

3.5 AIR VENTS

.1 Install manual air vents at high points in piping systems.

.2 Install isolating valve at each automatic air valve.

.3 Install drain piping to approved location and terminate where discharge is visible.

3.6 DIELECTRIC COUPLINGS

.1 General: compatible with system, to suit pressure rating of system.

.2 Locations: where dissimilar metals are joined.

.3 NPS 2 and under: isolating unions or bronze valves.

.4 Over NPS 2: isolating flanges.

3.7 PIPEWORK INSTALLATION

.1 Screwed fittings jointed with Teflon tape.

.2 Protect openings against entry of foreign material.

.3 Install to isolate equipment and allow removal without interrupting operation of other equipment or systems.

.4 Assemble piping using fittings manufactured to ANSI standards.

.5 Saddle type branch fittings may be used on mains if branch line is no larger than half size of main.

.1 Hole saw (or drill) and ream main to maintain full inside diameter of branch line prior to welding saddle.

.6 Install exposed piping, equipment, rectangular cleanouts and similar items parallel or perpendicular to building lines.

.7 Install concealed pipework to minimize furring space, maximize headroom, conserve space.

.8 Slope piping, except where indicated, in direction of flow for positive drainage and venting.

.9 Install, except where indicated, to permit separate thermal insulation of each pipe.

.10 Group piping wherever possible.

.11 Ream pipes, remove scale and other foreign material before assembly.

.12 Use eccentric reducers at pipe size changes to ensure positive drainage and venting.

.13 Provide for thermal expansion as indicated.

.14 Valves:

- .1 Install in accessible locations.
- .2 Remove interior parts before soldering.
- .3 Install with stems above horizontal position unless otherwise indicated.
- .4 Valves accessible for maintenance without removing adjacent piping.
- .5 Install globe valves in bypass around control valves.
- .6 Use gate or ball valves at branch take-offs for isolating purposes except where otherwise specified.
- .7 Install butterfly valves between weld neck flanges to ensure full compression of liner.
- .8 Install plug cock or ball valves for glycol service.
- .9 Use chain operators on valves NPS 2 1/2 and larger where installed more than 2400mm above floor in Mechanical Rooms.

.15 Check Valves:

- .1 Install silent check valves on discharge of pumps and vertical piping.
- .2 Install swing check valves in horizontal lines.

.16 Screwed fittings jointed with Teflon tape.

.17 Protect openings against entry of foreign material.

.18 Install to isolate equipment and allow removal without interrupting operation of other equipment or systems.

.19 Assemble piping using fittings manufactured to ANSI standards.

.20 Saddle type branch fittings may be used on mains if branch line is no larger than half size of main.

- .1 Hole saw (or drill) and ream main to maintain full inside diameter of branch line prior to welding saddle.

.21 Install exposed piping, equipment, rectangular cleanouts and similar items parallel or perpendicular to building lines.

.22 Install concealed pipework to minimize furring space, maximize headroom, conserve space.

.23 Slope piping, except where indicated, in direction of flow for positive drainage and venting.

.24 Install, except where indicated, to permit separate thermal insulation of each pipe.

.25 Group piping wherever possible.

.26 Ream pipes, remove scale and other foreign material before assembly.

.27 Use eccentric reducers at pipe size changes to ensure positive drainage and venting.

.28 Provide for thermal expansion as indicated.

.29 Valves:

.1 Install in accessible locations.

.2 Remove interior parts before soldering.

.3 Install with stems above horizontal position unless otherwise indicated.

.4 Valves accessible for maintenance without removing adjacent piping.

.5 Install globe valves in bypass around control valves.

.6 Use gate or ball valves at branch take-offs for isolating purposes except where otherwise specified.

.7 Install butterfly valves between weld neck flanges to ensure full compression of liner.

.8 Install plug cock or ball valves for glycol service.

.9 Use chain operators on valves NPS 2 1/2 and larger where installed more than 2400mm above floor in Mechanical Rooms.

.30 Check Valves:

.1 Install silent check valves on discharge of pumps and vertical piping.

.2 Install swing check valves in horizontal lines.

3.8 ESCUTCHEONS

.1 Install on pipes passing through walls, partitions, floors, and ceilings in finished areas.

.2 Construction: one piece type with set screws. Chrome or nickel plated brass or type 302 stainless steel.

.3 Sizes: outside diameter to cover opening or sleeve. Inside diameter to fit around pipe or outside of insulation if so provided.

3.9 PREPARATION FOR FIRE STOPPING

.1 Material and installation within annular space between pipes, ducts, insulation and adjacent fire separation to Section 07 84 00.

.2 Uninsulated unheated pipes not subject to movement: No special preparation.

.3 Uninsulated heated pipes subject to movement: wrap with non-combustible smooth material to permit pipe movement without damaging fires topping material or installation.

.4 Insulated pipes and ducts: ensure integrity of insulation and vapour barriers.

3.10 FLUSHING OUT OF PIPING SYSTEMS

.1 Flush system in accordance with Section 23 08 02.

.2 Before start-up, clean interior of piping systems in accordance with requirements of Section 01 74 11 supplemented as specified in Section 23 08 02.

.3 Preparatory to acceptance, clean and refurbish equipment and leave in operating condition, including replacement of filters in piping systems.

3.11 PRESSURE TESTING OF EQUIPMENT AND PIPEWORK

.1 Advise Departmental Representative 48 hours minimum prior to performance of pressure tests.

.2 Pipework: test as specified in relevant sections of heating, ventilating and air conditioning work.

.3 Maintain specified test pressure without loss for 4 hours minimum unless specified for longer period of time in relevant mechanical sections.

.4 Prior to tests, isolate equipment and other parts which are not designed to withstand test pressure or media.

.5 Conduct tests in presence of Departmental Representative.

.6 Pay costs for repairs or replacement, retesting, and making good. Departmental Representative to determine whether repair or replacement is appropriate.

.7 Insulate or conceal work only after approval and certification of tests by Departmental Representative.

3.12 EXISTING SYSTEMS

.1 Connect into existing piping systems at times approved by Departmental Representative.

.2 Request written approval 10 days minimum, prior to commencement of work.

.3 Be responsible for damage to existing plant by this work.

.4 Ensure daily clean-up of existing areas.

3.13 CLEANING

.1 Clean in accordance with Section 01 74 11.

.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 74 20.

END OF SECTION

Part 1 GENERAL

1.1 REFERENCES

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

.1 ANSI/ASHRAE 90.1-2010, SI; Energy Standard for Buildings Except Low-Rise Residential Buildings (ANSI/ASHRAE/IES).

.2 Electrical Equipment Manufacturers' Advisory Council (EEMAC)

1.2 SECTIONS INCLUDES

.1 Electrical work to conform to Electrical Divisions including the following:

.1 Supplier and installer responsibility is indicated in Motor, Control and Equipment Schedule on electrical drawings and related mechanical responsibility is indicated on Mechanical Equipment Schedule on mechanical drawings.

.2 Control wiring and conduit is specified in Division 26 except for conduit, wiring and connections below 50 V which are related to control systems specified in Division 23. Refer to Division 26 for quality of materials and workmanship.

1.3 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Section 01 33 00.

1.4 CLOSEOUT SUBMITTALS

.1 Provide maintenance data for motors, drives and guards for incorporation into manual specified in Section 01 33 00.

1.5 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 74 20.

.2 Divert unused metal and wiring materials from landfill to metal recycling facility approved by Departmental Representative.

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

.4 Dispose of corrugated cardboard, polystyrene, plastic packaging material in appropriate on-site bin for recycling in accordance with site waste management program.

Part 2 PRODUCTS

2.1 GENERAL

.1 Motors to be high efficiency, in accordance with local Hydro company standards and the requirements of ASHRAE 90.1.

2.2 SYSTEM DESCRIPTION

.1 Performance Requirements: Provide only inverter grade motors.

.2 Variable Speed Drives: Design motors for operation with Variable Frequency Drives as noted on the Motor Schedule.

.3 Supply mechanical equipment complete with electrical motors.

- .1 Provide a complete listing of motors required on the project within twenty (20) days of contract award; list kW, Voltage, Phasing, efficiency, and other pertinent information for review.
- .2 Provide motors designed, manufactured, and tested in accordance with the latest edition of the following codes and standards: NEMA, EEMAC, CSA, CEC Part 1, IEEE and ANSI.
- .3 Motors shall conform to EEMAC Standard MG1, applicable IEEE Standards, and applicable CSA Standards unless otherwise noted. All motors to be high efficiency in accordance ASHRAE 90.1.

.4 Electrical Requirements:

- .1 Voltage and Frequency:
  - .1 Under .373 kW, provide single phase 120V motors.
  - .2 .373kW and larger, provide 3-phase, 60Hz power supply at 600 Volts or 208Volts.
  - .3 Design and manufacture motors to operate with ±10% voltage and ±5% frequency variations of the nameplate ratings.
  - .4 Do not exceed a combined voltage and frequency variation of ±10%.
- .2 Operating Characteristics:
  - .1 Torque: Motors must meet or exceed the locked rotor (starting) and minimum breakdown torques specified in NEMA standard for Design B for the ratings specified.
  - .2 Current: Locked rotor (starting) currents are not to exceed NEMA Design B maximum values for the specified rating. Motors are capable of a 20 second stall at six times full load current without injurious heating to the motor components.
  - .3 Efficiency: Premium Efficient design Motors will have a minimum and nominal full load efficiency that will meet or exceed the values listed in NEMA MG-1, 12.55 Table 12-6B when tested in accordance with NEMA test standard MG1-12.54.1, IEEE Test Procedure 112, Method B using accuracy improvement by segregated loss determination including stray load loss measurements. The minimum efficiency is guaranteed.
  - .4 Power Factor: The power factor of 3600 and 1800 rpm, 3 through 186.5 kW 250 HP ratings at full load, at full voltage must be a minimum of 85%. Six pole ratings will be excluded from this requirement.
- .3 Service Factor and Ambient:
  - .1 Standard motors will be rated for a 1.15 service factor in a 400°C ambient.
- .4 Insulation:

.1 Install standard motors with a full Class F non-hygroscopic insulation system.

.2 Dip and bake standard motors in polyester varnish to consolidate the winding.

.5 Mechanical Construction:

.1 Frame Size:

.1 Conform the horsepower/frame relationship to the latest NEMA standard for T-frame motors.

.2 Motors covered by this specification will be 143T-449T frame sizes.

.2 Motor Type:

.1 Totally Enclosed Fan Cooled (TEFC):

.1 Design motor to prevent free exchange of air between inside and outside of motor housing.

.2 Provide integral fan to direct cooling air over exterior surface of frame; fan constructed from one piece corrosion-resistant material.

.3 Construct fan covers from pressed steel for frames 140T-400T and of cast iron for 440T frames.

.4 Construct motor frame and end brackets from cast iron construction; include stainless steel nameplate.

.5 Provide two (2) drains at lowest point in frame.

.3 Bearings:

.1 All motors must have anti-friction bearings, sized for L-10 life of at least 50,000 hours under minimum V belt heave sizes for maximum loading conditions, refer to NEMA MG-1, 14.41 Table 14-1, or 150,000 hours L-10 life for a direct connected load.

.2 Bearings must be double-shielded, vacuum degassed steel ball bearings selected for electric motor service.

.3 Re-grease bearing housings with provision for purging old grease.

.4 Lubricate bearings with a premium moisture resistant grease of a temperature range of -290°C to +1490°C.

.5 Cast iron inner bearing caps.

.6 Zinc cadmium plate all fasteners and motor hardware.

.7 Use cast iron conduit box, diagonally split and rotatable in 90° increments:

.1 Use four (4) hex head bolts to secure conduit box to frame.

.2 Use four (4) hex head bolts for the conduit box cover.

.8 Zinc cadmium plate external hardware to resist corrosion.

.9 External full gloss epoxy enamel paint withstands industrial environments.

.10 Choose stainless steel and stamped nameplates in accordance with NEMA MG-1, 10.40. Nameplate information must include the nominal efficiency value in accordance with standard NEMA MG-1, 12.54.2.

.6 Motor Tests and Inspections:

.1 Production Tests: Each motor shall receive a routine commercial testing in accordance with NEMA MG-1, 12. Prototype test reports shall be for each rating.

.2 Sound Level: The noise level of each motor shall comply with NEMA MG-1, 12.49.

.3 Vibration Level: The vibration level of each motor shall not exceed those values listed in NEMA MG-1, 12.05.

.7 Motor Starter and Accessories:

.1 NEMA type, motor starters in accordance with the following specification and the motor starter schedule(s), unless otherwise noted. All loose motor starters and accessories shall be supplied and installed by the Mechanical trade.

.2 All starter locations shall be coordinated with electrical discipline on site. It is mechanical contractor’s responsibility to coordinate starter locations with electrical on site prior to commencement of electrical rough-ins.

.3 Unless otherwise noted, starters for single phase motors to be 120 volt, thermal overload protected manual starting switches with a neon pilot light, a surface or flush mounting NEMA enclosure to suit the application. Where an automatic operation is required, the enclosure shall also include a "Hand-Off-Auto" selector switch c/w minimum 2 NO and 2 NC contacts in an enclosure to match the starter enclosure. The starter enclosure shall be equipped with all required power supply, control transformer and fuses etc. to make it a complete and operational starter.

.4 Unless otherwise noted, starters for 3 phase motors less than 50Hp (37.3 kw) to be full voltage, non-reversing magnetic starters for across-the-line service. Full protection of each phase to be included in the starters by means of one (1) overload relay per phase per starter. Starters to be equipped with "Hand-Off-Auto" switches, pilot lights, control transformers, auxiliary contacts (minimum 2NO and 2 NC), and other accessories as per the starter schedule(s).

.5 Unless otherwise noted, starters for 3 phase motors 50 Hp (37.3 kW) up to 150 Hp (112 kW), to be reduced voltage, non-reversing, auto-transformer type starters. Full protection of each phase to be included in the starters by means of one (1) overload relay per phase per starter. Starters to be equipped with "Hand-Off-Auto" switches, pilot lights, control transformers, auxiliary contacts (minimum 2NO and 2 NC), and other accessories as per the starter schedule(s).

.6 Unless otherwise noted, starters for 3-phase motors 150 HP (112 kW) or larger, shall be reduced voltage, non-reversing, closed transition "wye-delta" starters. Full protection of each phase shall be included in the starters by means of one (1) overload relay per phase per starter. Starters shall be equipped with "Hand-Off-Auto" switches, pilot lights, control transformers, auxiliary contacts (minimum 2NO and 2 NC) and other accessories as per the starter schedule(s).

.7 Enclosures for starters located in sprinklered areas to be NEMA 3, enclosure for starters located outdoors shall be NEMA 4X, other loose starter enclosures to be NEMA 1 unless otherwise noted.

.8 The motor starter(s) for 2-speed fan(s) to be 2-speed type suitable for use with a two-speed double winding motor and complete with a forty-five (45) second time delay to allow the fan to coast down to low speed before it is operated at low speed.

.9 Identification nameplates to be engraved black-white-black lamacoid, suitably sized, complete with bevelled edges and stainless steel securing screws. Engraving must be approved by the Departmental Representative.

.10 Each starter supplied must be capable of starting the particular motor under the imposed load.

2.3 SOURCE QUALITY CONTROL

.1 Tests and Inspections:

.1 Production Tests: Each motor will receive a routine commercial testing in accordance with NEMA MG-1, 12. Produce prototype test reports for each rating.

.2 Sound Level: The noise level of each motor must comply with NEMA MG-1, 12.49.

.3 Vibration Level: The vibration level of each motor must not exceed those values listed in NEMA MG-1, 12.05.

2.4 TEMPORARY MOTORS

.1 If delivery of specified motor will delay completion or commissioning work, install motor approved by Departmental Representative for temporary use. Work will only be accepted when specified motor is installed.

2.5 BELT DRIVES

.1 Fit reinforced belts in sheave matched to drive. Multiple belts to be matched sets.

.2 Use cast iron or steel sheaves secured to shafts with removable keys unless otherwise specified.

.3 For motors under 7.5 kW: standard adjustable pitch drive sheaves, having plus or minus 10% range. Use mid-position of range for specified r/min.

.4 For motors 7.5 kW and over: sheave with split tapered bushing and keyway having fixed pitch unless specifically required for item concerned. Provide sheave of correct size to suit balancing.

.5 Correct size of sheave to be determined during commissioning.

.6 Minimum drive rating: 1.5 times nameplate rating on motor. Keep overhung loads within manufacturer's design requirements on prime mover shafts.

.7 Motor slide rail adjustment plates to allow for centre line adjustment.

.8 Supply one set of spare belts for each set installed in accordance with Section 01 78 00.

2.6 DRIVE GUARDS

.1 Provide guards for unprotected drives.

.2 Guards for belt drives;

.1 Expanded metal screen welded to steel frame.

.2 Minimum 1.2 mm thick sheet metal tops and bottoms.

.3 38 mm dia holes on both shaft centres for insertion of tachometer.

.4 Removable for servicing.

.3 Provide means to permit lubrication and use of test instruments with guards in place.

.4 Install belt guards to allow movement of motors for adjusting belt tension.

.5 Guard for flexible coupling:

.1 "U" shaped, minimum 1.6 mm thick galvanized mild steel.

.2 Securely fasten in place.

.3 Removable for servicing.

.6 Unprotected fan inlets or outlets:

.1 Wire or expanded metal screen, galvanized, 19 mm mesh.

.2 Net free area of guard: not less than 80% of fan openings.

.3 Securely fasten in place.

.4 Removable for servicing.

Part 3 EXECUTION

3.1 INSTALLATION

.1 Confirm coordination required, final connections, loads and locations of motors prior to installation.

.2 Mechanical subtrade is responsible for installing motors for mechanical equipment; deciding location of motors, conduit and connection points shown for equipment supplied by mechanical and as indicated on Electrical Drawings for estimating purposes only.

.3 Division 26 will provide line voltage connections for all mechanical equipment.

END OF SECTION

Part 1 GENERAL

1.1 REFERENCES

.1 ASTM International Inc.

.1 ASTM A53-12/A53M-12, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.

.2 ASTM A105/A105M-10a, Standard Specification for Carbon Steel Forgings, for Piping Applications.

.2 Canada Green Building Council (CaGBC)

.1 LEED Canada 2009 for Design and Construction-2010, LEED Canada 2009 for Design and Construction Leadership in Energy and Environmental Design Green Building Rating System Reference Guide.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00.

.2 Product Data:

.1 Provide manufacturer's printed product literature and datasheets for fixtures, and include product characteristics, performance criteria, physical size, finish and limitations.

.1 Manufacturer, model number, line contents, pressure and temperature rating.

.2 Movement handled, axial, lateral, angular and the amounts of each.

.3 Nominal size and dimensions including details of construction and assembly.

.3 Sustainable Design Submittals:

.1 LEED Submittals: in accordance with Section 01 35 21.

1.3 CLOSEOUT SUBMITTALS

.1 Provide maintenance and operation data in accordance with Section 01 78 00.

.1 Data to include:

.1 Servicing requirements, including special requirements, stuffing box packing, lubrication and recommended procedures.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle in accordance with Section 01 61 00.

.2 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

.3 Packaging Waste Management: remove for reuse of pallets, crates, paddling and packaging materials in accordance with Section 01 74 20.

Part 2 PRODUCTS

2.1 SLIP TYPE EXPANSION JOINTS

.1 Application: for axial pipe movement, as indicated.

.2 Repacking: under full line pressure.

.3 Body and packing housings: Class 150, 1MPa carbon steel pipe to ASTM A53/A53M, Grade B. Wall thickness to match pipe with raised face flanges to match pipe.

.4 Slip or traverse sleeves: carbon steel pipe to ASTM A53/A53M, Grade B, hard chrome plated.

.5 Anchor base: construction steel, welded to body.

.6 Guides (internal and external): embody into packing housing with concentric alignment of slip or traverse sleeve with packing housing.

.7 Extension limit stop: stainless steel, to prevent over-extension with accessible and removable pins.

.8 Packing rings: 6 minimum, PTFE.

.9 Thermal plastic packing: PTFE.

.10 Lubricating fittings: pet cocks with grease nipple.

.11 Plunger body and plunger:

.1 Plunger body: heavy wall carbon steel welded to body.

.2 Plunger: carbon steel with hex head for use with socket wrench.

.12 Lubricant: to manufacturer's recommendations.

.13 Lubricant gun: complete with hose assembly.

2.2 BELLOWS TYPE EXPANSION JOINTS

.1 For axial, lateral or angular movements, as indicated.

.2 Maximum operating pressure: to suit operating pressure

.3 Maximum operating temperature: 48 degrees C.

.4 Type A: controlled flexing, factory tested to 1 ½ times maximum working pressure. Provide test certificates.

.5 Bellows:

.1 Multiple bellows, hydraulically formed, single ply, austenitic stainless steel for specified fluid, pressure and temperature, water treatment and pipeline cleaning procedures.

.6 Reinforcing or control rings:

.1 2 piece nickel iron.

.7 Ends:

.1 Flanges to match pipe.

.8 Liner:

.1 Austenitic stainless steel in direction of flow.

.9 Shroud:

.1 Carbon steel, painted.

2.3 FLEXIBLE CONNECTION

.1 Application: to suit motion.

.2 Minimum length in accordance with manufacturer's recommendations to suit offset.

.3 Inner hose: Stainless steel corrugated.

.4 Braided wire mesh stainless steel outer jacket.

.5 Diameter and type of end connection: Flanged or threaded, size to match pipe size.

.6 Operating conditions:

.1 Working pressure: 1034 kPa.

.2 Working temperature: 50 degrees C.

.3 To match system requirements.

2.4 ANCHORS AND GUIDES

.1 Alignment guides:

.1 To accommodate specified thickness of insulation.

.2 Vapour barriers, jackets to remain uninterrupted.

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 PIPE CLEANING AND START-UP

.1 In accordance with Section 23 08 02.

3.3 PERFORMANCE VERIFICATION

.1 In accordance with Section 23 08 01.

3.4 CLEANING

.1 Clean in accordance with Section 01 74 11.

.2 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 20.

END OF SECTION

Part 1 GENERAL

1.1 REFERENCES

.1 American National Standards Institute/American Society of Mechanical Engineers (ANSI/ASME)

.1 ASME B31.1-2012, Power Piping.

.2 ANSI/ASME B31.3-2006, Process Piping.

.3 ASME Boiler and Pressure Vessel Code BPVC-2010:

.1 BPVC 2010 Section I: Power Boilers.

.2 BPVC 2010 Section V: Nondestructive Examination.

.3 BPVC 2010 Section IX: Welding and Brazing Qualifications.

.2 American National Standards Institute/American Water Works Association (ANSI/AWWA)

.1 ANSI/AWWA C206-03, Field Welding of Steel Water Pipe.

.3 American Welding Society (AWS)

.1 AWS C1.1M/C1.1-2000(R2006), Recommended Practices for Resistance Welding.

.2 AWS Z49.1-2005, Safety in Welding, Cutting and Allied Process.

.3 AWS W1-2000, Welding Inspection Handbook.

.4 Canada Green Building Council (CaGBC)

.1 LEED Canada For New Construction and Major Renovations 2009.

.5 Canadian Standards Association (CSA International)

.1 CSA W47.2-M1987(R2008), Certification of Companies for Fusion Welding of Aluminum.

.2 CSA W48-06, Filler Metals and Allied Materials for Metal Arc Welding.

.3 CSA B51-03(R2007), Boiler, Pressure Vessel and Pressure Piping Code.

.4 CSA-W117.2-2006, Safety in Welding, Cutting and Allied Processes.

.5 CSA W178.1-2008, Certification of Welding Inspection Organizations.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00.

.2 Sustainable Design Submittals:

.1 LEED Submittals: in accordance with Section 01 35 21.

1.3 QUALITY ASSURANCE

.1 Qualifications:

.1 Welders:

.1 Welding qualifications in accordance with CSA B51.

.2 Use qualified and licensed welders possessing certificate for each procedure performed from authority having jurisdiction.

.3 Submit welder's qualifications to Departmental Representative.

.4 Each welder to possess identification symbol issued by authority having jurisdiction.

.5 Certification of companies for fusion welding of aluminum in accordance with CSA W47.2.

.2 Inspectors:

.1 Inspectors qualified to CSA W178.2.

.3 Certifications:

.1 Registration of welding procedures in accordance with CSA B51.

.2 Copy of welding procedures available for inspection.

.3 Safety in welding, cutting and allied processes in accordance with CSA-W117.2.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle in accordance with Section 01 61 00.

.2 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

.3 Packaging Waste Management: remove for reuse of pallets, crates, paddling and packaging materials in accordance with Section 01 74 20.

Part 2 PRODUCTS

2.1 ELECTRODES

.1 Electrodes: in accordance with CSA W48 Series.

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 QUALITY OF WORK

.1 Welding: in accordance with ANSI/ASME B31.3, ANSI/ASME Boiler and Pressure Vessel Code, Sections I and IX and ANSI/AWWA C206, using procedures conforming to AWS B3.0, AWS C1.1, and applicable requirements of provincial authority having jurisdiction.

3.3 INSTALLATION REQUIREMENTS

.1 Identify each weld with welder's identification symbol.

.2 Backing rings:

.1 Where used, fit to minimize gaps between ring and pipe bore.

.2 Do not install at orifice flanges.

.3 Fittings:

.1 NPS 2 and smaller: install welding type sockets.

.2 Branch connections: install welding tees or forged branch outlet fittings.

3.4 INSPECTION AND TESTS - GENERAL REQUIREMENTS

.1 Review weld quality requirements and defect limits of applicable codes and standards with Departmental Representative before work is started.

.2 Formulate "Inspection and Test Plan" in co-operation with Departmental Representative.

.3 Do not conceal welds until they have been inspected, tested and approved by inspector.

.4 Provide for inspector to visually inspect welds during early stages of welding procedures in accordance with Welding Inspection Handbook. Repair or replace defects as required by codes and as specified.

3.5 SPECIALIST EXAMINATIONS AND TESTS

.1 General:

.2 Perform examinations and tests by specialist qualified to CSA W178.1 and CSA W178.2 and approved by Departmental Representative.

.3 To ANSI/ASME Boiler and Pressure Vessels Code, Section V, CSA B51 and requirements of authority having jurisdiction.

.4 Inspect and test 10% of welds in accordance with "Inspection and Test Plan" by non-destructive visual examination and magnetic particle (hereinafter referred to as "particle") tests.

.2 Hydrostatically test welds to ANSI/ASME B31.1.

.3 Visual examinations: include entire circumference of weld externally and wherever possible internally.

.4 Failure of visual examinations:

.1 Upon failure of welds by visual examination, perform additional testing as directed by Departmental Representative of total of up to 10% of welds, selected at random by Departmental Representative by particle tests.

3.6 DEFECTS CAUSING REJECTION

.1 As described in ANSI/ASME B31.1 and ANSI/ASME Boiler and Pressure Vessels Code.

3.7 REPAIR OF WELDS WHICH FAILED TESTS

.1 Re-inspect and re-test repaired or re-worked welds at Contractor's expense.

3.8 CLEANING

.1 Clean in accordance with Section 01 74 11.

.2 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 20.

END OF SECTION

Part 1 GENERAL

1.1 REFERENCES

.1 American Society of Mechanical Engineers (ASME)

.1 ASME B40.100-2005, Pressure Gauges and Gauge Attachments.

.2 ASME B40.200-2008, Thermometers, Direct Reading and Remote Reading.

.2 Canada Green Building Council (CaGBC)

.1 LEED Canada 2009 for Design and Construction, LEED Canada 2009 for Design and Construction Leadership in Energy and Environmental Design Green Building Rating System Reference Guide.

.3 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-14.4-M88, Thermometers, Liquid-in-Glass, Self Indicating, Commercial/Industrial Type.

.2 CAN/CGSB-14.5-M88, Thermometers, Bimetallic, Self-Indicating, Commercial/Industrial Type.

.4 Efficiency Valuation Organization (EVO)

.1 International Performance Measurement and Verification Protocol (IPMVP)

.1 IPMVP 2007 Version.

.5 Green Seal Environmental Standards (GS)

.1 GS-11-11, Standard for Paints and Coatings.

.2 GS-36-11, Standard for Commercial Adhesives.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for thermometers and pressure gauges and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Shop Drawings:

.1 Submit drawings indicating type and range for each type of gauge and thermometer.

.3 Certificates:

.1 Submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.4 Test and Evaluation Reports:

.1 Submit certified test reports for thermometers and pressure gauges from approved independent testing laboratories, indicating compliance with specifications for specified performance characteristics and physical properties.

1.3 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 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 thermometers and pressure gauges off ground, indoors, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect thermometers and pressure gauges from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

.4 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding and packaging materials in accordance with Section 01 74 20.

Part 2 PRODUCTS

2.1 GENERAL

.1 Design point to be at mid-point of scale or range.

.2 Ranges: as required for each system’s expected minimum and maximum operating points.

2.2 DIRECT READING THERMOMETERS

.1 Industrial, variable angle type, mercury-free, liquid filled, 125 mm scale length: to CAN/CGSB-14.4.

.1 Resistance to shock and vibration.

2.3 REMOTE READING THERMOMETERS

.1 100 mm diameter mercury-free liquid filled activated dial type: to CAN/CGSB-14.5, accuracy within one scale division, brass movement, stainless steel capillary, stainless steel spiral armour, stainless steel bulb and polished brass case for wall mounting.

2.4 THERMOMETER WELLS

.1 Copper pipe: copper or bronze.

.2 Steel pipe: stainless steel.

2.5 PRESSURE GAUGES

.1 112 mm, dial type: to ASME B40.100, Grade 2A, stainless steel bourdon tube having 0.5% accuracy full scale unless otherwise specified.

.2 Provide:

.1 Snubber for pulsating operation.

.2 Diaphragm assembly for corrosive service.

.3 Gasketted pressure relief back with solid front.

.4 Bronze stop cock.

.5 Oil filled for high vibration applications.

Part 3 EXECUTION

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate 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 GENERAL

.1 Install thermometers and gauges so they can be easily read from floor or platform.

.1 If this cannot be accomplished, install remote reading units.

.2 Install between equipment and first fitting or valve.

3.3 THERMOMETERS

.1 Install in wells on piping. Include heat conductive material inside well.

.2 Install in locations as indicated and on inlet and outlet of:

.1 Heat exchangers.

.2 Water heating and cooling coils.

.3 Water boilers.

.4 Chillers.

.5 Cooling towers.

.6 DHW tanks.

.3 Install wells for balancing purposes.

.4 Use extensions where thermometers are installed through insulation.

3.4 PRESSURE GAUGES

.1 Install in locations as follows:

.1 Suction and discharge of pumps.

.2 Upstream and downstream of PRV's.

.3 Upstream and downstream of control valves.

.4 Inlet and outlet of coils.

.5 Inlet and outlet of liquid side of heat exchangers.

.6 Outlet of boilers.

.7 In other locations as indicated.

.2 Install gauge cocks for balancing purposes, elsewhere as indicated.

.3 Use extensions where pressure gauges are installed through insulation.

3.5 NAMEPLATES

.1 Install engraved lamicoid nameplates in accordance with Section 23 05 53.01, identifying medium.

3.6 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11.

.3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 20.

.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.7 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by thermometer and gauge installation.

END OF SECTION

Part 1 GENERAL

1.1 REFERENCES

.1 American Society of Mechanical Engineers (ASME)

.1 ASME B1.20.1-1983(R2006), Pipe Threads, General Purpose (Inch).

.2 ASME B16.18-2001, Cast Copper Alloy Solder Joint Pressure Fittings.

.2 ASTM International

.1 ASTM A276-10, Standard Specification for Stainless Steel Bars and Shapes.

.2 ASTM B62-09, Standard Specification for Composition Bronze or Ounce Metal Castings.

.3 ASTM B283/B283M-11a, Standard Specification for Copper and Copper Alloy Die Forgings (Hot-Pressed).

.4 ASTM B505/B505M-11, Standard Specification for Copper-Base Alloy Continuous Castings.

.3 Canada Green Building Council (CaGBC)

.1 LEED Canada For New Construction and Major Renovations 2009.

.4 Manufacturers Standardization Society of the Valve and Fittings Industry, Inc. (MSS)

.1 MSS SP-25-2008, Standard Marking System for Valves, Fittings, Flanges and Unions.

.2 MSS SP-80-2008, Bronze Gate Globe, Angle and Check Valves.

.3 MSS SP-110-2010, Ball Valves, Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00.

.2 Product Data:

.1 Provide manufacturer's printed product literature and data sheets for equipment and systems and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Submit WHMIS MSDS - Material Safety Data Sheets.

.3 Shop Drawings:

.1 Submit data for valves specified in this Section.

.4 Sustainable Design Submittals:

.1 LEED Canada-NC Submittals: in accordance with Section 01 35 21.

1.3 CLOSEOUT SUBMITTALS

.1 Provide maintenance data for incorporation into manual specified in Section 01 78 00.

1.4 MAINTENANCE MATERIAL SUBMITTALS

.1 Extra Materials/Spare Parts:

.2 Furnish following spare parts:

.1 Valve seats: one for every 10 valves each size, minimum 1.

.2 Discs: one for every 10 valves, each size, minimum 1.

.3 Stem packing: one for every 10 valves, each size, minimum 1.

.4 Valve handles: 2 of each size.

.5 Gaskets for flanges: one for every 10 flanged joints, minimum 1.

.3 Tools:

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 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: remove for reuse of pallets, crates, padding, and packaging materials in accordance with Section 01 74 20.

Part 2 PRODUCTS

2.1 MATERIALS

.1 Valves:

.1 Except for specialty valves, to be single manufacturer.

.2 End Connections:

.1 Connection into adjacent piping/tubing:

.1 Steel pipe systems: screwed ends to ANSI/ASME B1.20.1.

.2 Copper tube systems: solder ends to ASME B16.18.

.3 Lockshield Keys:

.1 Where lockshield valves are specified, provide 2 keys of each size: malleable iron cadmium plated.

.4 Gate Valves:

.1 Requirements common to gate valves, unless specified otherwise:

.1 Standard specification: MSS SP-80.

.2 Bonnet: union with hexagonal shoulders.

.3 Connections: screwed with hexagonal shoulders.

.4 Inspection and pressure testing: to MSS SP-80. Tests to be hydrostatic.

.5 Packing: non-asbestos.

.6 Handwheel: non-ferrous.

.7 Handwheel Nut: bronze to ASTM B62.

.2 NPS 2 and under, non-rising stem, solid wedge disc, Class 125

.1 Body: with long disc guides, screwed bonnet with stem retaining nut.

.2 Operator: Handwheel.

.3 NPS 2 and under, non-rising stem, solid wedge disc, Class 150:

.1 Body: with long disc guides, screwed bonnet with stem retaining nut.

.2 Operator: Handwheel.

.4 NPS 2 and under, rising stem, split wedge disc, Class 125:

.1 Body: with long disc guides, screwed bonnet.

.2 Disc: split wedge, bronze to ASTM B283/B283M, loosely secured to stem.

.3 Operator: handwheel.

.5 NPS 2 and under, rising stem, solid wedge disc, Class 125:

.1 Body: with long disc guides, screwed bonnet.

.2 Operator: handwheel.

.6 NPS 2 and under, rising stem, solid wedge disc, Class 150:

.1 Body: with long disc guides, screwed bonnet.

.2 Operator: handwheel.

.5 Globe Valves:

.1 Requirements common to globe valves, unless specified otherwise:

.1 Standard specification: MSS SP-80.

.2 Bonnet: union with hexagonal shoulders.

.3 Connections: screwed with hexagonal shoulders.

.4 Pressure testing: to MSS SP-80. Tests to be hydrostatic.

.5 Stuffing box: threaded to bonnet with gland follower, packing nut, high grade non-asbestos packing.

.6 Handwheel: non-ferrous.

.7 Handwheel Nut: bronze to ASTM B62.

.2 NPS 2 and under, composition disc, Class 125:

.1 Body and bonnet: screwed bonnet.

.2 Disc and seat: renewable rotating PTFE, regrindable bronze seat, loosely secured to bronze stem to ASTM B505/B505M.

.3 Operator: handwheel.

.3 NPS 2 and under, composition disc, Class 150:

.1 Body and bonnet: union bonnet.

.2 Disc and seat: renewable rotating PTFE disc in easily removable disc holder, regrindable bronze seat, loosely secured to bronze stem to ASTM B505/B505M.

.3 Operator: handwheel.

.4 NPS 2 and under, plug disc, Class 150, screwed ends:

.1 Body and bonnet: union bonnet.

.2 Disc and seat ring: tapered plug type with disc stem ring of AISI S420 stainless steel to ASTM A276, loosely secured to stem.

.3 Operator: handwheel.

.5 Angle valve, NPS 2 and under, composition disc, Class 150:

.1 Body and bonnet: union bonnet.

.2 Disc and seat: renewable rotating PTFE disc in slip-on easily removable disc holder having integral guides, regrindable bronze seat, loosely secured to stem.

.3 Operator: handwheel.

.6 Check Valves:

.1 Requirements common to check valves, unless specified otherwise:

.1 Standard specification: MSS SP-80.

.2 Connections: screwed with hexagonal shoulders.

.2 NPS 2 and under, swing type, bronze disc, Class 125:

.1 Body: Y-pattern with integral seat at 45 degrees, screw-in cap with hex head.

.2 Disc and seat: renewable rotating disc, two-piece hinge disc construction; seat: regrindable.

.3 NPS 2 and under, swing type, bronze disc:

.1 Body: Y-pattern with integral seat at 45 degrees, screw-in cap with hex head.

.2 Disc and seat: renewable rotating disc, two-piece hinge disc construction; seat: regrindable.

.4 NPS 2 and under, swing type, composition disc, Class 200:

.1 Body: Y-pattern with integral seat at 45 degrees, screw-in cap with hex head.

.2 Disc: renewable rotating disc of number 6 composition to suit service conditions, bronze two-piece hinge disc construction.

.5 NPS 2 and under, horizontal lift type, composition disc, Class 150:

.1 Body: with integral seat, union bonnet ring with hex shoulders, cap.

.2 Disc: renewable PTFE rotating disc in disc holder having guides top and bottom, of bronze to ASTM B62.

.6 NPS 2 and under, vertical lift type, bronze disc, Class 125:

.1 Disc: rotating disc having guides top and bottom, disc guides, retaining rings.

.7 Silent Check Valves:

.1 NPS 2 and under:

.1 Body: cast high tensile bronze to ASTM B62 with integral seat.

.2 Pressure rating: Class 125.

.3 Connections: screwed ends to ANSI/ASME B1.20.1 and with hex. shoulders.

.4 Disc and seat: renewable rotating disc.

.5 Stainless steel spring, heavy duty.

.6 Seat: regrindable.

.8 Ball Valves:

.1 NPS 2 and under:

.1 Body and cap: cast high tensile bronze to ASTM B62.

.2 Pressure rating: Class125

.3 Connections: screwed ends to ASME B1.20.1 and with hexagonal shoulders or solder ends to ANSI.

.4 Stem: tamperproof ball drive.

.5 Stem packing nut: external to body.

.6 Ball and seat: replaceable stainless steel solid ball and Teflon seats.

.7 Stem seal: PTFE with external packing nut.

.8 Operator: removable lever handle.

.9 Butterfly Valves:

.1 NPS 2 1/2 through NPS 6, 2068 kPa with grooved ends.

.1 Body: cast bronze, with copper-tube dimensioned grooved ends.

.2 Disc: elastomer coated ductile iron with integrally cast stem.

.3 Operator: lever or handwheel.

Part 3 EXECUTION

3.1 INSTALLATION

.1 Install rising stem valves in upright position with stem above horizontal.

.2 Remove internal parts before soldering.

.3 Install valves with unions at each piece of equipment arranged to allow servicing, maintenance, and equipment removal.

3.2 CLEANING

.1 Clean in accordance with Section 01 74 11.

.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 74 20.

END OF SECTION

Part 1 GENERAL

1.1 REFERENCES

.1 American Society of Mechanical Engineers (ASME)

.1 ASME B31.1-2012, Power Piping.

.2 ASTM International

.1 ASTM A125-96(2013)e1, Standard Specification for Steel Springs, Helical, Heat-Treated.

.2 ASTM A307-12, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.

.3 ASTM A563-07a(2014), Standard Specification for Carbon and Alloy Steel Nuts.

.3 Canada Green Building Council (CaGBC)

.1 LEED Canada For New Construction and Major Renovations 2009.

.4 Factory Mutual (FM)

.5 Manufacturer's Standardization Society of the Valves and Fittings Industry (MSS)

.1 MSS SP 58-2009, Pipe Hangers and Supports - Materials, Design and Manufacture.

.2 MSS SP 69-2003, Pipe Hangers and Supports - Selection and Application.

.3 MSS SP 89-2003, Pipe Hangers and Supports - Fabrication and Installation Practices.

.6 Underwriter's Laboratories of Canada (ULC)

.1 CAN/ULC-

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00.

.2 Product Data:

.1 Provide manufacturer's printed product literature and data sheets for hangers and supports and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:

.1 Submit shop drawings for:

.1 Bases, hangers and supports.

.2 Connections to equipment and structure.

.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.

.6 Sustainable Design Submittals:

.1 LEED Canada-NC Submittals: in accordance with Section 01 35 21.

1.3 CLOSEOUT SUBMITTALS

.1 Provide maintenance data for incorporation into manual specified in Section 01 78 00.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 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: remove for reuse of pallets, crates, padding, and packaging materials in accordance with Section 01 74 21.

Part 2 PRODUCTS

2.1 SYSTEM DESCRIPTION

.1 Design Requirements:

.2 Construct pipe hanger and support to manufacturer's recommendations utilizing manufacturer's regular production components, parts and assemblies.

.3 Base maximum load ratings on allowable stresses prescribed by ASME B31.1 or MSS SP 58.

.4 Ensure that supports, guides, anchors do not transmit excessive quantities of heat to building structure.

.5 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.

.6 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 ASME B31.1.

.2 Use components for intended design purpose only. Do not use for rigging or erection purposes.

.3 Finishes:

.1 Pipe hangers and supports: galvanized after manufacture.

.2 Use electro-plating galvanizing process or hot dipped galvanizing process.

.3 Ensure steel hangers in contact with copper piping are epoxy coated.

.4 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.

.1 Rod: 9 mm UL listed.

.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 to MSS-SP 58 and MSS-SP 69.

.5 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 to MSS SP 69.

.2 Cold piping NPS 2 1/2 or greater, hot piping: malleable iron top-of-beam jaw-clamp with hooked rod, spring washer, plain washer and nut UL listed.

.6 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 to MSS SP 69.

.7 Shop and field-fabricated assemblies:

.1 Trapeze hanger assemblies

.2 Steel brackets

.8 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.

.9 Pipe attachments: material to MSS SP 58:

.1 Attachments for steel piping: carbon steel black.

.2 Attachments for copper piping: copper plated black steel.

.3 Use insulation shields for hot pipework.

.4 Oversize pipe hangers and supports.

.10 Adjustable clevis: material to MSS SP 69 UL listed, 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.

.11 Yoke style pipe roll: carbon steel yoke, rod and nuts with cast iron roll, to MSS SP 69.

.12 U-bolts: carbon steel to MSS SP 69 with 2 nuts at each end to ASTM A563.

.1 Finishes for steel pipework: black.

.2 Finishes for copper, glass, brass or aluminum pipework: epoxy coated.

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

2.3 RISER CLAMPS

.1 Steel or cast iron pipe: galvanized carbon steel to MSS SP 58, type 42, UL listed.

.2 Copper pipe: carbon steel copper plated to MSS SP 58, type 42.

.3 Bolts: to ASTM A307.

.4 Nuts: to ASTM A563.

2.4 INSULATION PROTECTION SHIELDS

.1 Insulated cold piping:

.2 64 kg/m³ density insulation plus insulation protection shield to: MSS SP 69, galvanized sheet carbon steel. Length designed for maximum 3 m span.

.2 Insulated hot piping:

.1 Curved plate 300 mm long, with edges turned up, welded-in centre plate for pipe sizes NPS 12 and over, carbon steel to comply with MSS SP 69.

2.5 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 ANCHOR BOLTS AND TEMPLATES

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

2.8 HOUSE-KEEPING PADS

.1 Provide 100 mm high concrete housekeeping pads for base-mounted equipment; size pads 50 mm larger than equipment; chamfer pad edges.

.2 Concrete: to Section 03 30 00.

Part 3 EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION

.1 Install in accordance with:

.1 Manufacturer's instructions and recommendations.

.2 Vibration Control Devices:

.1 Install on piping systems at pumps, boilers, chillers, cooling towers, and as indicated.

.3 Clamps on riser piping:

.1 Support independent of connected horizontal pipework using riser clamps and riser clamp lugs welded to riser.

.2 Bolt-tightening torques to industry standards.

.3 Steel pipes: install below coupling or shear lugs welded to pipe.

.4 Cast iron pipes: install below joint.

.4 Clevis plates:

.1 Attach to concrete with 4 minimum concrete inserts, one at each corner.

.5 Provide supplementary structural steelwork where structural bearings do not exist or where concrete inserts are not in correct locations.

.6 Use approved constant support type hangers where:

.1 Vertical movement of pipework is 13 mm or more,

.2 Transfer of load to adjacent hangers or connected equipment is not permitted.

.7 Use variable support spring hangers where:

.1 Transfer of load to adjacent piping or to connected equipment is not critical.

.2 Variation in supporting effect does not exceed 25 % of total load.

3.3 HANGER SPACING

.1 Plumbing piping: to National Plumbing Code and authority having jurisdiction.

.2 Fire protection: to applicable fire code.

.3 Gas and fuel oil piping: up to NPS 1/2: every 1.8 m.

.4 Copper piping: up to NPS 1/2: every 1.5 m.

.5 Flexible joint roll groove pipe: in accordance with table below 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.

.6 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	

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

3.4 HANGER INSTALLATION

.1 Install hanger so that rod is vertical under operating conditions.

.2 Adjust hangers to equalize load.

.3 Support from structural members. Where structural bearing does not exist or inserts are not in suitable locations, provide supplementary structural steel members.

3.5 HORIZONTAL MOVEMENT

.1 Angularity of rod hanger resulting from horizontal movement of pipework from cold to hot position not to exceed 4 degrees from vertical.

.2 Where horizontal pipe movement is less than 13 mm, offset pipe hanger and support so that rod hanger is vertical in the hot position.

3.6 FINAL ADJUSTMENT

.1 Adjust hangers and supports:

.1 Ensure that rod is vertical under operating conditions.

.2 Equalize loads.

.2 Adjustable clevis:

.1 Tighten hanger load nut securely to ensure proper hanger performance.

.2 Tighten upper nut after adjustment.

.3 C-clamps:

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

.4 Beam clamps:

.1 Hammer jaw firmly against underside of beam.

3.7 FIELD QUALITY CONTROL

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

.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.

3.8 CLEANING

.1 Clean in accordance with Section 01 74 11.

.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 74 20.

END OF SECTION

Part 1 GENERAL

1.1 RELATED SECTIONS

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

.2 Section 25 30 02 – EMCS: Field Control Devices

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

1.2 PRODUCT DATA

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

.2 Provide manufacture's catalog cut sheets showing materials and performance data.

.3 Provide copy of UL and CSA file listing indicating the heating cable is specifically intended to provide supplementary heating to hot water service supply systems utilizing thermally insulated metal or plastic pipe.

1.3 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 74 20.

.2 Divert unused metal and wiring materials from landfill to metal recycling facility approved by Departmental Representative.

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

.4 Dispose of corrugated cardboard, polystyrene, plastic packaging material in appropriate on-site bin for recycling in accordance with site waste management program.

Part 2 PRODUCTS

2.1 SELF REGULATING ROOF AND GUTTER TRACING HEATING CABLES

.1 Supply self-regulating heatin cable with 16 AWG copper bus wires, ground braid to be tinned copper, self-regulating polymer core matrix, UV stabilized polyolefin weatherproof outer jacket. Heating capacity: 12W/m in snow or ice at 0°C.

.2 Accessories: Supply power connection kit, splice kits, and end seal kits as necessary to install as indicated on drawings.

.3 Electrical: 120V/208V single phase.

.4 Cables to be ULC listed for snow melting and de-icing equipment.

.5 Controls:

.1 Thermostat: remote bulb type, to Section 25 30 02. Ambient air sensing.

Part 3 EXECUTION

3.1 INSTALLATION

.1 Pipe heat tracing cable:

.1 Install heat tracing heating cables in accordance with manufacturer's instructions. Distribute and fasten cable evenly on pipe using pipe strap or tape at maximum spacing 0.5 m. Ensure that heating cables do not touch or cross each other at any point. Run only cold leads in conduit and ensure sensing bulb does not touch cable. Ground shield to building ground. Coordinate cable installation with insulation application. Loop additional cable at fittings, valves, and flanges.

.2 Make power and control connections.

3.2 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 01.

.2 Heat Tracing:

.1 Use 500 V megger to test cables for continuity and insulation value and record readings before, during and after installation.

.2 Where resistance of 50 megohms or less is measured, stop work and advise Departmental Representative.

.3 Hot Water Temperature Maintenance:

.1 Measure the heater circuit continuity and the insulation resistance between the braid and the bus wires with a 2500 Vdc megohmmeter.

.2 The tests should be performed at the following stages and shall be witnessed by the Departmental Representative.

.1 Prior to installation while the cable is still on the reel(s).

.2 After installation of the heating cable and completion of circuit fabrication kits, including splice kits, but prior to installation of thermal insulation.

.3 After installation of thermal insulation but prior to installation of wall or ceiling materials.

.3 The heater circuit shall be continuous and megohmmeter readings shall be at least 20 megohm regardless of the heater length. Circuits yielding unacceptable readings must be repaired or replaced.

.4 Submit records of the test data to the Departmental Representative.

END OF SECTION

Part 1 GENERAL

1.1 RELATED SECTIONS

.1 Section 03 30 00 - Cast-in-Place Concrete.

.2 Section 23 21 23 – Hydronic Pumps

.3 Section 23 34 00 –HVAC Fans

.4 Section 23 73 11 – Air Handling Units

.5 Section 23 82 40 Air and Water Source Unitary Heatpumps

.6 Section 23 05 93 - Testing, Adjusting and Balancing of HVAC.

1.2 REFERENCES

.1 National Fire Protection Association (NFPA)

.1 NFPA 13-2009, Installation of Sprinkler Systems.

.2 National Building Code of Canada (NBC) 2010.

1.3 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Section 01 33 00.

.2 Provide system shop drawings complete with performance and product data.

1.4 SUBMITTALS

.1 Provide required information in accordance with Section 01 30 00 – Administrative Requirements.

.2 Submit vibration isolation schedule indicating the tag number of the equipment isolated, the type of base selected, the type of isolator selected, and the isolator static deflection chosen.

.3 Submit shop drawing for all mounted mechanical equipment that reflects the dimensional and installation requirements of the approved piece of equipment submitted under different sections. Include electrical motor isolation.

.4 Submit proposed mounting detail drawings for approval by the Departmental Representative if manufacturer's drawings are not available or suitable.

.5 Submit report prepared by the isolation supplier that certifies that the installation has been checked and corrected as necessary.

.6 Provide inspection services by vibration isolation equipment and materials manufacturer’s representative for final installation.

1.5 QUALITY ASSURANCE

.1 Mount mechanical equipment in accordance with approved drawings and literature provided by the manufacturer and with the electric motor on the same base or frame as the driven equipment. Mount equipment true and level so that operation will not be affected by weight.

.2 Mount mechanical equipment on vibration isolators to minimize the transmission of vibrations to building structure.

.3 One manufacturer must provide all vibration control equipment. An exception to this is the vibration isolation supplied as an integral part of packaged equipment.

.4 The product supplier must check the vibration isolator system for effectiveness and proper installation when all equipment is in operation. Any isolation which is not performing as intended or which is not properly installed must be replaced at no additional cost.

.5 Provide isolation that will maintain stability during starting and stopping of equipment without any traverse and eccentric movement of equipment that would damage or adversely affect the equipment or attachments.

.6 Isolators must be selected and located to produce uniform loading and deflection even when equipment weight is not evenly distributed.

1.6 VIBRATION ISOLATION PERFORMANCE

.1 For each piece of equipment to be isolated, select the vibration isolation mounts on the basis of 98% vibration isolation efficiency at the lowest operating speed. That is, the natural frequency of each vibration isolation system shall be no higher than 1/10 of the lowest excitation frequency of the rotating machinery, when ever practicable, but in no case greater than 1/7.

.2 Where structural floor deflection will exceed 1/10 of the determined static deflection of the isolator, increase the isolator static deflection to maintain this minimum ratio of the floor to isolator deflection. Required floating floors shall be provided by civil trades.

.3 Static deflections shown on the drawings, specified or scheduled are a guide only. Actual isolators are to achieve the required static deflection under load, with at least 50% reserve deflection.

1.7 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 74 20.

.2 Divert unused metal and wiring materials from landfill to metal recycling facility approved by Departmental Representative.

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

.4 Dispose of corrugated cardboard, polystyrene, plastic packaging material in appropriate on-site bin for recycling in accordance with site waste management program.

Part 2 PRODUCTS

2.1 GENERAL

.1 Outdoor springs and housings shall be corrosion resistant.

.2 Isolators containing water which can be drained shall use a vertical limiting spring similar to type F-2.

2.2 ELASTOMERIC PADS

.1 Type EP1 - neoprene waffle or ribbed; 9 mm minimum thick; 50 durometer; maximum loading 350 kPa.

.2 Type EP2 - rubber waffle or ribbed; 9 mm minimum thick; 30 durometer natural rubber; maximum loading 415 kPa.

.3 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.

.4 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.

.5 Type EP5 – sound control underlayment 8mm minimum thick open cellular rubber mat reinforced with solid rubber particles bonded to fibreglass/cellulose backing with a density of 22lbs/cu.ft. and a minimum tensile strength of 45lbs.

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.

.2 Ratio of height when loaded to diameter of spring between 0.8 to 1.0.

.3 Cadmium plate for outdoor installations.

.4 Colour code springs.

2.5 SPRING MOUNT

.1 Zinc or cadmium plated hardware; housings coated with rust resistant paint.

.2 Type M2 - stable open spring: support on bonded 6 mm minimum thick ribbed neoprene or rubber friction and acoustic pad.

.3 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.

.4 Type M4 - restrained stable open spring: supported on two layers of bonded 6 mm minimum thick ribbed neoprene acoustic pads; built-in resilient limit stops, removable spacer plates.

.5 Type M5 - enclosed spring mounts with snubbers for isolation up to 950 kg maximum.

.6 Type M6 - restrained stable open spring: supported on three (3) layers of bonded 20 mm minimum thick rubber waffle pads; built-in resilient limit stops, removable spacer plates. Each spring shall be sized to limit a 20% compression. Hold down bolds for springs shall include a thick neoprene grommet at the bolt hole. Minimum length is 150mm with an allowable compression of 25mm, elongation of 16mm traverse movement of 16mm.

.7 Performance: as indicated.

2.6 FLEXIBLE CONNECTIONS

.1 Double sphere EPDM connector and expansion joint; multi-layerd tire cord fabric reinforcement with peroxide cured EPDM cover. Split baked enamel ductile iron floating flanges rated for 17Bar.

2.7 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.

.2 Type H1 - neoprene - in-shear, moulded with rod isolation bushing which passes through hanger box.

.3 Type H2 - stable spring, elastomeric washer, cup with moulded isolation bushing which passes through hanger box.

.4 Type H3 - stable spring, elastomeric element, cup with moulded isolation bushing which passes through hanger box.

.5 Type H4 - stable spring, elastomeric element with precompression washer and nut with deflection indicator.

.6 Performance: as indicated.

2.8 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.

2.9 HORIZONTAL THRUST RESTRAINT

.1 Spring and elastomeric element housed in box frame; assembly complete with rods and angle brackets for equipment and ductwork attachment; provision for adjustment to limit maximum start and stop movement to 9 mm.

.2 Arrange restraints symmetrically on either side of unit and attach at centerline of thrust.

2.10 STRUCTURAL BASES

.1 Type B1 - Prefabricated steel base: integrally welded on sizes up to 2400 mm on smallest dimension, split for field welding on sizes over 2400 mm on smallest dimension and reinforced for alignment of drive and driven equipment; without supplementary hold down devices; complete with isolation element attached to base brackets arranged to minimize height; pre-drilled holes to receive equipment anchor bolts; and complete with adjustable built-in motor slide rail where indicated.

.2 Type B2 - Steel rail base: structural steel, positioned for alignment of drive and driven equipment; without supplementary hold down devices; complete with isolation element attached to base brackets arranged to minimize height; and pre-drilled holes to receive equipment anchor bolts.

.3 Bases to clear housekeeping pads by 25 mm minimum.

2.11 INERTIA BASE

.1 Type B3 - Full depth perimeter structural or formed channels, frames: welded in place reinforcing rods running in both directions; spring mounted, carried by gusseted height-saving brackets welded to frame; and clear housekeeping pads by 50 mm minimum.

.2 Pump bases: "T" shaped, where applicable, to provide support for elbows.

.3 Concrete: to Section 03 30 00 - Cast-in-Place Concrete.

Part 3 EXECUTION

3.1 INSTALLATION

.1 Seismic control measures to meet requirements of NBC.

.2 Install vibration isolation equipment in accordance with manufacturers instructions and adjust mountings to level equipment.

.3 Ensure piping, ducting and electrical connections to isolated equipment do not reduce system flexibility and that piping, conduit and ducting passage through walls and floors do not transmit vibrations.

.4 Unless indicated otherwise, support piping connected to isolated equipment with spring mounts or spring hangers with 25 mm minimum static deflection as follows:

.1 Up to NPS4: first 3 points of support. NPS5 to NPS8: first 4 points of support. NPS10 and Over: first 6 points of support.

.2 First point of support shall have a static deflection of twice deflection of isolated equipment, but not more than 50 mm.

.5 Where isolation is bolted to floor use vibration isolation rubber washers.

.6 Block and shim level bases so that ductwork and piping connections can be made to a rigid system at the operating level, before isolator adjustment is made. Ensure that there is no physical contact between isolated equipment and building structure.

3.2 SITE VISIT

.1 Manufacturer to visit site and provide written certification that installation is in accordance with manufacturer's instructions and submit report to Departmental Representative.

.2 Provide Departmental Representative with notice 24 h in advance of visit.

.3 Make adjustments and corrections in accordance with written report.

3.3 VIBRATION CONTROL INSTALLATION

.1 Care must be taken to ensure that no ducts or piping transmit vibration to the walls and floors through which they pass. Pipe sleeves shall be tightly packed with low density fibreglass and sealed with non-hardening mastic on both sides. Provide minimum 25 mm thick packing around the perimeter of the isolated penetration.

.2 Manufacturer is to supervise the installation of vibration control equipment and issue certified report that the units have been properly installed and are performing with maximum efficiency.

.3 Supply to the Vibration Isolation Manufacturer approved drawings of all equipment to be isolated.

.4 All equipment shall be adequately isolated to maintain acceptable noise levels in the occupied areas of the building.

.5 When all equipment is in operation, the vibration isolation system shall be checked for efficiency and installation. Replace at no additional cost any isolation which is not performing as intended or that is not properly installed.

.6 All piping, electrical conduits and ductwork connecting isolating equipment shall not reduce the flexibility of the system.

.7 Resiliently support all piping connected to isolated equipment for the following distances or to the nearest flexible pipe connector.

Pipe Size	Distance
25 mm	120 diameters
50 mm	90 diameters
75 mm	80 diameters
100 mm	75 diameters
150 mm	60 diameters
200 mm	60 diameters
250 mm	54 diameters
300 mm	50 diameters
400 mm	45 diameters
610 mm	38 diameters

1.1.1 For resiliently supported pipe, select the three closest hangers to the vibration source with static deflection equal to the static deflection of the isolated machine. Select the remaining isolators for the lesser of 25 mm static deflection or one half of the static deflection of the isolated equipment.

.8 Provide isolators and inertia bases in accordance with the vibration isolation schedule as per the drawings.

3.4 FIELD QUALITY CONTROL

.1 Manufacturer's Field Services:

.1 Arrange with manufacturer's representative to review work of this Section and submit written reports to verify compliance with Contract Documents.

.2 Manufacturer's Field Services: consisting of product use recommendations and periodic site visits to review installation, scheduled as follows:

.1 After delivery and storage of Products.

.2 After preparatory work is complete but before installation commences.

.3 Twice during the installation, at 25 % and 60 % completion stages.

.4 Upon completion of installation.

.3 Submit manufacturer's reports to the 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 as indicated.

.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.

.6 Low-emitting materials.

END OF SECTION

Part 1 GENERAL

1.1 REFERENCES

.1 Canadian Standards Association (CSA)

.1 CAN/CSA-B149.1-10, Natural Gas and Propane Installation Code.

.2 CAN/CSA-B52-05 (R2009), Mechanical Refrigeration Code

.2 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-1.60-97, Interior Alkyd Gloss Enamel.

.2 CAN/CGSB-24.3-92, Identification of Piping Systems.

.3 National Fire Protection Association (NFPA)

.1 NFPA 13-2013, Standard for the Installation of Sprinkler Systems.

.2 NFPA 14-2010, Standard for the Installation of Standpipe and Hose Systems.

1.2 SUBMITTALS

.1 Product Data: submit product data for each item specified.

.2 Submittals: in accordance with Section 01 33 00.

.3 Product data to include paint colour chips, other products specified in this section.

.4 Samples:

.1 Submit samples in accordance with Section 01 33 00.

.2 Samples to include nameplates, labels, tags, lists of proposed legends.

1.3 QUALITY ASSURANCE

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

.2 Health and Safety:

.1 Do construction occupational health and safety in accordance with Section 01 35 29.

1.4 DELIVERY, STORAGE, AND HANDLING

.1 Packing, shipping, handling and unloading:

.1 Deliver, store and handle in accordance with Section 01 61 00.

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

.2 Waste Management and Disposal:

.1 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse and recycling in accordance with Section 01 74 20

.2 Dispose of unused paint material at official hazardous material collections site approved by Departmental Representative.

.3 Do not dispose of unused paint material into sewer system, into streams, lakes, onto ground or in locations where it will pose health or environmental hazard.

Part 2 PRODUCTS

2.1 SYSTEM NAMEPLATES

.1 Colours:

.1 Hazardous: red letters, white background.

.2 Elsewhere: black letters, white background (except where required otherwise by applicable codes).

.2 Construction:

.1 3 mm thick laminated plastic, matte finish, with square corners, letters accurately aligned and machine engraved into core.

.3 Sizes:

.1 Conform to following table:

Size # mm	Sizes (mm)	No. of Lines	Height of Letters (mm)
1	10 x 50	1	3
2	13 x 75	1	5
3	13 x 75	2	3
4	20 x 100	1	8
5	20 x 100	2	5
6	20 x 200	1	8
7	25 x 125	1	12
8	25 x 125	2	8
9	35 x 200	1	20

.2 Use maximum of 25 letters/numbers per line.

.4 Locations:

.1 Terminal cabinets, control panels: use size #5.

.2 Equipment in Mechanical Rooms: use size #9.

.5 Identification for PWGSC Preventive Maintenance Support System (PMSS):

.1 Use arrangement of Main identifier, Source identifier, Destination identifier.

.2 Equipment in Mechanical Room:

.3 Main identifier: size #9.

.4 Source and Destination identifiers: size #6.

.5 Terminal cabinets, control panels: size #5.

.6 Equipment elsewhere: sizes as appropriate.

2.2 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.

2.3 PIPING SYSTEMS GOVERNED BY CODES

.1 Identification:

.2 Natural gas: to CAN/CSA-B149.1.

.3 Refrigerant: to CAN/CSA-B52.

.4 Sprinklers: to NFPA 13.

.5 Standpipe and hose systems: to NFPA 14.

2.4 IDENTIFICATION OF PIPING SYSTEMS

.1 Identify contents by background colour marking, pictogram (as necessary), legend; direction of flow by arrows. To CAN/CGSB-24.3 except where specified otherwise.

.2 Pictograms:

.1 Where required: Workplace Hazardous Materials Information System (WHMIS) regulations.

.3 Legend:

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

.4 Arrows showing direction of flow:

.1 Outside diameter of pipe or insulation less than 75 mm: 100 mm long x 50 mm high.

.2 Outside diameter of pipe or insulation 75 mm and greater: 150 mm long x 50 mm high.

.3 Use double-headed arrows where flow is reversible.

.5 Extent of background colour marking:

.1 To full circumference of pipe or insulation.

.2 Length to accommodate pictogram, full length of legend and arrows.

.6 Materials for background colour marking, legend, arrows:

.1 Pipes and tubing 20 mm and smaller: waterproof and heat-resistant pressure sensitive plastic marker tags.

.2 Other pipes: pressure sensitive vinyl with protective overcoating, waterproof contact adhesive undercoating, suitable for ambient of 100% RH and continuous operating temperature of 150 degrees C and intermittent temperature of 200 degrees C.

.7 Colours and Legends:

.1 Where not listed, obtain direction from Departmental Representative.

.2 Colours for legends, arrows: to following table:

Background colour:	Legend, arrows:

Yellow	BLACK
Green	WHITE
Red	WHITE

.3 Background colour marking and legends for piping systems:

Contents	Background colour marking	Legend
City water	Green	CITY WATER
Treated water	Green	TREATED WATER
Hot water heating supply	Yellow	HEATING SUPPLY
Hot water heating return	Yellow	HEATING RETURN
Make-up water	Yellow	MAKE-UP WTR
Boiler feed water	Yellow	BLR. FEED WTR
Steam [_____] kPa	Yellow	[_____] kPa STEAM
Steam condensate (gravity)	Yellow	ST.COND.RET (GRAVITY)
Steam condensate (pumped)	Yellow	ST.COND.RET (PUMPED)
Safety valve vent	Yellow	STEAM VENT
Intermittent blow-off	Yellow	INT. BLOW-OFF
Continuous blow-off	Yellow	CONT. BLOW-OFF
Chilled drinking water	Green	CH. DRINK WTR
Drinking water return	Green	CH. DRINK WTR. CIRC
Domestic hot water supply	Green	DOM. HW SUPPLY
Dom. HWS recirculation	Green	DOM. HW CIRC
Domestic cold water supply	Green	DOM. CWS
Waste water	Green	WASTE WATER
Storm water	Green	STORM
Sanitary	Green	SAN
Plumbing vent	Green	SAN. VENT
Refrigeration suction	Yellow	REF. SUCTION
Refrigeration liquid	Yellow	REF. LIQUID
Refrigeration hot gas	Yellow	REF. HOT GAS
No. [_____] fuel oil suction	Yellow	# [_____] FUEL OIL
No. [_____] fuel oil return	Yellow	# [_____] FUEL OIL
Natural gas	to Codes	
Gas regulator vents	to Codes	
Fire protection water	Red	FIRE PROT. WTR
Sprinklers	Red	SPRINKLERS
Instrument air	Green	INSTRUMENT AIR

2.5 IDENTIFICATION DUCTWORK SYSTEMS

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

.2 Colours: back, or co-ordinated with base colour to ensure strong contrast.

2.6 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.

2.7 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.

2.8 LANGUAGE

.1 Identification in English.

Part 3 EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 TIMING

.1 Provide identification only after painting specified Section 09 91 99 has been completed.

3.3 INSTALLATION

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

.2 Provide ULC and or CSA registration plates as required by respective agency.

.3 Identify systems, equipment to conform to PWGSC PMSS.

3.4 NAMEPLATES

.1 Locations:

.1 In conspicuous location to facilitate easy reading and identification from operating floor.

.2 Standoffs:

.1 Provide for nameplates on hot and/or insulated surfaces.

.3 Protection:

.1 Do not paint, insulate or cover.

3.5 LOCATION OF IDENTIFICATION ON PIPING AND DUCTWORK SYSTEMS

.1 On long straight runs in open areas in boiler rooms, equipment rooms, galleries, tunnels: at not more than 17 m intervals and more frequently if required to ensure that at least one is visible from any one viewpoint in operating areas and walking aisles.

.2 Adjacent to each change in direction.

.3 At least once in each small room through which piping or ductwork passes.

.4 On both sides of visual obstruction or where run is difficult to follow.

.5 On both sides of separations such as walls, floors, partitions.

.6 Where system is installed in pipe chases, ceiling spaces, galleries, confined spaces, at entry and exit points, and at access openings.

.7 At beginning and end points of each run and at each piece of equipment in run.

.8 At point immediately upstream of major manually operated or automatically controlled valves, and dampers. Where this is not possible, place identification as close as possible, preferably on upstream side.

.9 Identification easily and accurately readable from usual operating areas and from access points.

.1 Position of identification approximately at right angles to most convenient line of sight, considering operating positions, lighting conditions, risk of physical damage or injury and reduced visibility over time due to dust and dirt.

3.6 VALVES, CONTROLLERS

.1 Valves and operating controllers, except at plumbing fixtures, radiation, or where in plain sight of equipment they serve: Secure tags with non-ferrous chains or closed "S" hooks.

.2 Install one copy of flow diagrams, valve schedules mounted in frame behind non-glare glass where directed by Departmental Representative. Provide one copy (reduced in size if required) in each operating and maintenance manual.

.3 Number valves in each system consecutively.

3.7 CLEANING

.1 Proceed in accordance with Section 01 74 11.

.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 GENERAL

.1 TAB means to test, adjust and balance to perform in accordance with requirements of Contract Documents and to do other work as specified in this section.

1.2 QUALIFICATIONS OF TAB PERSONNEL

.1 Names of personnel it is proposed to perform TAB to be submitted to and approved by Departmental Representative within 90 days of award of contract.

.2 Provide documentation confirming qualifications, successful experience.

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 so as 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 be 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 so as 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 contract documents before project construction is started and confirm in writing to Departmental Representative adequacy of provisions for TAB and other aspects of design and installation pertinent to success of TAB.

.2 Review specified standards and report to Departmental Representative in writing all 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 15.

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 working days prior to start of TAB.

.2 Start TAB when building is essentially completed, including:

.3 Installation of ceilings, doors, windows, other construction affecting TAB.

.4 Application of weatherstripping, sealing, caulking.

.5 All pressure, leakage, other tests specified elsewhere in Division 23.

.6 All provisions for TAB installed and operational.

.7 Start-up, verification for proper, normal and safe operation of mechanical and associated electrical and control systems affecting TAB including but not limited to:

.8 Proper thermal overload protection in place for electrical equipment.

.9 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.

.10 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 HVAC systems, central equipment: plus 5%, minus 5 %.

.2 HVAC systems, distribution: plus 10%, minus 5%.

.3 Hydronic systems: plus or minus 10%.

1.11 ACCURACY TOLERANCES

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

1.12 INSTRUMENTS

.1 Prior to TAB, submit to Departmental Representative list of instruments to be 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 SUBMITTALS

.1 Submit, prior to commencement of TAB:

.2 Proposed methodology and procedures for performing TAB if different from referenced standard.

.3 Sample TAB reports for review by Departmental representative.

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:

.2 Details of instruments used.

.3 Details of TAB procedures employed.

.4 Calculations procedures.

.5 Summaries.

1.15 TAB REPORT

.1 Format to be in accordance with referenced standard.

.2 TAB report to show results in SI units and to include:

.1 Detailed tested values at each tested piece of equipment.

.2 Project record drawings.

.3 Single line system schematics indicating general routing of duct/piping complete with annotations for outlet number. Outlet number to correspond to outlet number indicated in TAB report. System schematics to include:

.1 Dedicated outdoor air system. Include separate schematics for supply distribution and for return/exhaust air distribution.

.2 Fancoils and exhaust fans with more than one diffuser

.3 Submit 2 copies of TAB Report to Departmental Representative for verification and approval, in English, in D-ring binders, complete with index tabs.

1.16 VERIFICATION

.1 Reported results subject to verification by Departmental Representative.

.2 Provide manpower and instrumentation to verify up to 30% of reported results.

.3 Number and location of verified results to be at discretion of Departmental Representative.

.4 If values within the 30% verification sample are not reproducible as listed in TAB report, bear 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. Markings not to be eradicated or covered in any way.

1.18 COMPLETION OF TAB

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

1.19 AIR SYSTEMS

.1 Standard: TAB to be to most stringent of TAB standards of AABC and NEBB.

.2 Do TAB of systems, equipment, components, specified in Division 23.

.3 Qualifications: personnel performing TAB to be current member in good standing of AABC or NEBB and qualified to standards of AABC or NEBB.

.4 Quality assurance: Perform TAB under direction of supervisor qualified by to standards of AABC or NEBB.

.5 Measurements: to include, but not limited to, following 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, but not be limited to, following as appropriate:

.7 Inlet and outlet of dampers, filter, coil, humidifier, fan, other equipment causing changes in conditions.

.8 At controllers, controlled device.

.9 Locations of systems measurements to include, but not be limited to, following as appropriate: Main ducts, main branch, sub-branch, run-out (or grille, register or diffuser).

1.20 HYDRONIC SYSTEMS

.1 Definitions: for purposes of this section, to include low pressure hot water heating, condenser water, glycol systems.

.2 Standard: TAB to be to most stringent AABC or NEBB.

.3 Do TAB of systems, equipment, components, controls specified Division 21, 22, 23

.4 Qualifications: personnel performing TAB to be current member in good standing of AABC or NEBB and qualified to standards of AABC or NEBB.

.5 Quality assurance: Perform TAB under direction of supervisor qualified by to standards of AABC or NEBB.

.6 Measurements: to include, but not limited to, following as appropriate for systems, equipment, components, controls: Flow rate, static pressure, pressure drop (or loss), temperature, specific gravity, density, RPM, electrical power, voltage, noise, vibration.

.7 Locations of equipment measurement: To include, but not be limited to, following as appropriate:

.8 Inlet and outlet of heat exchangers (primary and secondary sides), boiler, coil, humidifier, fluid cooler, condenser, pump, PRV, control valve, other equipment causing changes in conditions.

.9 At controllers, controlled device.

.10 Locations of systems measurements to include, but not be limited to, following as appropriate: Supply and return of primary and secondary loops (main, main branch, branch, sub-branch of all hydronic systems, inlet connection of make-up water.

1.21 OTHER SYSTEMS

.1 Plumbing systems:

.2 TAB procedures:

.1 Flush valves: adjust to suit project pressure conditions.

.2 Pumped sanitary systems: test for proper operation at all possible flow rates.

1.22 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 Building pressure conditions:

.1 Adjust HVAC systems, equipment, controls to ensure specified pressure conditions during winter design conditions.

.3 TAB procedures:

.1 Balance all supply air outlets to design conditions

.2 Balance all exhaust air outlets to design conditions

.3 Balance return air outlets as specified on drawings or to ensure supply air is 10% larger than the sum of exhaust air and return air, whichever is less.

1.23 DOMESTIC HWC SYSTEMS

.1 Meet requirements as specified for hydronic systems.

.2 Locations of equipment measurements: To include, but not be limited to, following as appropriate: Inlet and outlet of heaters, tank, pump, circulator, at controllers, controlled device.

.3 Locations of systems measurements to include, but not be limited to, following as appropriate: main, main branch, branch, sub-branch.

1.24 OTHER SYSTEMS

.1 Plumbing systems:

.2 TAB procedures:

.1 Flush valves: adjust to suit project pressure conditions.

.2 Pumped sanitary systems: test for proper operation at all possible flow rates.

.3 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.

.4 Building pressure conditions:

.1 Adjust HVAC systems, equipment, controls to ensure specified pressure conditions during winter design conditions.

.5 TAB procedures:

.1 Balance all supply air outlets to design conditions

.2 Balance all exhaust air outlets to design conditions

.3 Balance return air outlets as specified on drawings or to ensure supply air is 10% larger than the sum of exhaust air and return air, whichever is less.

1.25 POST- OCCUPANCY TAB

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

Part 2 PRODUCTS

2.1 NOT USED

.1 Not used.

Part 3 EXECUTION

3.1 NOT USED

.1 Not used.

END OF SECTION

Part 1 GENERAL

1.1 GENERAL

.1 Ducts over 5 m in length, forming part of a supply, return or exhaust ductwork system directly or indirectly connected to air handling equipment to be pressure tested for leaks.

1.2 TIMING

.1 Ducts to be tested before installation of insulation or any other form of concealments.

.2 Test after seals have cured.

.3 Test when ambient temperature will not affect effectiveness of seals, gaskets, etc.

1.3 EXCLUSIONS

.1 Flexible connections to VAV boxes.

1.4 REFERENCES

.1 SMACNA HVAC Air Duct Leakage Test Manual, 1985.

1.5 TEST PROCEDURES

.1 Maximum lengths of ducts to be tested to be 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 Reference Standard.

.5 Seal leaks that can be heard or felt, regardless of their contribution to total leakage.

1.6 TESTING AGENCY

.1 Installing Contractor.

1.7 VERIFICATION

.1 Departmental Representative to witness tests and to verify reported results.

.2 To be certified by the same TAB agency approved by Departmental Representative to undertake TAB on this project.

1.8 TEST INSTRUMENTS

.1 Testing agency to provide instruments for tests.

.2 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.

.3 Test apparatus to be accurate to within +/- 3 % of flow rate and pressure.

.4 Submit details of test instruments to be used to Departmental Representative at least one month before anticipated start date.

.5 Test instruments to be calibrated and certificate of calibration deposited with Departmental Representative no more than 3 months before start of tests.

.6 Instruments to be re-calibrated every six months thereafter.

1.9 SYSTEM LEAKAGE TOLERANCES

.1 System leakage tolerances specified herein are stated as a percentage of total flow rate handled by the system. Therefore, when testing sections of ductwork this acceptable leakage shall be pro-rated to entire system. Leakage for sections of duct systems shall not exceed the total allowable leakage.

.2 Leakage tests on following systems not to exceed specified leakage rates.

.1 Small duct systems up to 250 Pa: Leakage 2 %.

.2 Terminal box and duct on downstream side of terminal box: Leakage 2 %.

.3 Large low pressure duct systems up to 500 Pa: Leakage 2 %.

.3 Evaluation of test results to use surface area of duct and pressure in duct as basic parameters.

1.10 REPORT FORMS

.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.

1.11 PRESSURE TEST REPORTS

.1 Prepare report of results and submit to Departmental Representative within 7 days 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.

.2 Include test reports in final TAB report.

Part 2 PRODUCTS

2.1 NOT USED

.1 Not Used.

Part 3 EXECUTION

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 GENERAL

1.1 REFERENCES

.1 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.

.2 TIAC Codes:

.1 CRD: Code Round Ductwork,

.2 CRF: Code Rectangular Finish.

.2 Reference Standards:

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

.1 ANSI/ASHRAE/IES 90.1-2010, SI; Energy Standard for Buildings Except Low-Rise Residential Buildings.

.2 ASTM International Inc.

.1 ASTM B209M-10, Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric).

.2 ASTM C335-10e1, Standard Test Method for Steady State Heat Transfer Properties of Pipe Insulation.

.3 ASTM C411-11, Standard Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation.

.4 ASTM C449-07, Standard Specification for Mineral Fiber-Hydraulic-Setting Thermal Insulating and Finishing Cement.

.5 ASTM C547-11, Standard Specification for Mineral Fiber Pipe Insulation.

.6 ASTM C553-11, Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.

.7 ASTM C612-10, Standard Specification for Mineral Fiber Block and Board Thermal Insulation.

.8 ASTM C795-08, Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel.

.9 ASTM C921-10, Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.

.3 Canadian General Standards Board (CGSB)

.1 CGSB 51-GP-52Ma-89, Vapour Barrier, Jacket and Facing Material for Pipe, Duct and Equipment Thermal Insulation.

.4 Canada Green Building Council (CaGBC)

.1 LEED Canada-NC- 2009, LEED (Leadership in Energy and Environmental Design): Green Building Rating System Reference Package For New Construction and Major Renovations.

.5 Thermal Insulation Association of Canada (TIAC): National Insulation Standards (2005).

.6 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.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00.

.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.

.3 Shop Drawings:

.1 Submit shop drawings for each insulation type proposed for the project.

.4 Samples:

.1 Submit for approval: complete assembly of each type of insulation system, insulation, coating, and adhesive proposed.

.2 Mount sample on 12 mm plywood board.

.3 Affix typewritten label beneath sample indicating service.

.5 Manufacturers' Instructions:

.1 Provide manufacture's written duct insulation jointing recommendations and special handling criteria, installation sequence, cleaning procedures.

.6 Sustainable Design Submittals:

.1 LEED Submittals: in accordance with Section 01 35 21.

1.3 QUALITY ASSURANCE

.1 Qualifications:

.2 Installer: specialist in performing work of this section, and have at least 3 years successful experience in this size and type of project, and a member of TIAC.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle in accordance with Section 01 61 00.

.2 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address and ULC markings.

.3 Packaging Waste Management: remove for reuse of pallets, crates, padding and packaging materials in accordance with Section 01 74 20.

Part 2 PRODUCTS

2.1 FIRE AND SMOKE RATING

.1 To CAN/ULC-S102:

.2 Maximum flame spread rating: 25.

.3 Maximum smoke developed rating: 50.

2.2 INSULATION

.1 Thermal conductivity ("k" factor) not to exceed specified values at 24°C mean temperature when tested in accordance with ASTM C335.

.2 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).

.3 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.

2.3 JACKETS

.1 Canvas:

.1 220gm/m² cotton, plain weave, treated with dilute fire retardant lagging adhesive to ASTM C921.

.2 Lagging adhesive: compatible with insulation.

.1 Maximum VOC limit 200 g/L to SCAQMD Rule 1168.

2.4 ACCESSORIES

.1 Vapour retarder lap adhesive:

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

.1 Maximum VOC limit 170 g/L to SCAQMD Rule 1168.

.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, untreated.

.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, plain, 50 mm wide minimum.

.7 Contact adhesive: quick-setting

.1 Maximum VOC limit 200 g/L to SCAQMD Rule 1168.

.8 Canvas adhesive: washable.

.1 Maximum VOC limit 200 g/L to SCAQMD Rule 1168.

.9 Tie wire: 1.5mm stainless steel.

.10 Banding: 19mm wide, 0.5 mm thick stainless steel.

.11 Facing: 25mm galvanized steel hexagonal wire mesh stitched on one face of insulation.

.12 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 manufacturers 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.

.1 Ensure hangers, and supports are outside vapour retarder jacket.

.5 Hangers and supports in accordance with Section 23 05 29.

.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 temperatire 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]
Outside air ducts to mixing plenum	[C-1]	[yes]	[25]
Mixing plenums	[C-1]	[yes]	[25]
Exhaust duct between dampers and louvres	[C-1]	[no]	[25]
Rectangular ducts outside	[C-1]	[special]	[50]
Round ducts outside	[C-1]	[special]	[50]
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.

.1 Finishes: conform to following table:

	TIAC Code	
	Rectangular	Round
Indoor, concealed	none	none
Indoor, exposed within mechanical room	CRF/1	CRD/2
Indoor, exposed elsewhere	CRF/2	CRD/3
Outdoor, exposed to precipitation	CRF/3	CRD/4
Outdoor, elsewhere	CRF/4	CRD/5

3.5 CLEANING

.1 Clean in accordance with Section 01 74 11.

.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 74 20.

END OF SECTION

Part 1 GENERAL

1.1 SUMMARY

.1 Section Includes:

.1 Thermal insulation for piping and piping accessories in commercial type applications.

1.2 REFERENCES

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

.1 ASHRAE Standard 90.1-2007, Energy Standard for Buildings Except Low-Rise Residential Buildings (ANSI approved; IESNA co-sponsored.

.2 American Society for Testing and Materials International (ASTM)

.1 ASTM B209M-10, Standard Specification for Aluminum and Aluminum Alloy Sheet and Plate (Metric).

.2 ASTM C335/C335M-10e1, Standard Test Method for Steady State Heat Transfer Properties of Horizontal Pipe Insulation.

.3 ASTM C411-11, Standard Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation.

.4 ASTM C449-07, Standard Specification for Mineral Fiber-Hydraulic-Setting Thermal Insulating and Finishing Cement.

.5 ASTM C533-07, Standard Specification for Calcium Silicate Block and Pipe Thermal Insulation.

.6 ASTM C547-07e1, Standard Specification for Mineral Fiber Pipe Insulation.

.7 ASTM C795-08, Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel.

.8 ASTM C921-10, Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.

.3 Canadian General Standards Board (CGSB)

.1 CGSB 51-GP-52Ma-89, Vapour Barrier, Jacket and Facing Material for Pipe, Duct and Equipment Thermal Insulation.

.2 CAN/CGSB-51.53-95, Poly (Vinyl Chloride) Jacketing Sheet, for Insulated Pipes, Vessels and Round Ducts.

.4 Department of Justice Canada (Jus)

.1 Canadian Environmental Assessment Act (CEAA), 1992, c. 37.

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

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

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

.1 Material Safety Data Sheets (MSDS).

.6 Manufacturer's Trade Associations

.1 Thermal Insulation Association of Canada (TIAC): Mechanical Insulation Best Practice Guide (Revised 2005).

.7 Underwriters' Laboratories of Canada (ULC)

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

.2 CAN/ULC-S701-11, Standard for Thermal Insulation, Polystyrene, Boards and Pipe Covering.

.3 CAN/ULC-S702-09, Thermal Insulation, Mineral Fibre, for Buildings

.4 ULC-S702.2-10, Standard for Thermal Insulation, Mineral Fibre, for Buildings, Part 2: Application Guidelines.

1.3 DEFINITIONS

.1 For purposes of this section:

.1 "CONCEALED" - insulated mechanical services in suspended ceilings and non-accessible chases and furred-in spaces.

.2 "EXPOSED" - will mean "not concealed" as specified.

.2 TIAC ss:

.1 CRF: Code Rectangular Finish.

.2 CPF: Code Piping Finish.

1.4 SUBMITTALS

.1 Submittals: in accordance with Section 01 33 00.

.2 Product Data:

.1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00. Include product characteristics, performance criteria, and limitations.

.1 Submit one copy of Workplace Hazardous Materials Information System (WHMIS) Material Safety Data Sheets (MSDS).

.3 Shop Drawings:

.1 Submit shop drawings in accordance with Section 01 33 00.

.4 Samples:

.1 Submit samples in accordance with Section 01 33 00.

.2 Submit for approval: complete assembly of each type of insulation system, insulation, coating, and adhesive proposed. Mount sample on 12 mm plywood board. Affix label beneath sample indicating service.

.5 Quality assurance submittals: submit following in accordance with Section 01 33 00.

.1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.2 Instructions: submit manufacturer's installation instructions.

.2 Departmental Representative will make available 1 copy of systems supplier's installation instructions.

1.5 QUALITY ASSURANCE

.1 Qualifications:

.2 Installer: specialist in performing work of this Section, and have at least 3 years successful experience in this size and type of project, member of TIAC.

.2 Health and Safety:

.1 Do construction occupational health and safety in accordance with Section 01 35 29.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Packing, shipping, handling and unloading:

.2 Deliver, store and handle in accordance with manufacturer's written instructions and Section 01 61 00.

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

.4 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

.2 Storage and Protection:

.1 Protect from weather, construction traffic.

.2 Protect against damage.

.3 Store at temperatures and conditions required by manufacturer.

.3 Waste Management and Disposal:

.1 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse and recycling in accordance with Section 01 74 20.

.2 Place excess or unused insulation and insulation accessory materials in designated containers.

.3 Divert unused metal materials from landfill to metal recycling facility approved by Departmental Representative.

.4 Dispose of unused adhesive material at official hazardous material collections site approved by Departmental Representative.

Part 2 PRODUCTS

2.1 FIRE AND SMOKE RATING

.1 In accordance with CAN/ULC-S102.

.2 Maximum flame spread rating: 25

.3 Maximum smoke developed rating: 50

2.2 INSULATION

.1 Mineral fibre specified includes glass fibre, rock wool, slag wool.

.2 Thermal conductivity ("k" factor) not to exceed specified values at 24°C mean temperature when tested in accordance with ASTM C335.

.3 TIAC Code A-1: rigid moulded mineral fibre without factory applied vapour retarder jacket.

.1 Mineral fibre: to CAN/ULC-S702 and ASTM C547.

.2 Maximum "k" factor: 0.035 W/m°C; to CAN/ULC-S702 and ASTM C547.

.4 TIAC Code A-3: rigid moulded mineral fibre with factory applied vapour retarder jacket.

.1 Mineral fibre: to CAN/ULC-S702 and ASTM C547.

.2 Jacket: to CGSB 51-GP-52Ma.

.3 Maximum "k" factor: 0.035 W/m°C ; to CAN/ULC-S702 and ASTM C547.

.5 TIAC Code C-2: mineral fibre blanket faced with factory applied vapour retarder jacket (as scheduled in PART 3 of this section).

.1 Mineral fibre: to CAN/ULC-S702 and ASTM C547.

.2 Jacket: to CGSB 51-GP-52Ma.

.3 Maximum "k" factor: 0.035 W/m°C ; to CAN/ULC-S702 and ASTM C547.

.6 TIAC Code A-6: flexible unicellular tubular elastomer.

.1 Insulation: with vapour retarder jacket.

.2 Jacket: to CGSB 51-GP-52Ma.

.3 Maximum "k" factor: 0.04 W/m°C.

.4 Certified by manufacturer: free of potential stress corrosion cracking corrodants.

2.3 INSULATION SECUREMENT

.1 Tape: self-adhesive, aluminum, plain, 50 mm wide minimum.

.2 Contact adhesive: quick setting.

.3 Canvas adhesive: washable.

.4 Tie wire: 1.5mm diameter stainless steel.

.5 Bands: stainless steel, 19 mm wide, 0.5 mm thick.

2.4 VAPOUR RETARDER LAP ADHESIVE

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

2.5 INDOOR VAPOUR RETARDER FINISH

.1 Vinyl emulsion type acrylic, compatible with insulation.

2.6 OUTDOOR VAPOUR RETARDER FINISH

.1 Vinyl emulsion type acrylic, compatible with insulation.

.2 Reinforcing fabric: fibrous glass, untreated 305 g/m².

2.7 JACKETS

.1 Canvas:

.1 220 and 120 gm/m² cotton, plain weave, treated with dilute fire retardant lagging adhesive to ASTM C921.

.2 Lagging adhesive: compatible with insulation.

.2 Aluminum:

.1 To ASTM B209M.

.2 Thickness: 0.50 mm sheet.

.3 Finish: smooth.

.4 Joining: longitudinal and circumferential slip joints with 50 mm laps.

.5 Fittings: 0.5 mm thick die-shaped fitting covers with factory-attached protective liner.

.6 Metal jacket banding and mechanical seals: stainless steel, 19 mm wide, 0.5 mm thick at 300 mm spacing.

2.8 WEATHERPROOF CAULKING FOR JACKETS INSTALLED OUTDOORS

.1 Caulking to: Section 07 92 00.

Part 3 EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 PRE-INSTALLATION REQUIREMENT

.1 Pressure testing of piping systems and adjacent equipment to be complete, witnessed and certified.

.2 Surfaces clean, dry, free from foreign material.

3.3 INSTALLATION

.1 Install in accordance with TIAC National Standards.

.2 Apply materials in accordance with manufacturers instructions and this specification.

.3 Use two layers with staggered joints when required nominal wall thickness exceeds 75 mm.

.4 Maintain uninterrupted continuity and integrity of vapour retarder jacket and finishes.

.1 Install hangers, supports outside vapour retarder jacket.

.5 Supports, Hangers:

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

3.4 REMOVABLE, PRE-FABRICATED, INSULATION AND ENCLOSURES

.1 Application: at valves, flanges and unions at equipment.

.2 Design: to permit periodic removal and replacement without damage to adjacent insulation.

.3 Insulation:

.1 Insulation, fastenings and finishes: same as system.

.2 Jacket: PVC.

3.5 INSTALLATION OF ELASTOMERIC INSULATION

.1 Insulation to remain dry. Overlaps to manufacturers instructions. Ensure tight joints.

.2 Provide vapour retarder as recommended by manufacturer.

3.6 PIPING INSULATION SCHEDULES

.1 Includes valves, valve bonnets, strainers, flanges and fittings unless otherwise specified.

.2 TIAC Code: A-1.

.1 Securements: Tape at 300 mm on centre.

.2 Seals: lap seal adhesive, lagging adhesive.

.3 Installation: TIAC Code 1501-H.

.3 TIAC Code: A-3.

.1 Securements: Tape at 300 mm on centre.

.2 Seals: VR lap seal adhesive, VR lagging adhesive.

.3 Installation: TIAC Code: 1501-C.

.4 TIAC Code: A-6.

.1 Insulation securements: tape.

.2 Seals: lap seal adhesive, lagging adhesive.

.5 TIAC Code: C-2 with vapour retarder jacket.

.1 Insulation securements: SS bands at 300 mm on centre.

.2 Seals: lap seal adhesive, lagging adhesive.

.3 Installation: TIAC Code: 1501-C.

.6 Thickness of insulation as listed in following table.

.1 Run-outs to individual units and equipment not exceeding 4000 mm long.

.2 Do not insulate exposed runouts to plumbing fixtures, chrome plated piping, valves, fittings.

Application	Temp degrees C	TIAC code	Pipe sizes (NPS) and insulation thickness (mm)					
	Run out		to 1	1 1/4 to 2	2 1/2 to 4	5 to 6	8 & over	
Steam	up to 175	[A-1]	38	50	65	75	90	90
Steam, Saturated and Superheated	over 175	[A-1]	38	65	65	75	90	90
Condensate Return	60 - 94	[A-1]	25	38	38	38	38	38
Pumped Condensate return	up to 94	[A-1]	25	38	38	38	38	38
Boiler Feed Water		[A-1]	25	25	25	25	25	25
Hot	60 -	[A-1]	25	38	38	38	38	38

Water Heating	94							
Hot Water Heating	up to 59	[A-1]	25	25	25	25	38	38
Glycol Heating	60 - 94	[A-1]	25	38	38	38	38	38
Glycol Heating	up to 59	[A-1]	25	25	25	25	38	38
Domestic HWS		[A-1]	25	25	25	38	38	38
Chilled Water	4 - 13	[A-3]	25	25	25	25	25	25
Chilled Water or Glycol	below 4	[A-3]	25	25	38	38	38	38
Dual Temp. Heating		[A-3]	[_____]	[_____]	[_____]	[_____]	[_____]	[_____]
Dual Temp. Cooling		[A-3]	[_____]	[_____]	[_____]	[_____]	[_____]	[_____]
Chilled Water Pump Casing		[A-3]	25	25	25	25	25	25
Condenser Water Outdoors			[_____]	[_____]	[_____]	[_____]	[_____]	[_____]
Condenser Water Indoors			[_____]	[_____]	[_____]	[_____]	[_____]	[_____]
Refrig		[A-3]	25	25	25	25	25	25

erated Drinking Water								
Domestic CWS		[A-3]	25	25	25	25	25	25
Domestic CWS with vapour retarder		[C-2]	25	25	25	25	25	25
Refrigerant[hot gas][liquid][suction]	4 - 13	[A-6]	25	25	25	25	25	25
Refrigerant[hot gas][liquid] [suction]	below 4	[A-6]	25	25	38	38	38	38
RWL and RWP		[C-2]	25	25	25	25	25	25
Cooling Coil cond. drain		[C-2]	25	25	25	25	25	25
Diesel generator exhaust system		[A-2]	38	65	65	75	90	90

.7 Finishes:

.1 Exposed indoors: PVC jacket.

.2 Exposed in mechanical rooms: PVC jacket.

.3 Concealed, indoors: canvas on valves, fittings. No further finish.

.4 Use vapour retarder jacket on TIAC code A-3 insulation compatible with insulation.

.5 Outdoors: water-proof aluminum jacket.

.6 Finish attachments: SS, at 150 mm on centre. Seals: closed.

.7 Installation: to appropriate TIAC code CRF/1 through CPF/5.

3.7 FIELD QUALITY CONTROL

.1 Verification requirements in accordance with Section 01 45 00, include:

.1 Materials and resources.

.2 Storage and collection of recyclables.

.3 Construction waste management.

.4 Resource reuse.

.5 Recycled content.

.6 Local/regional materials.

.7 Certified wood.

.8 Low-emitting materials.

3.8 CLEANING

.1 Proceed in accordance with Section 01 74 11.

.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 SECTIONS

.1 Section 01 91 13 - Commissioning: General Requirements, supplemented as specified herein.

.2 Section 23 08 02 - Cleaning and Start-up of Mechanical Piping Systems.

.3 Section 22 42 01 - Plumbing Specialities and Accessories.

.4 Section 23 57 00 - Heat Exchangers for HVAC.

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

1.2 REFERENCES

.1 ASTM E202-09, Standard Test Methods for Analysis of Propylene Glycols.

1.3 CLEANING AND START-UP OF MECHANICAL PIPING SYSTEMS

.1 In accordance with Section 23 08 02.

1.4 HYDRONIC SYSTEMS - PERFORMANCE VERIFICATION (PV)

.1 Timing:

.1 After cleaning is completed and system is in full operation.

.2 When systems are operational, perform following tests:

.1 Conduct full scale tests at maximum design flow rates, temperatures and pressures for continuous consecutive period of 48 hours to demonstrate compliance with design criteria.

.2 Verify performance of hydronic system circulating pumps as specified in relevant technical sections, recording system pressures, temperatures, fluctuations by simulating maximum design conditions and varying.

.1 Pump operation.

.2 Boiler and/or chiller operation.

.3 Pressure bypass open/closed.

.4 Control pressure failure.

.5 Maximum heating demand.

.6 Maximum cooling demand.

.7 Boiler and/or chiller failure.

.8 Cooling tower (and/or industrial fluid cooler) fan failure.

.9 Outdoor reset. Re-check heat exchanger output supply temperature at 100% and 50% reset, maximum water temperature.

1.5 HYDRONIC SYSTEM CAPACITY TEST

.1 Timing: After:

.1 TAB has been completed

.2 Verification of operating, limit, safety controls.

.3 Verification of primary and secondary pump flow rates.

.4 Verification of accuracy of temperature and pressure sensors and gauges.

.2 Calculate system capacity at test conditions.

.3 Using manufacturer's published data and calculated capacity at test conditions, extrapolate system capacity at design conditions.

.4 When capacity test is completed, return controls and equipment status to normal operating conditions.

.5 Submit sample of system water to approved testing agency to determine if chemical treatment is correct. Include cost.

.6 Heating system capacity test:

.1 Perform capacity test when ambient temperature is within 10% of design conditions. Simulate design conditions by:

.1 Increasing OA flow rates through heating coils (in this case, monitor heating coil discharge temperatures at all times to ensure that coils are not subjected to freezing conditions) or

.2 Reducing space temperature by turning of heating system for sufficient period of time before starting testing.

.2 Test procedures:

.1 Open fully heat exchanger, heating coil and radiation control valves.

.2 With boilers on full firing and hot water heating supply temperature stabilized, record flow rates and supply and return temperatures simultaneously.

.3 Conduct flue gas analysis test on boilers at full load and at low fire conditions.

1.6 GLYCOL SYSTEMS

.1 Test to prove concentration will prevent freezing to minus 40°C Test inhibitor strength and include in procedural report. Refer to ASTM E202.

1.7 POTABLE WATER SYSTEMS

.1 When cleaning is completed and system filled:

.1 Verify performance of equipment and systems as specified elsewhere in Division 15.

.2 Check for proper operation of water hammer arrestors. Run one outlet for 10 seconds, then shut of water immediately. If water hammer occurs, replace water hammer arrestor or recharge air chambers. Repeat for each outlet and flush valve.

.3 Confirm water quality consistent with supply standards, verifying that no residuals remain as a result of flushing and/or cleaning.

1.8 WET AND DRY PIPE SPRINKLER SYSTEM, STANDPIPE AND HOSE SYSTEMS

.1 Cleaning, testing, start-up, performance verification of equipment, systems, components, and devices is specified elsewhere in Division 15.

.2 Verification of controls, detection devices, alarm devices is specified Electrical Divisions.

.3 Demonstrate that fire hose will reach to most remote location regardless of partitions, obstructions, etc.

.4 Verify operation of interlocks between HVAC systems and fire alarm systems.

1.9 SANITARY AND STORM DRAINAGE SYSTEMS

.1 Buried systems: Perform tests prior to back-filling. Perform hydraulic tests to verify grades and freedom from obstructions.

.2 Ensure that traps are fully and permanently primed.

.3 Ensure that fixtures are properly anchored, connected to system.

.4 Operate flush valves, tank and operate each fixture to verify drainage and no leakage.

.5 Cleanouts: Refer to Section 22 42 01.

.6 Roof drains:

.1 Refer to Section 22 42 01.

.2 Remove caps as required.

1.10 REPORTS

.1 In accordance with Section 01 91 13: Reports, supplemented as specified herein.

1.11 TRAINING

.1 In accordance with Section 01 91 13: Training of O&M Personnel, supplemented as specified.

Part 2 PRODUCTS

2.1 NOT USED

.1 Not Used.

Part 3 EXECUTION

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 GENERAL

1.1 RELATED SECTIONS

.1 Section 23 25 00 - HVAC Water Treatment Systems.

.2 Section 23 05 93 - Testing Adjusting and Balancing for HVAC.

1.2 REFERENCES

.1 American Society for Testing and Materials

.1 ASTM E202-10, Standard Test Methods for Analysis of Ethylene Glycols and Propylene Glycols.

1.3 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 74 20.

.2 Dispose of unused cleaning solutions at official hazardous material collections site approved by the Departmental Representative.

.3 Do not dispose of unused cleaning solutions into sewer system, into streams, lakes, onto ground or in other locations where it will pose health or environmental hazard.

.4 Remove from site and dispose of packaging materials at appropriate recycling facilities.

.5 Dispose of corrugated cardboard, polystyrene, plastic packaging material in appropriate on-site bin for recycling in accordance with site waste management program.

Part 2 PRODUCTS

2.1 CLEANING SOLUTIONS

.1 Tri-sodium phosphate: 0.40 kg per 100 L water in system.

.2 Sodium carbonate: 0.40 kg per 100 L water in system.

.3 Low-foaming detergent: 0.01 kg per 100 L water in system.

Part 3 EXECUTION

3.1 CLEANING HYDRONIC AND STEAM SYSTEMS

.1 Timing

.1 Systems to be operational, hydrostatically tested and with safety devices functional, before cleaning is carried out.

.2 Cleaning Agency:

.1 Retain qualified water treatment specialist to perform system cleaning.

.3 Install instrumentation such as flow meters, orifice plates, pitot tubes, flow metering valves only after cleaning is certified as complete.

.4 Cleaning procedures:

.1 Provide detailed report outlining proposed cleaning procedures at least 4 weeks prior to proposed starting date. Report to include:

.1 Cleaning procedures, flow rates, elapsed time.

.2 Chemicals and concentrations to be used.

.3 Inhibitors and concentrations.

.4 Specific requirements for completion of work.

.5 Special precautions for protecting piping system materials and components.

.6 Complete analysis of water to be used to ensure water will not damage systems or equipment.

.2 Once process is complete, Chemical treatment representative shall provide a letter certifying that systems have been properly cleaned and passivated.

.3 Provide temporary piping connection, by-passes and strainers as required for introduction of cleaning chemicals and removal of debris.

.5 Conditions at time of cleaning of systems

.1 Systems to be free from construction debris, dirt and other foreign material.

.2 Control valves to be operational, fully open to ensure that terminal units can be cleaned properly.

.3 Strainers to be clean prior to initial fill.

.4 Install temporary filters on pumps not equipped with permanent filters.

.5 Install pressure gauges on strainers to detect plugging.

.6 Report on Completion of Cleaning

.1 When cleaning is completed, submit report, complete with certificate of compliance with specifications of cleaning component supplier.

.7 Hydronic Systems:

.1 Fill system with water, ensure air is vented from system.

.2 Fill expansion tanks 1/3 to 1/2 full, charge system with compressed air to at least 35 kPa (does not apply to diaphragm type expansion tanks).

.3 Use water metre to record volume of water in system to +/- 0.5%.

.4 Provide an adequate quantity chemicals to thoroughly clean all new piping and associated equipment by removing sludge, oil, dirt and debris. Utilize multi-component phosphate based cleaner and a bio-dispersant. These products shall be used for cleaning and flushing of all new water systems (excluding domestic water). Cleaning and flushing procedure shall be as per manufacturer's instructions.

.5 Provide temporary piping connection, by-passes and strainers as required for introduction of cleaning chemicals and removal of debris.

.6 Closed loop systems: circulate system cleaner at 60 degrees C for at least 72 h. Drain as quickly as possible. Refill with water and inhibitors. Test concentrations and adjust to recommended levels.

.7 Flush velocity in system mains and branches to ensure removal of debris. System pumps may be used for circulating cleaning solution provided that velocities are adequate.

.8 Add chemical solution to system.

.9 Establish circulation, raise temperature slowly to maximum design. Circulate for 12 h, ensuring flow in all circuits. Remove heat, continue to circulate until temperature is below 38 degrees C. Drain as quickly as possible. Refill with clean water. Circulate for 6 h at design temperature. Drain and repeat procedures specified above. Flush through low point drains in system. Refill with clean water adding to sodium sulphite (test for residual sulphite).

.8 Glycol Systems:

.1 In addition to procedures specified above perform procedures specified herein.

.2 Test to prove concentration will prevent freezing to minus 40° C Test inhibitor strength and include in procedural report. Refer to ASTM E202.

3.2 DOMESTIC WATER

.1 All domestic hot, cold and domestic recirculation water systems will be required to be flushed and disinfected. Add chlorine to water in system to 50 milligrams per litre (50 ppm) and let stand for 24 hours. Check chlorine content after 24 hours and insure the content is not less than 20 milligrams per litre (20 ppm). If less than 20 milligrams per litre (20 ppm) repeat process. Flush system until the chlorine content of water being drained is equal to the chlorine content of the make-up water. Utilize plumbing fixtures (i.e. lav, sinks, flushometers, and similar criteria.) for drainage.

3.3 START-UP OF HYDRONIC SYSTEMS

.1 After cleaning is completed and system is filled:

.1 Establish circulation and expansion tank level, set pressure controls.

.2 Ensure air is removed.

.3 Check pumps to be free from air, debris, possibility of cavitation when system is at design temperature.

.4 Dismantle system pumps used for cleaning, inspect, replace worn parts, install new gaskets and new set of seals.

.5 Clean out strainers repeatedly until system is clean.

.6 Commission water treatment systems as specified in Section 23 25 00.

.7 Check water level in expansion tank with cold water with circulating pumps OFF and again with pumps ON.

.8 Repeat with water at design temperature.

.9 Check pressurization to ensure proper operation and to prevent water hammer, flashing, cavitation. Eliminate water hammer and other noises.

.10 Bring system up to design temperature and pressure slowly over a 48 hour period.

.11 Perform TAB as specified in Section 23 05 93.

.12 Adjust pipe supports, hangers, springs as necessary.

.13 Monitor pipe movement, performance of expansion joints, loops, guides, anchors.

.14 If sliding type expansion joints bind or if bellows type expansion joints flex incorrectly, shut down system, re-align, repeat start-up procedures.

.15 Re-tighten bolts, etc. using torque wrench, to compensate for heat-caused relaxation. Repeat several times during commissioning.

.16 Check operation of drain valves.

.17 Adjust valve stem packings as systems settle down.

.18 Fully open all balancing valves (except those that are factory-set).

.19 Check operation of over-temperature protection devices on circulating pumps.

.20 Adjust alignment of piping at pumps to ensure flexibility, adequacy of pipe movement, absence of noise or vibration transmission.

END OF SECTION

Part 1 GENERAL

1.1 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 01 78 00 - Closeout Submittals.

.3 Section 23 08 02 - Cleaning and Start-Up of Mechanical Piping Systems.

.4 Section 23 05 01 - Installation of Pipework.

.5 Section 23 08 01 - Performance Verification of Mechanical Piping Systems.

1.2 REFERENCES

.1 American Society of Mechanical Engineers (ASME)

.1 ANSI/ASME B16.5-2009, Pipe Flanges and Flanged Fittings.

.2 ANSI/ASME B16.18-2012, Cast Copper Alloy Solder Joint Pressure Fittings.

.3 ANSI/ASME B16.22-2001(R2010), Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings.

.4 ANSI/ASME B18.2.1-2010, Square, Hex, Heavy Hex, and Askew Head Bolts and Hex, Heavy Hex, Hex Flange, Lobed Head, and Lag Screws.

.2 ASTM International

.1 ASTM A47/A47M-99(R2009), Specification for Ferritic Malleable Iron Castings.

.2 ASTM A53-12/A53M-12, Specification for Pipe, Steel, Black and Hot-Dipped, Zinc Coated, Welded and Seamless.

.3 ASTM B32-08, Specification for Solder Metal.

.4 ASTM B75M-99(R2011), Specification for Seamless Copper Tube.

.3 Canadian Standards Association (CSA)

.1 CSA W47.1-09, Certification of Companies for Fusion Welding of Steel Structures.

.2 CAN/CSA-B149.1-10, Natural Gas Installation Code.

.3 CAN/CSA-B149.2-10, Propane Installation Code.

1.3 PRODUCT DATA

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

.2 Indicate on manufacturers catalogue literature following: valves.

1.4 CLOSEOUT SUBMITTALS

.1 Provide maintenance data for incorporation into manual specified in Section 01 78 00.

1.5 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 74 20.

.2 Collect and separate plastic, paper packaging and corrugated cardboard in accordance with Waste Management Plan.

.3 Fold up metal banding, flatten and place in designated area for recycling.

Part 2 PRODUCTS

2.1 PIPE

.1 Steel pipe: to ASTM A53/A53M, Schedule 40, seamless as follows:

.1 NPS 1/2 to 2, screwed.

.2 NPS 2 1/2 and over, plain end.

.2 Copper tube: to ASTM B75M.

2.2 JOINTING MATERIAL

.1 Screwed fittings: pulverized lead paste.

.2 Welded fittings: to CSA W47.1.

.3 Flange gaskets: nonmetallic flat.

.4 Soldered: to ASTM B32-08, tin antimony 5/5.

2.3 FITTINGS

.1 Steel pipe fittings, screwed, flanged or welded:

.1 Malleable iron: screwed, banded, Class 150.

.2 Steel pipe flanges and flanged fittings: to ANSI/ASME B16.5.

.3 Welding: butt-welding fittings.

.4 Unions: malleable iron, brass to iron, ground seat, to ASTM A47/A47M.

.5 Bolts and nuts: to ANSI/ASME B18.2.1.

.6 Nipples: schedule 40, to ASTM A53/A53M.

.2 Copper pipe fittings, screwed, flanged or soldered:

.1 Cast copper fittings: to ANSI/ASME B16.18.

.2 Wrought copper fittings: to ANSI/ASME B16.22.

2.4 VALVES

.1 Provincial Code approved, lubricated plug type.

Part 3 EXECUTION

3.1 PIPING

.1 Install in accordance with Section 23 05 01, supplemented as specified herein.

.2 Install in accordance with applicable Provincial/Territorial Codes.

.3 Install in accordance with CAN/CSA B149.1.

.4 Install drip points:

.1 At low points in piping system.

.2 At connections to equipment.

3.2 VALVES

.1 Install valves with stems upright or horizontal unless otherwise approved by Departmental Representative.

.2 Install valves at branch take-offs to isolate pieces of equipment, and as indicated.

3.3 FIELD QUALITY CONTROL

.1 Test system in accordance with CAN/CSA B149.1 and requirements of authorities having jurisdiction.

3.4 PURGING

.1 Purge after pressure test in accordance with CAN/CSA B149.1.

3.5 PRE-START-UP INSPECTIONS

.1 Check vents from regulators, control valves, terminate outside building in approved location, protected against blockage, damage.

.2 Check gas trains, entire installation is approved by authority having jurisdiction.

3.6 CLEANING AND START-UP

.1 In accordance with Section 23 08 02, supplemented as specified herein.

.2 In accordance with requirements of CAN/CSA B149.1.

3.7 PERFORMANCE VERIFICATION (P.V.)

.1 Refer to Section 23 08 01.

END OF SECTION

Part 1 GENERAL

1.1 RELATED REQUIREMENTS

.1 Section 23 05 05 – Installation of Pipework.

1.2 REFERENCES

.1 American National Standards Institute/American Water Works Association (ANSI/AWWA)

.1 ANSI/AWWA C111/A21.11-12, Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.

.2 American Society of Mechanical Engineers (ASME)

.1 ASME B16.1-10, Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250.

.2 ASME B16.3-11, Malleable Iron Threaded Fittings: Classes 150 and 300.

.3 ASME B16.5-09, Pipe Flanges and Flanged Fittings: NPS ½ through NPS 24 Metric/Inch Standard.

.4 ASME B16.9-07, Factory-Made Wrought Buttwelding Fittings.

.5 ASME B18.2.1-10, Square Hex, Heavy Hex and Askew Head Bolts and Hex, Heavy Hex, Hex Flange. Loaded Head and Lag Screws (Inch Series).

.6 ASME B18.2.2-10, Nuts for General Applications: Machine Screw Nuts, Hex, Square, Hex Flange, and Coupling Nuts (Inch Series).

.3 ASTM International

.1 ASTM A47/A47M-99(2014), Standard Specification for Ferritic Malleable Iron Castings.

.2 ASTM A53-12/A53M-12, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc Coated Welded and Seamless.

.3 ASTM A536-84(2009), Standard Specification for Ductile Iron Castings.

.4 ASTM B61-08, Standard Specification for Steam or Valve Bronze Castings.

.5 ASTM B62-09, Standard Specification for Composition Bronze or Ounce Metal Castings.

.6 ASTM E202-10, Standard Test Method for Analysis of Ethylene Glycols and Propylene Glycols.

.4 Canada Green Building Council (CaGBC)

.1 LEED Canada-NC-2009, LEED (Leadership in Energy and Environmental Design): Green Building Rating System for New Construction and Major Renovations 2009.

.5 CSA International

.1 CSA B242-05(R2011), Groove and Shoulder Type Mechanical Pipe Couplings.

.2 CSA W48-06, Filler Metals and Allied Materials for Metal Arc Welding.

.6 Manufacturer's Standardization of the Valve and Fittings Industry (MSS)

.1 MSS-SP-67-2002a, Butterfly Valves.

.2 MSS-SP-70-06, Gray Iron Gate Valves, Flanged and Threaded Ends.

.3 MSS-SP-71-05, Gray Iron Swing Check Valves Flanged and Threaded Ends.

.4 MSS-SP-80-08, Bronze Gate, Globe, Angle and Check Valves.

.5 MSS-SP-85-02, Gray Iron Globe and Angle Valves, Flanged and Threaded Ends.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for hydronic systems 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 Indicate on drawings:

.1 Components and accessories.

.4 Sustainable Design Submittals:

.1 LEED Canada submittals: in accordance with Section 01 35 21.

.2 Construction Waste Management:

.1 Submit project Waste Management Plan highlighting recycling and salvage requirements.

.2 Submit calculations on end-of-project recycling rates, salvage rates, and landfill rates demonstrating that 75% of construction wastes were recycled or salvaged.

.3 Building Energy and Water Consumption: submit copy of Measurement and Verification Plan following IPMVP.

1.4 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00.

.2 Operation and Maintenance Data: submit operation and maintenance data for hydronic systems for incorporation into manual.

.1 Include special servicing requirements.

1.5 EXTRA STOCK MATERIALS

.1 Supply spare parts as follows:

.1 Valve seats: 1 minimum for every ten valves, each size. Minimum one.

.2 Discs: 1 minimum for every ten valves, each size. Minimum one.

.3 Stem packing: 1 minimum for every ten valves, each size. Minimum one.

.4 Valve handles: 2 minimum of each size.

.5 Gaskets for flanges: 1 minimum for every ten flanges.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 and with manufacturer's written instructions.

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

.3 Storage and Handling Requirements:

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

.2 Store and protect hydronic systems from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

.4 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding and packaging materials as specified in Waste Reduction Workplan in accordance with Section 01 74 20.

Part 2 PRODUCTS

2.1 PIPE

.1 Steel pipe: to ASTM A53/A53M, Grade B, as follows:

.1 To NPS 6: Schedule 40.

2.2 PIPE JOINTS

.1 NPS 2 and under: screwed fittings with PTFE tape.

.2 NPS 2-1/2 and over: welding fittings and flanges to CSA W48.

.3 Roll grooved: standard coupling to CSA B242.

.4 Flanges: plain, slip-on to ANSI/AWWA C111/ A21.11.

.5 Orifice flanges: slip-on raised face, 2100 kPa.

.6 Flange gaskets: to ANSI/AWWA C111/ A21.11.

.7 Pipe thread: taper.

.8 Bolts and nuts: to ASME B18.2.1 and ASME B18.2.2.

.9 Roll grooved coupling gaskets: type EPDM.

2.3 FITTINGS

.1 Screwed fittings: malleable iron, to ASME B16.3, Class 150.

.2 Pipe flanges and flanged fittings:

.1 Cast iron: to ASME B16.1, Class 125.

.2 Steel: to ASME B16.5.

.3 Butt-welding fittings: steel, to ASME B16.9.

.4 Unions: malleable iron, to ASTM A47/A47M and ASME B16.3.

.5 Fittings for roll grooved piping: malleable iron to ASTM A47/A47M ductile iron to ASTM A536.

2.4 VALVES

.1 Connections:

.1 NPS 2 and smaller: screwed ends.

.2 NPS 2-1/2 and larger: flanged or grooved ends.

.2 Gate valves: to MSS-SP-70 or MSS-SP-80 application: isolating equipment, control valves, pipelines:

.1 NPS 2 and under:

.1 Mechanical Rooms: Class 125, rising stem, wedge disc, as specified Section 23 05 23.01.

.2 Elsewhere: Class 125, non- rising stem, solid wedge disc, as specified Section 23 05 23.01.

.2 NPS 2-1/2 and over:

.1 Mechanical Rooms: rising stem, wedge disc, lead free bronze trim, as specified Section 23 05 23.02.

.1 Operators: chain or manual.

.2 Elsewhere: non-rising stem, solid wedge disc, lead free bronze trim, as specified Section 23 05 23.02.

.1 Operators: chain or manual.

.3 Butterfly valves: to MSS-SP-67 application: isolating cells or section of multiple component equipment (i.e. multi-section coils, multi-cell cooling towers):

.1 NPS 2-1/2 and over: grooved ends: as specified Section 23 05 17.

.4 Globe valves: to MSS-SP- 80 application: throttling, flow control, emergency bypass:

.1 NPS 2 and under:

.1 Mechanical Rooms: with PTFE disc, as specified Section 23 05 23.01.

.2 Elsewhere: globe, with composition disc, as specified Section 23 05 23.01.

.2 NPS 2-1/2 and over:

.1 With composition lead free bronze disc, lead free bronze trim, as specified Section 23 05 23.02.

.5 Circuit Balancing Valves:

.1 Ductile iron body, globe type, with EPDM seat, and venturi taps.

.2 Rated for 2065kPa, flanged or grooved with handwheel operator complete with memory stop.

.6 Drain valves: Gate, Class 125, non-rising stem, solid wedge disc, as specified Section 23 05 23.01.

.7 Swing check valves: to MSS-SP-71.

.1 NPS 2 and under:

.1 Class 125, swing, with composition disc, as specified Section 23 05 23.01.

.2 NPS 2-1/2 and over:

.1 Flanged or grooved ends: as specified Section 23 05 23.02.

.8 Silent check valves:

.1 NPS 2 and under:

.1 As specified Section 23 05 23.01.

.2 NPS 2-1/2 and over:

.1 Flanged or grooved ends: as specified Section 23 05 23.02.

.9 Ball valves:

.1 NPS 2 and under: as specified Section 23 05 23.01.

2.5 PIPING INSTALLATION

.1 Install pipework in accordance with Section 23 05 05.

2.6 CIRCUIT BALANCING VALVES

.1 Install flow balancing valves for all control valves and as indicated.

2.7 CLEANING, FLUSHING AND START-UP

.1 In accordance with Section 23 08 02.

2.8 TESTING

.1 Test system in accordance with Section 21 05 01.

.2 For glycol systems, retest with propylene glycol to ASTM E202, inhibited, for use in building system after cleaning. Repair leaking joints, fittings or valves.

2.9 BALANCING

.1 In accordance with Section 23 05 93 for applicable procedures.

2.10 GLYCOL CHARGING

.1 Include mixing tank and positive displacement pump for glycol charging.

.2 Retest for concentration to ASTM E202 after cleaning.

2.11 PERFORMANCE VERIFICATION

.1 In accordance with Section 23 08 01.

.2 Progress Cleaning: clean in accordance with Section 01 74 11.

.1 Leave Work area clean at end of each day.

.3 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11.

.4 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 20.

.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

2.12 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by hydronic systems installation.

END OF SECTION

Part 1 GENERAL

1.1 REFERENCES

.1 ASME

.1 ASME Boiler and Pressure Vessel Code (BPVC), Section VII-2013.

.2 ASTM International

.1 ASTM A47/A47M-99(2014), Standard Specification for Ferritic Malleable Iron Castings.

.2 ASTM A278/A278M-01(2011), Standard Specification for Gray Iron Castings for Pressure-Containing Parts for Temperatures up to 650 degrees F (350 degrees C).

.3 ASTM A516/A516M-10, Standard Specification for Pressure Vessel Plates, Carbon Steel, for Moderate - and Lower - Temperature Service.

.4 ASTM A536-84(2009), Standard Specification for Ductile Iron Castings.

.5 ASTM B62-09, Standard Specification for Composition Bronze or Ounce Metal Castings.

.3 Canada Green Building Council (CaGBC)

.1 LEED Canada 2009 for Design and Construction-2010, LEED Canada 2009 for Design and Construction Leadership in Energy and Environmental Design Green Building Rating System Reference Guide.

.4 CSA Group

.1 CSA B51-09, Boiler, Pressure Vessel, and Pressure Piping Code.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00.

.2 Product Data:

.1 Provide manufacturer's printed product literature and datasheets for expansion tanks, air vents, separators, valves, and strainers, and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:

.1 Submit shop drawings for:

.1 Expansion Tanks

.2 Strainers

.3 Air separators

.4 Suction Diffusers

.5 Air vents

.6 Pressure reducing valves

1.3 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle in accordance with Section 01 61 00.

.2 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

.3 Packaging Waste Management: remove for reuse of pallets, crates, padding and packaging materials in accordance with Section 01 74 20.

Part 2 PRODUCTS

2.1 DIAPHRAGM TYPE EXPANSION TANK

.1 Vertical steel pressurized diaphragm type expansion tank.

.2 Capacity: as per mechanical schedules.

.3 Diaphragm sealed in EPDM suitable for 115 degrees C operating temperature.

.4 Working pressure: 520 kPa.

.5 Air precharged to 140 kPa (initial fill pressure of system).

.6 Base mount for vertical installation.

2.2 AUTOMATIC AIR VENT

.1 Standard float vent: brass body and NPS 1/8 connection and rated at 620 kPa working pressure.

.2 Float: solid material suitable for 115 degrees C working temperature

2.3 AIR SEPARATOR - IN-LINE

.1 Working pressure: 860 kPa.

.2 Size: to match line size.

2.4 COMBINATION SEPARATORS/STRAINER S

.1 Steel, tested and stamped in accordance with ANSI/ASME BPVC, for 860 kPa operating pressure, with galvanized steel integral strainer with 5 mm perforations, tangential inlet and outlet connections, and internal stainless steel air collector tube.

2.5 COMBINATION LOW PRESSURE RELIEF AND REDUCING VALVE

.1 Adjustable pressure setting: 206 kPa relief, 551 to 140 kPa reducing.

.2 Low inlet pressure check valve.

.3 Removable strainer.

2.6 PIPE LINE STRAINER

.1 NPS 1/2 to 2: bronze body to ASTM B62, screwed connections, Y pattern.

.2 NPS 2 1/2 to 12: cast iron body to ASTM A278/A278M, Class 30 flanged connections.

.3 Blowdown connection: NPS 1

.4 Screen: stainless steel with 1.19 mm perforations.

.5 Working pressure: 860 kPa.

2.7 SUCTION DIFFUSER

.1 Body: cast iron with flanged connections.

.2 Strainer: with built-in, disposable 1.19 mm mesh, low pressure drop screen and NPS 1blowdown connection.

.3 Permanent magnet particle trap.

.4 Full length straightening vanes.

.5 Pressure gauge tappings.

.6 Adjustable support leg.

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 GENERAL

.1 Run drain lines and blow off connections to terminate above nearest drain.

.2 Maintain adequate clearance to permit service and maintenance.

.3 Should deviations beyond allowable clearances arise, request and follow Departmental Representative's directive.

.4 Check shop drawings for conformance of tappings for ancillaries and for equipment operating weights.

3.3 STRAINERS

.1 Install in horizontal or down flow lines.

.2 Ensure clearance for removal of basket.

.3 Install ahead of each pump.

.4 Install ahead of each automatic control valve larger than NPS 1and as indicated.

3.4 AIR VENTS

.1 Install at high points of systems.

.2 Install gate valve on automatic air vent inlet. Run discharge to nearest drain.

3.5 EXPANSION TANKS

.1 Adjust expansion tank pressure to suit design criteria.

3.6 PRESSURE SAFETY RELIEF VALVES

.1 Run discharge pipe to terminate above nearest drain.

3.7 SUCTION DIFFUSERS

.1 Install on inlet to pumps having suction size greater than 50.

3.8 PERFORMANCE VERIFICATION

.1 Operational requirements in accordance with Section 01 79 00, include:

.1 Repair and maintenance materials and instructions.

3.9 CLEANING

.1 Clean in accordance with Section 01 74 11.

.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 74 20.

END OF SECTION

Part 1 GENERAL

1.1 REFERENCES

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

.1 ANSI/ASHRAE/IES Standard 90.1-2010, Energy Standard for Buildings Except Low-Rise Residential Buildings.

.2 Canada Green Building Council (CaGBC)

.1 LEED Canada 2009 for Design and Construction-2010, LEED Canada 2009 for Design and Construction Leadership in Energy and Environmental Design Green Building Rating System Reference Guide.

.3 CSA Group

.1 CAN/CSA-B214-12, Installation Code for Hydronic Heating Systems.

.4 Electrical Equipment Manufacturers Association of Canada (EEMAC)

.5 National Electrical Manufacturers' Association (NEMA)

.1 NEMA MG 1-2011, Motors and Generators.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00.

.2 Product Data:

.1 Provide manufacturer's printed product literature and datasheets for pump, circulator, and equipment, and include product characteristics, performance criteria, physical size, finish and limitations indicate point of operation, and final location in field assembly.

.3 Shop Drawings:

.1 Provide shop drawings indicating the following:

.1 Casing construction

.2 Certified pump curves showing performance characteristics, including NSPH curve where applicable and seal types.

.1 Provide parallel pump curve for parallel pump systems

.3 Impeller size and construction

.4 Electrical requirements

.5 Variable speed drives

.4 Submit manufacturer's detailed composite wiring diagrams for control systems showing factory installed wiring and equipment on packaged equipment or required for controlling devices or ancillaries, accessories and controllers.

1.3 CLOSEOUT SUBMITTALS

.1 Provide maintenance and operation data for incorporation into manual specified in Section 01 78 00.

1.4 MAINTENANCE

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

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle in accordance with Section 01 61 00.

.2 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

.3 Packaging Waste Management: remove for reuse of pallets, crates, padding and packaging materials in accordance with Section 01 74 20.

Part 2 PRODUCTS

2.1 EQUIPMENT

.1 Size and select components to: CAN/CSA-B214.

2.2 IN-LINE CIRCULATORS

.1 Pump to be maintenance free design and capable of operating in variable speed applications. Pump to be designed for quiet operation.

.2 Volute: cast iron with flanged design suction and discharge connections.

.3 Impeller: Non-metallic

.4 Shaft: alloy steel with permanently lubricated sealed precision bearings. Bearings to be permanently oil lubricated.

.5 Seal assembly: mechanical for service to 107°C. Seal to be carbon/silicone assembly

.6 Coupling: rigid

.7 Motor: resilient mounted, drip proof, non-overloading at any point on the pump curve. CSA and UL listed.

.8 Capacity: as indicated.

.9 Design pressure: 1034 kPa.

2.3 VERTICAL IN-LINE CIRCULATORS

.1 Vertical In-Line End Suction Pumps: Centrifugal in-line single or double suction as specified; direct coupled for up to 5.6 kW and split spacer coupling for 7.5 kW and over and as follows:

.1 Volute of cast iron rated for 1225 kPa or ductile iron for 2500 kPa. Provide the following casing accessories: drain plug, flanged inlet and outlet, separate tapped flush line and gauge connections.

.2 Bronze dynamically balanced impeller or equivalent alloy, keyed to shaft, held in place by self-locking bronze cap screw.

.3 Equip direct coupled pumps with steel shaft with bronze shaft sleeve; equip spacer coupling pumps with stainless steel shaft.

.4 Equip direct coupled pumps with carbon/ni-resist or tungsten carbide mechanical seal; equip spacer coupling pumps with Durametallic Type RA outside mechanical seal.

.5 Equip all pumps with flush lines piped from pump discharge to mechanical seals.

.2 Seals and Packing: Supply all pumps with mechanical seals as detailed in individual sections and as follows:

.1 Provide a stuffing box integral with pump casing and lantern rings where packing glands are specified on schedule, equipped with four Teflon coated rings.

.2 Provide shield over stuffing box to prevent water spray; provide stainless steel shafts on associated pumps where packing glands are used.

Part 3 EXECUTION

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for hydronic pump 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 APPLICATION

.1 Manufacturer's Instructions: comply with manufacturer's written recommendations, including product technical bulletins, handling, storage and installation instructions, and data sheets.

3.3 INSTALLATION

.1 Install hydronic pumps to: CAN/CSA-B214.

.2 In line circulators: install as indicated by flow arrows.

.1 Support at inlet and outlet flanges or unions.

.2 Install with bearing lubrication points accessible.

.3 Ensure that pump body does not support piping or equipment.

.1 Provide stanchions or hangers for this purpose.

.2 Refer to manufacturer's installation instructions for details.

.4 Pipe drain tapping to floor drain.

.5 Install volute venting pet cock in accessible location.

.6 Check rotation prior to start-up.

.7 Install pressure gauge test cocks.

3.4 START-UP

.1 General:

.1 In accordance with Section 01 91 13: General Requirements; supplemented as specified herein.

.2 In accordance with manufacturer's recommendations.

.2 Procedures:

.1 Before starting pump, check that cooling water system over-temperature and other protective devices are installed and operative.

.2 After starting pump, check for proper, safe operation.

.3 Check installation, operation of mechanical seals, packing gland type seals. Adjust as necessary.

.4 Check base for free-floating, no obstructions under base.

.5 Run-in pumps for 12 continuous hours minimum.

.6 Verify operation of over-temperature and other protective devices under low- and no-flow condition.

.7 Eliminate air from scroll casing.

.8 Adjust water flow rate through water-cooled bearings.

.9 Adjust flow rate from pump shaft stuffing boxes to manufacturer's recommendation.

.10 Adjust alignment of piping and conduit to ensure true flexibility.

.11 Eliminate cavitation, flashing and air entrainment.

.12 Adjust pump shaft seals, stuffing boxes, glands.

.13 Measure pressure drop across strainer when clean and with flow rates as finally set.

.14 Replace seals if pump used to degrease system or if pump used for temporary heat.

.15 Verify lubricating oil levels.

3.5 PERFORMANCE VERIFICATION (PV)

.1 General:

.1 Verify performance in accordance with Section 01 91 13: General Requirements, supplemented as specified herein.

.2 Verify that manufacturer's performance curves are accurate.

.3 Ensure valves on pump suction and discharge provide tight shut-off.

.4 Net Positive Suction Head (NPSH):

.1 Application: measure NPSH for pumps which operate on open systems and with water at elevated temperatures.

.2 Measure using procedures prescribed in Section 01 91 13.

.3 Where procedures do not exist, discontinue PV, report to Departmental Representative and await instructions.

.5 Multiple Pump Installations - Series and Parallel:

.1 Repeat PV procedures specified above for pump performance and pump BHP for combinations of pump operations.

.6 Mark points of design and actual performance at design conditions as finally set upon completion of TAB.

.7 Commissioning Reports: in accordance with Section 01 91 13 reports supplemented as specified herein. Reports to include:

.1 Record of points of actual performance at maximum and minimum conditions and for single and parallel operation as finally set at completion of commissioning on pump curves.

.2 Use Report Forms specified in Section 01 91 13: Report Forms and Schematics.

.3 Pump performance curves (family of curves).

3.6 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11.

.3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 20.

.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

Part 1 GENERAL

1.1 RELATED SECTIONS

.1 Section 23 05 01 - Installation of Pipework.

1.2 REFERENCES

.1 ASME

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

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

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

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

.2 ASTM International

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

.2 ASTM B280-13, Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service.

.3 Canada Green Building Council (CaGBC)

.1 LEED Canada 2009 for Design and Construction-2010, LEED Canada 2009 for Design and Construction Leadership in Energy and Environmental Design Green Building Rating System Reference Guide.

.4 CSA Group

.1 CSA B52-13, Mechanical Refrigeration Code.

.5 Environment Canada (EC)

.1 EPS 1/RA/1-96, Environmental Code of Practice for the Elimination of Fluorocarbon Emissions from Refrigeration and Air Conditioning Systems.

1.3 ADMINISTRATIVE REQUIREMENTS

.1 Pre-installation Meetings:

.1 Convene pre-installation meeting 1 week prior to beginning work of this Section and on-site installation, with contractor's representative and Departmental Representative in accordance with Section 01 31 19 to:

.1 Verify project requirements.

.2 Review installation and substrate conditions.

.3 Co-ordination with other building construction subtrades.

.4 Review manufacturer's written installation instructions and warranty requirements.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for refrigerant piping, fittings and equipment and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Submit 2 copies of WHMIS MSDS. Indicate VOC's for adhesive and solvents during application and curing.

.3 Test Reports: submit certified test reports from approved independent testing laboratories indicating compliance with specifications for specified performance characteristics and physical properties.

.4 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.5 Sustainable Design Submittals:

.1 LEED Canada submittals: in accordance with Section 01 35 21.

.2 Construction Waste Management:

.1 Submit project Waste Management Plan highlighting recycling and salvage requirements.

.2 Submit calculations on end-of-project recycling rates, salvage rates, and landfill rates demonstrating that 75% of construction wastes were recycled or salvaged.

1.5 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00.

.2 Operation and Maintenance Data: submit operation and maintenance data for refrigerant piping for incorporation into manual.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 and with manufacturer's written instructions.

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

.3 Storage and Handling Requirements:

.1 Store materials indoors 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 Management Plan related to Work of this Section and in accordance with Section 01 35 21.

Part 2 PRODUCTS

2.1 TUBING

.1 Processed for refrigeration installations, deoxidized, dehydrated and sealed.

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

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

2.2 FITTINGS

.1 Service: design pressure 2070 kPa and temperature 121°C.

.2 Brazed:

.1 Fittings: wrought copper to ASME B16.22.

.2 Joints: silver solder, 45% Ag-15% Cu and non-corrosive flux.

.3 Flanged:

.1 Bronze or brass, to ASME B16.24, Class 150 and Class 300.

.2 Gaskets: suitable for service.

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

.4 Flared:

.1 Bronze or brass, for refrigeration, to ASME B16.26.

2.3 PIPE SLEEVES

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

2.4 VALVES

.1 22 mm and under: Class 500, 3.5 Mpa, globe or angle non-directional type, diaphragm, packless type, with forged brass body and bonnet, moistureproof seal for below freezing applications, brazed connections.

.2 Over 22 mm: Class 375, 2.5 Mpa, globe or angle type, diaphragm, packless type, back-seating, cap seal, with cast bronze body and bonnet, moistureproof seal for below freezing applications, brazed connections.

.3 Isolation Valves:

.1 Class 650, 4.48 MPa, ball valve, forged brass body, compatible with HCFC and HFC refrigerants, full flow design, 100% copper extended connections, operating range -40°C – 120°C.

2.5 MATERIALS

.1 Liquid Indicators: Provide double port type liquid indicators with copper brass body with flared or solder ends include removable seal caps on each port to allow for refrigerant condition.

.2 Strainers: Provide angle replaceable cartridge type refrigerant strainers with brass shell; having cartridge material and screen size suitable for refrigerant and piping materials utilized in the system.

.3 Hot Gas Regulator: Provide sweat end, screw adjustment, integral electric shut off valve, or a separate electric solenoid shut-off valve upstream of hot gas regulator.

.4 Filter Driers: Provide angle type combination filter driers with brass shell that incorporates a combined straining and drying material; include replaceable desiccant material.

.5 Solenoid Valves: Provide solenoid valves having copper or brass body with flared or screwed ends, replaceable coil assembly and that incorporate a manually operated stem to serve as a bypass in case of coil failure.

.6 Expansion Valves: Provide angle type or straight through expansion valves suitable for the refrigerant utilized in the system; use valves that have brass body, internal or external equalizer, adjustable superheat setting and having capillary tube and remote sensing bulb.

.7 Charging Valves: Provide general purpose type refrigerant charging valves with brass body, flared or solder ends having removable valve core; include quick coupling connection valve inlet for system charging connection.

.8 Flexible Connectors: Provide flexible connectors consisting of close pitch corrugated bronze hose with single layer of exterior braiding providing additional strength that prevents elongation of corrugated section; include connectors minimum 230 mm long, include bronze fittings to facilitate connection to equipment.

.9 Insulation: Insulate suction and liquid lines throughout;; provide curved 150 mm long metal plate to protect insulation at hanger locations.

Part 3 EXECUTION

3.1 GENERAL

.1 In accordance with Section 23 05 01, supplemented as specified herein

.2 Install in accordance with CSA B52, EPS1/RA/1 and ASME B31.5.

3.2 BRAZING PROCEDURES

.1 Bleed inert gas into pipe during brazing.

.2 Remove valve internal parts, solenoid valve coils, sight glass.

.3 Do not apply heat near expansion valve and bulb.

3.3 PIPING INSTALLATION

.1 General:

.2 Soft annealed copper tubing: bend without crimping or constriction

.3 Hard drawn copper tubing: do not bend. Minimize use of fittings.

.2 Hot gas lines:

.1 Pitch at least 1:240 down in direction of flow to prevent oil return to compressor during operation.

.2 Provide trap at base of risers greater than 2400 mm high and at each 7600 mm thereafter.

.3 Provide inverted deep trap at top of risers.

.4 Provide double risers for compressors having capacity modulation.

.1 Large riser: install traps as specified above.

.2 Small riser: size for 5.1 m/s at minimum load. Connect upstream of traps on large riser.

3.4 PRESSURE AND LEAK TESTING

.1 Close valves on factory charged equipment and other equipment not designed for test pressures.

.2 Leak test to CSA B52 before evacuation to 2MPa and 1MPa on high and low sides respectively.

.3 Test Procedure: Build pressure up to 35 kPa with refrigerant gas on high and low sides. Supplement with nitrogen to required test pressure. Test for leaks with electronic or halide detector. Repair leaks and repeat tests.

3.5 DEHYDRATION AND CHARGING

.1 Close service valves on factory charged equipment.

.2 Ambient temperatures to be at least 13°C for at least 12 hours before and during dehydration.

.3 Use copper lines of largest practical size to reduce evacuation time.

.4 Use two-stage vacuum pump with gas ballast on 2nd stage capable of pulling 5Pa absolute and filled with dehydrated oil.

.5 Measure system pressure with vacuum gauge. Take readings with valve between vacuum pump and system closed.

.6 Triple evacuate system components containing gases other than correct refrigerant or having lost holding charge as follows:

.1 Twice to 14Pa absolute and hold for 4 h.

.2 Break vacuum with refrigerant to 14kPa.

.3 Final to 5Pa absolute and hold for at least 12 h.

.4 Isolate pump from system, record vacuum and time readings until stabilization of vacuum.

.5 Submit test results to Departmental Representative.

.7 Charging:

.1 Charge system through filter-drier and charging valve on high side. Low side charging not permitted.

.2 With compressors off, charge only amount necessary for proper operation of system. If system pressures equalize before system is fully charged, close charging valve and start up. With unit operating, add remainder of charge to system.

.3 Re-purge charging line if refrigerant container is changed during charging process.

.8 Checks:

.1 Make checks and measurements as per manufacturer's operation and maintenance instructions.

.2 Record and report measurements to Departmental Representative.

3.6 LIQUID INDICATORS

.1 Provide full size liquid indicators in main liquid line leaving condenser. If a receiver is used, install in liquid line leaving receiver.

3.7 STRAINERS

.1 Provide full size strainer ahead of each automatic valve. Where multiple expansion valves with integral strainers are used, install single main liquid line strainer.

.2 Provide shut-off valve at each side of strainer to facilitate maintenance.

3.8 REFRIGERANT DRIERS

.1 Provide full flow permanent refrigerant drier in low temperature systems and systems utilizing hermetic compressors.

.2 Mount drier vertically in liquid line adjacent to receiver with 3-valve bypass assembly to permit isolation of drier for servicing.

3.9 FILTER-DRIERS

.1 Filter-driers may be used in systems instead of separate strainers and driers.

.2 Install with 3-valve bypass assembly to permit isolation for servicing.

3.10 SOLENOID VALVES

.1 Provide solenoid valves in liquid line of systems operating with single pump-out or pump-down compressor control, in liquid line of single or multiple evaporator systems and in oil bleeder lines from flooded evaporators to stop flow of oil and refrigerant into the suction line when system shuts down.

.2 Provide solenoid valves with manually operable stems.

3.11 EXPANSION VALVES

.1 Size expansion valves properly to avoid penalty of being undersized at full load and of being excessively oversized at partial load.

.2 Properly evaluate refrigerant pressure drop through system to determine the available pressure drop across the valve.

.3 Select valves for maximum load at design operating pressure and minimum 6°C of superheat.

.4 Locate remote expansion valve sensing bulb immediately after evaporator outlet on suction line.

3.12 CHARGING VALVES

.1 Provide refrigerant charging connections in liquid line between receiver shut-off valve and expansion valve.

3.13 FLEXIBLE CONNECTORS

.1 In general install suction and hot gas piping connections to compressors with three directional changes for distance of minimum six pipe diameters before reaching point of support.

.2 Flexible connectors shall only be utilized at or near compressors where it is not physically possible to absorb vibration within piping configuration.

3.14 INSTRUCTIONS

.1 Post instructions in frame with glass cover in accordance with Section 01 78 01 and CSA B52.

END OF SECTION

Part 1 GENERAL

1.1 REFERENCES

.1 ASME

.1 ASME Boiler and Pressure Vessel Code (BPVC), Section VII-2013.

.2 Canada Green Building Council (CaGBC)

.1 LEED Canada 2009 for Design and Construction, LEED Canada 2009 for Design and Construction Leadership in Energy and Environmental Design Green Building Rating System Reference Guide.

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

.1 Material Safety Data Sheets (MSDS).

1.2 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Section 01 33 00.

1.3 CLOSEOUT SUBMITTALS

.1 Submit operation and maintenance data for incorporation into manual specified in Section 01 78 00.

.2 Include following:

.1 Log sheets as recommended by manufacturer.

1.4 WASTE MANAGEMENT AND DISPOSAL

.1 Unused metal and wiring materials are to be diverted from landfill to a metal recycling facility as approved by the Departmental Representative.

.2 Dispose of unused water treatment chemicals at official hazardous material collections site approved by Departmental Representative.

.3 Do not dispose of unused water treatment chemicals into sewer system, into streams, lakes, onto ground or in other locations where it will pose health or environmental hazard.

.4 Remove from site and dispose of packaging materials at appropriate recycling facilities.

.5 Dispose of corrugated cardboard, polystyrene, plastic, packaging material in appropriate on-site bin for recycling in accordance with site waste management program.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 and with manufacturer's written instructions.

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

.3 Storage and Handling Requirements:

.1 Store materials indoors 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 Management Plan related to Work of this Section and in accordance with Section 01 35 21.

Part 2 PRODUCTS

2.1 MANUFACTURER

.1 Equipment, chemicals, and service provided by one supplier.

2.2 WATER TREATMENT FOR HYDRONIC SYSTEMS

.1 Chemical Pot Feeder:

.1 Provide one 7.6L by-pass pot feeder for each closed water loop system for the addition of the corrosion inhibitor. Each feeder shall be welded steel and have a maximum pressure of 300 psi and a maximum temperature of 200°F. In/out connections shall be ¾” FNPTHot.

.2 Bypass Filter Housing:

.1 Provide one by-pass filter housing for each closed water loop system to provide sidestream filtration. Each housing shall be welded steel and have a maximum pressure of 250 psi and a maximum temperature of 250°F. In/out connections shall be ¾” FNPT. It shall house 1 x 20” filter cartridges and have a maximum flowrate of 0.9L/S.

.2 Provide startup quantity (enough for at least 5 changes per filter housing) of twenty inch long cotton filters with stainless steel core rated at 25 microns.

.3 Make-Up Water Flow Meter:

.1 Provide one water meter for each closed water loop system to measure and monitor the flow of make-up water. The meter shall be manufactured from cast bronze and have both a totalizing register and a 10 gpc contacting head. The meter shall have ¾” NPT male connections and be capable of 1L/S continuous flow with an accuracy of +/- 1.5%. The meter shall be able to withstand a maximum operating pressure of 1034Kpa.

.4 Four Port Corrosion Coupon Rack – Steel:

.1 Provide one 4 port condensate corrosion coupon rack shall be provided for each closed water loop system for possible future corrosion study use. Each rack is designed to monitor the effectiveness of the water management program. The rack shall be constructed of black steel piping with 4 carbon steel/teflon coupon holders. It shall have a maximum pressure of 1034Kpa and a maximum fluid temperature of 121°C. In/out pipe size shall be 25mm.

.5 Chemicals

.1 Provide 1 years supply.

.6 Bypass Filter Housing:

.1 Provide one by-pass filter housing for each closed water loop system to provide sidestream filtration. Each housing shall be welded steel and have a maximum pressure of 250 psi and a maximum temperature of 250°F. In/out connections shall be ¾" FNPT. It shall house 1 x 20" filter cartridges and have a maximum flowrate of 0.9L/S.

.2 Provide startup quantity (enough for at least 5 changes per filter housing) of twenty inch long cotton filters with stainless steel core rated at 25 microns.

.7 Test Equipment

.1 One wall mountable test cabinet with light shall be provided. The cabinet shall come complete with all required equipment and reagents for performing water tests for hardness, alkalinity, molybdate, and nitrite. It shall include an electronic conductivity & pH meter, a glycol refractometer and all associated glassware for performance of on-site water tests.

2.3 PACKAGED GLYCOL FEED SYSTEM

.1 Provide a packaged, pre-piped glycol feed system for automatic addition of glycol. The system automatically maintains pressure in the loop by adding glycol solution to make up for losses. Glycol addition is controlled by a pressure switch with adjustable low and high set points.

.2 The packaged system shall include:

.1 A polyethylene tank mounted on a steel frame.

.2 Pump shall be bronze rotary gear type

.3 Float switch for low level pump shufoff and alarm.

.4 NEMA 4X control panel

.1 Hand-Off-Auto

.2 Pump "on" indicator light

.3 Dry contact for remote low level indication to BAS

.4 Power Cord with Plug, 120V.

.5 Provide audible alarm and push button silence.

2.4 GLYCOL SUPPLY

.1 Provide only premixed glycol solution to scheduled propylene glycol concentration, glycol solution shall be Dowfrost or equivalent.

2.5 WATER SOFTENER

.1 General: 2 sodium zeolite exchangers with common brine tank with eductor and manifold.

.2 Performance: to reduce effluent hardness to less than 1 ppm.

.3 Control:

.1 Automatic feature to prevent regeneration of both exchangers at same time.

.2 Seven day clock permitting regeneration as required. Provide for adjustment of brine/rinse and backwash cycles.

.4 Water meter:

.1 Provide totalizing water meter.

.2 Refer to Section 22 42 16.

2.6 CHEMICALS

.1 Provide 1 years supply.

.2 Obtain chemicals from manufacturer with existing valid contract with DND.

2.7 TEST EQUIPMENT

.1 Provide one set of test equipment for each system to verify performance.

.2 Complete with carrying case, reagents for chemicals, specialized or supplementary equipment.

Part 3 EXECUTION

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for HVAC water treatment systems 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 MANUFACTURER'S INSTRUCTIONS

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

3.3 INSTALLATION

.1 Install HVAC water treatment systems in accordance with ASME Boiler and Pressure Code Section VII, and requirements and standards of authorities having jurisdiction, except where specified otherwise.

.2 Ensure adequate clearances to permit performance of servicing and maintenance of equipment.

3.4 CHEMICAL FEED PIPING

.1 Install crosses at changes in direction. Install plugs in unused connections.

3.5 CLEANING OF MECHANICAL SYSTEM

.1 Provide copy of recommended cleaning procedures and chemicals for approval by Departmental Representative.

.2 Flush mechanical systems and equipment with approved cleaning chemicals designed to remove deposition from construction such as pipe dope, oils, loose mill scale and other extraneous materials. Use chemicals to inhibit corrosion of various system materials that are safe to handle and use.

.3 Examine and clean filters and screens, periodically during circulation of cleaning solution, and monitor changes in pressure drop across equipment.

.4 Drain and flush systems until alkalinity of rinse water is equal to make-up water. Refill with clean water treated to prevent scale and corrosion during system operation.

.5 Disposal of cleaning solutions approved by authority having jurisdiction.

3.6 WATER TREATMENT SERVICES

.1 Provide water treatment monitoring and consulting services for period of 1 year after system start-up. Service to include:

- .1 Initial water analysis and treatment recommendations.
- .2 System start-up assistance.
- .3 Operating staff training.
- .4 Visit plant every 30 days during period of operation and as required until system stabilizes, and advise on treatment system performance.
- .5 Provide necessary recording charts and log sheets for 1 year operation.
- .6 Provide necessary laboratory and technical assistance.
- .7 Provide clear, concise, written instructions and advice to operating staff.

3.7 WATER SOFTENER

.1 Install in accordance with manufacturer's instructions.

.2 Install water meter in water softener inlet piping.

3.8 FIELD QUALITY CONTROL

.1 Start-up:

- .1 Start up water treatment systems in accordance with manufacturer's instructions.

.2 Commissioning:

- .1 Commissioning Agency: to be installing water treatment sub-contractor.
- .2 Timing:
  - .1 After start-up deficiencies rectified.
  - .2 After start-up and before TAB of connected systems.
- .3 Pre-commissioning Inspections: verify:
  - .1 Presence of test equipment, reagents, chemicals, details of specific tests performed, and operating instructions.

.2 Suitability of log book.

.3 Currency and accuracy of initial water analysis.

.4 Required quality of treated water.

.4 Commissioning procedures - applicable to Water Treatment Systems:

.1 Establish, adjust as necessary and record automatic controls and chemical feed rates.

.2 Monitor performance continuously during commissioning of connected systems and until acceptance of project.

.3 Establish test intervals, regeneration intervals.

.4 Record on approved report forms commissioning procedures, test procedures, dates, times, quantities of chemicals added, raw water analysis, treated water analysis, test results, instrument readings, adjustments made, results obtained.

.5 Establish, monitor and adjust automatic controls and chemical feed rates as necessary.

.6 Visit project at specified intervals after commissioning is satisfactorily completed to verify that performance remains as set during commissioning (more often as required until system stabilizes at required level of performance).

.7 Advise Departmental Representative in writing on matters regarding installed water treatment systems.

.5 Commissioning procedures - Water Softeners:

.1 Demonstrate compliance with specifications by chemical analyses of raw water and treated water.

.2 Determine, demonstrate actual softening capacity between regenerations.

.3 Establish regeneration intervals and procedures.

.4 Train O&M personnel in regeneration procedures.

.6 Commissioning procedures - Closed Circuit Hydronic Systems:

.1 Analyze water in system.

.2 Based upon an assumed rate of loss approved by Departmental Representative, establish rate of chemical feed.

.3 Record types, quantities of chemicals applied.

.7 Training:

.1 Commission systems, perform tests in presence of, and using assistance of, assigned O&M personnel.

.2 Train O&M personnel in softener regeneration procedures.

.8 Certificates:

.1 Upon completion, furnish certificates confirming satisfactory installation and performance.

.9 Commissioning Reports:

.1 To include system schematics, test results, test certificates, raw and treated water analyses, design criteria, other data required by Departmental Representative.

.10 Commissioning activities during Warranty Period:

.1 Check out water treatment systems on regular basis and submit written report to Departmental Representative.

3.9 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11.

.3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 20.

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

.2 ASTM International

.1 ASTM A480/A480M-13b, Standard Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet and Strip.

.2 ASTM A635/A635M-13, Standard Specification for Steel, Sheet and Strip, Heavy-Thickness Coils, Hot-Rolled, Alloy, Carbon, Structural, High-Strength Low-Alloy, and High-Strength Low-Alloy with Improved Formability, General Requirements for.

.3 ASTM A653/A653M-13, Standard Specification for Steel Sheet, Zinc Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-Dip Process.

.3 Canada Green Building Council (CaGBC)

.1 LEED Canada 2009 for Design and Construction-2010, LEED Canada 2009 for Design and Construction Leadership in Energy and Environmental Design Green Building Rating System Reference Guide.

.4 National Fire Protection Association (NFPA)

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

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

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

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

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

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

.3 IAQ Guideline for Occupied Buildings Under Construction 2007.

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

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

1.2 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 and with manufacturer's written instructions.

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

.3 Storage and Handling Requirements:

.1 Store materials indoors 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 Management Plan related to Work of this Section and in accordance with Section 01 35 21.

Part 2 PRODUCTS

2.1 SEAL CLASSIFICATION

.1 Classification as follows:

Maximum Pressure Pa	SMACNA Seal Class
500	C
250	C
125	C
125	Unsealed

.2 Seal classification:

.1 Class C: transverse joints and connections made air tight with gaskets, sealant, tape or combination thereof. Longitudinal seams unsealed.

.2 Unsealed seams and joints.

2.2 SEALANT

.1 Sustainability Characteristics:

.1 Adhesives and sealants: in accordance with Section 07 92 00.

.2 Adhesives and sealants: VOC limit 70 g/L maximum to SCAQMD Rule 1168 GS-36.

.2 Sealant: oil resistant, polymer type flame resistant duct sealant. Temperature range of minus 30 degrees C to plus 93 degrees C.

2.3 TAPE

.1 Tape: polyvinyl treated, open weave fiberglass tape, 50 mm wide.

2.4 DUCT LEAKAGE

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

2.5 FITTINGS

.1 Fabrication: to SMACNA.

.2 Radiused elbows.

.1 Rectangular: Centreline radius: 1.0 times width of duct.

.2 Round: Centreline radius: 1.0 times diameter.

.3 Mitred elbows, rectangular:

.1 To 400 mm: with single thickness turning vanes.

.2 Over 400 mm: with double thickness turning vanes.

.4 Branches:

.1 Rectangular main and branch: 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.

.4 Main duct branches: with splitter damper.

.5 Transitions:

.1 Diverging: 20 degrees maximum included angle.

.2 Converging: 30 degrees maximum included angle.

.6 Offsets:

.1 Short radiused elbows.

2.6 FIRE STOPPING

.1 Retaining angles around duct, on both sides of fire separation in accordance with Section 07 84 00.

.2 Fire stopping material and installation must not distort duct.

2.7 GALVANIZED STEEL

.1 Lock forming quality: to ASTM A653/A653M, Z90 zinc coating, minimum 30% recycled content.

.2 Thickness, fabrication and reinforcement: to SMACNA.

.3 Joints: to SMACNA

2.8 STAINLESS STEEL

.1 To ASTM A480/A480M, Type 304, minimum 75% recycled content.

.2 Finish: No. 4

.3 Thickness, fabrication and reinforcement: to SMACNA.

.4 Joints: to SMACNA.

2.9 HANGERS AND SUPPORTS

.1 Hangers and Supports: in accordance with Section 23 05 29.

.1 Strap hangers: of same material as duct but next sheet metal thickness heavier than duct.

.1 Maximum size duct supported by strap hanger: 500.

.2 Hanger configuration: to SMACNA.

.3 Hangers: galvanized steel angle with black steel rods to following table:

Duct Size (mm)	Angle Size (mm)	Rod Size (mm)

up to 750	25 x 25 x 3	6
751 to 1050	40 x 40 x 3	6
1051 to 1500	40 x 40 x 3	10
1501 to 2100	50 x 50 x 3	10
2101 to 2400	50 x 50 x 5	10
2401 and over	50 x 50 x 6	10

.2 Upper hanger attachments:

.1 For concrete: manufactured concrete inserts.

.2 For steel joist: manufactured joist clamp.

.3 For steel beams: manufactured beam clamps:

Part 3 EXECUTION

.1 Do work in accordance with NFPA 90A, NFPA 90B, SMACNA and as indicated on drawings.

.2 Do not break continuity of insulation vapour barrier with hangers or rods.

.1 Insulate strap hangers 100 mm beyond insulated duct.

.3 Support risers in accordance with SMACNA.

.4 Install breakaway joints in ductwork on sides of fire separation.

.5 Manufacture duct in lengths and diameter to accommodate installation of acoustic duct lining where acoustic lining is indicated.

3.2 HANGERS

.1 Strap hangers: install in accordance with SMACNA.

.2 Angle hangers: complete with locking nuts and washers.

.3 Hanger spacing: in accordance with as follows:

Duct Size (mm)	Spacing (mm)
to 1500	3000
1501 and over	2500

3.3 SEALING AND TAPING

.1 Apply sealant to outside of joint to manufacturer's recommendations.

.2 Bed tape in sealant and recoat with minimum of one coat of sealant to manufacturers recommendations.

3.4 LEAKAGE TESTS

.1 Refer to Section 23 05 94.

.2 In accordance with SMACNA HVAC Duct Leakage Test Manual.

.3 Do 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 20 m long with not less than three branch takeoffs and one 90 degrees elbows.

.7 Complete test before performance insulation or concealment Work.

END OF SECTION

Part 1 GENERAL

1.1 REFERENCES

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

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

1.2 PRODUCT DATA

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

.2 Indicate the following:

.1 Flexible connections.

.2 Duct access doors.

.3 Turning vanes.

.4 Instrument test ports.

1.3 CERTIFICATION OF RATINGS

.1 Catalogue or published ratings to be those obtained from tests carried out by manufacturer or independent testing agency signifying adherence to codes and standards.

1.4 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 74 20.

.2 Collect and separate plastic, paper packaging and corrugated cardboard in accordance with Waste Management Plan

.3 Fold up metal banding, flatten and place in designated area for recycling.

Part 2 PRODUCTS

2.1 GENERAL

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

2.2 FLEXIBLE CONNECTIONS

.1 Frame: galvanized sheet metal frame 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°C to plus 90°C, density of 1.3 kg/m².

2.3 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.

2.4 TURNING VANES

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

2.5 INSTRUMENT TEST

.1 1.6 mm thick steel zinc plated after manufacture.

.2 Cam lock handles with neoprene expansion plug and handle chain.

.3 28 mm minimum inside diameter. Length to suit insulation thickness.

.4 Neoprene mounting gasket.

2.6 SPIN-IN COLLARS

.1 Conical galvanized sheet metal spin-in collars with lockable butterfly damper.

.2 Sheet metal thickness to co-responding round duct standards.

Part 3 EXECUTION

3.1 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:

.1 600 x 600 mm for person size entry.
.2 200 x 200 mm for servicing entry.
.3 150 x 200 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 Elsewhere as indicated.

.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.

.2 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.

.3 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.

END OF SECTION

Part 1 GENERAL

1.1 REFERENCES

.1 Canada Green Building Council (CaGBC)

.1 LEED Canada 2009 for Design and Construction-2010, LEED Canada 2009 for Design and Construction Leadership in Energy and Environmental Design Green Building Rating System Reference Guide.

.2 Sheet Metal and Air Conditioning National Association (SMACNA)

.1 SMACNA HVAC Duct Construction Standards, Metal and Flexible-2013.

1.2 PRODUCT DATA

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

1.3 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 74 20, and with the Waste Reduction Workplan.

.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 GENERAL

.1 Manufacture to SMACNA standards.

2.2 SPLITTER DAMPERS

.1 Of same material as duct but one sheet metal thickness heavier, with appropriate stiffening.

.2 Single thickness construction.

.3 Control rod with locking device and position indicator.

.4 Rod configuration to prevent end from entering duct.

.5 Pivot: piano hinge.

.6 Folded leading edge.

2.3 SINGLE BLADE DAMPERS

.1 Of same material as duct, but one sheet metal thickness heavier. V-groove stiffened.

.2 Size and configuration to recommendations of SMACNA, except maximum height 100 mm indicated.

.3 Locking quadrant with shaft extension to accommodate insulation thickness.

.4 Inside and outside nylon end bearings.

.5 Channel frame of same material as adjacent duct, complete with angle stop.

2.4 MULTI-BLADED DAMPERS

.1 Factory manufactured of material compatible with duct.

.2 Opposed blade: configuration, metal thickness and construction to recommendations of SMACNA.

.3 Maximum blade height: 100 mm.

.4 Bearings: self-lubricating nylon.

.5 Linkage: shaft extension with locking quadrant.

.6 Channel frame of same material as adjacent duct, complete with angle stop.

Part 3 EXECUTION

3.1 INSTALLATION

.1 Install where indicated.

.2 Install in accordance with recommendations of SMACNA and in accordance with manufacturer's instructions.

.3 For supply, return and exhaust systems, locate balancing dampers in each branch duct.

.4 Runouts to registers and diffusers: install single blade damper located as close as possible to main ducts.

.5 All dampers to be vibration free.

.6 Ensure damper operators are observable and accessible.

END OF SECTION

Part 1 GENERAL

1.1 REFERENCES

.1 ASTM International

.1 ASTM A653/A653M-13, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by Hot-Dip Process.

.2 Canada Green Building Council (CaGBC)

.1 LEED Canada 2009 for Design and Construction-2010, LEED Canada 2009 for Design and Construction Leadership in Energy and Environmental Design Green Building Rating System Reference Guide.

1.2 PRODUCT DATA

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

1.3 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 74 20, and with the Waste Reduction Workplan.

.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 MULTI-LEAF DAMPERS

.1 Opposed for mixing air or parallel blade type for directional flow.

.2 Extruded aluminum, interlocking blades, complete with extruded vinyl seals, spring stainless steel side seals, extruded aluminum frame.

.3 Pressure fit self-lubricated bronze bearings.

.4 Linkage: plated steel tie rods, brass pivots and plated steel brackets, complete with plated steel control rod.

.5 Operator: to Section 25.

.6 Performance:

.1 Leakage: in closed position less than 2% of rated air flow at 250 Pa differential across damper.

.7 Insulated aluminum dampers:

.1 Frames: insulated with extruded polystyrene foam with RSI 0.88.

.2 Blades: constructed from aluminum extrusions with internal hollows insulated with polyurethane or polystyrene foam, RSI 0.88.

2.2 BACK DRAFT DAMPERS

.1 Automatic gravity operated, multi leaf, aluminum construction with nylon bearings, spring assisted.

Part 3 EXECUTION

3.1 INSTALLATION

.1 Install where indicated.

.2 Install in accordance with recommendations of SMACNA and in accordance with manufacturer's instructions.

.3 For supply, return and exhaust systems, locate balancing dampers in each branch duct.

.4 Runouts to registers and diffusers: install single blade damper located as close as possible to main ducts.

.5 All dampers to be vibration free.

.6 Ensure damper operators are observable and accessible.

END OF SECTION

Part 1 GENERAL

1.1 REFERENCES

.1 Canada Green Building Council (CaGBC)

.1 LEED Canada 2009 for Design and Construction-2010, LEED Canada 2009 for Design and Construction Leadership in Energy and Environmental Design Green Building Rating System Reference Guide.

.2 National Fire Protection Association (NFPA)

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

.3 Underwriters Laboratories of Canada (ULC)

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

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

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

1.2 PRODUCT DATA

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

.2 Indicate the following:

.1 Fire dampers.

.2 Smoke dampers.

.3 Fire stop flaps.

.4 Operators.

.5 Fusible links.

.6 Design details of break-away joints.

1.3 CLOSEOUT SUBMITTALS

.1 Provide maintenance data for incorporation into manual specified in Section 01 78 00.

1.4 EXTRA MATERIALS

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

.2 Provide following:

.1 6 fusible links of each type.

1.5 CERTIFICATION OF RATINGS

.1 Catalogue or published ratings shall be those obtained from tests carried out by manufacturer or those ordered by him from independent testing agency signifying adherence to codes and standards.

1.6 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 74 20, and with the Waste Reduction Workplan.

.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 FIRE DAMPERS

.1 Fire dampers: arrangement Type B or C, and bear label of ULC, meet requirements of Fire Commissioner of Canada (FCC) and NFPA 90A. Fire damper assemblies to be 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.

.3 Top hinged: offset single damper, round or square; multi-blade hinged 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 installed as per manufacture’s listing.

2.2 FIRE STOP FLAPS

.1 To be ULC listed and labelled and fire tested in accordance with CAN/ULC-S112.2.

.2 Construct of minimum 1.5 mm thick sheet steel with 1.6 mm thick non-asbestos ULC listed insulation and corrosion-resistant pins and hinges.

.3 Flaps to be held open with fusible link conforming to ULC-S505 and close at 74°C.

Part 3 EXECUTION

3.1 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.

.5 Coordinate with installer of firestopping.

.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 REFERENCES

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

.2 Canada Green Building Council (CaGBC)

.1 LEED Canada 2009 for Design and Construction-2010, LEED Canada 2009 for Design and Construction Leadership in Energy and Environmental Design Green Building Rating System Reference Guide.

.3 National Fire Protection Association (NFPA)

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

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

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

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

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

.5 Underwriters' Laboratories (UL)

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

.6 Underwriters' Laboratories of Canada (ULC)

.1 CAN/ULC-S110-2007, Standard Methods of Tests for Air Ducts.

1.2 PRODUCT DATA

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

.2 Indicate the following:

.1 Thermal properties.

.2 Friction loss.

.3 Acoustical loss.

.4 Leakage.

.5 Fire rating.

1.3 CERTIFICATION OF RATINGS

.1 Catalogue or published ratings to be those obtained from tests carried out by manufacturer or independent testing agency signifying adherence to codes and standards.

1.4 SAMPLES

.1 Submit samples with product data of different types of flexible duct being used in accordance with Section 01 33 00.

1.5 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 74 20.

.2 Collect and separate plastic, paper packaging and corrugated cardboard in accordance with Waste Management Plan.

.3 Fold up metal banding, flatten and place in designated area for recycling.

Part 2 PRODUCTS

2.1 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 NON-METALLIC - INSULATED

.1 Type 4: non-collapsible, coated aluminum foil/mylar 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.

Part 3 EXECUTION

3.1 DUCT INSTALLATION

.1 Install in accordance with: SMACNA.

END OF SECTION

Part 1 GENERAL

1.1 REFERENCES

.1 ASTM International

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

.2 ASTM C916-85(2007), Standard Specification for Adhesives for Duct Thermal Insulation.

.3 ASTM C1071-12, Standard specification for Fibrous Glass Duct Lining Insulation (Thermal and Sound Absorbing Material).

.4 ASTM C1338-14, Standard Test Method for Determining Fungi Resistance of Insulation Materials and Facings.

.5 ASTM G21-13, Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi.

.2 Canada Green Building Council (CaGBC)

.1 LEED Canada 2009 for Design and Construction-2010, LEED Canada 2009 for Design and Construction Leadership in Energy and Environmental Design Green Building Rating System Reference Guide.

.3 National Fire Protection Association (NFPA)

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

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

.4 North American Insulation Manufacturers Association (NAIMA)

.1 NAIMA AH116-2002, Fibrous Glass Duct Construction Standards.

.5 Sheet Metal and Air Conditioning Contractor's National Association (SMACNA)

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

.2 SMACNA IAQ Guideline for Occupied Buildings Under Construction-2007.

.6 Underwriter's Laboratories of Canada (ULC)

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

1.2 PRODUCT DATA

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

1.3 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 74 20.

.2 Collect and separate plastic, paper packaging and corrugated cardboard in accordance with Waste Management Plan

Part 2 PRODUCTS

2.1 DUCT LINER

.1 General:

.1 Fibrous glass duct liner: air stream side faced with 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.

.2 Rigid:

.1 Use on flat surfaces.

.2 25 mm thick, to CGSB 51-GP-10M, fibrous glass rigid board duct liner.

.3 Density: 36 kg/m³ minimum.

.4 Thermal resistance to be minimum 0.76 m².°C/W for 25 mm thickness when tested in accordance with ASTM C177, at 24°C mean temperature.

.3 Flexible:

.1 Use on round or oval surfaces.

.2 25 mm thick, to CGSB-51-GP-11M, fibrous glass blanket duct liner.

.3 Density: 24 kg/m³ minimum.

.4 Thermal resistance to be minimum 0.74 m².°C/W for 25 mm thickness when tested in accordance with ASTM C177, at 24°C mean temperature.

2.2 ADHESIVE

.1 Meet requirements of NFPA 90A and NFPA 90B.

.2 Flame spread rating shall not exceed 25. Smoke development rating shall not exceed 50. Temperature range minus 29°C to plus 93°C.

2.3 FASTENERS

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

2.4 JOINT TAPE

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

2.5 SEALER

.1 Meet requirements of NFPA 90A and NFPA 90B.

.2 Flame spread rating shall not exceed 25. Smoke development rating shall not exceed 50. Temperature range minus 68°C to plus 93°C.

Part 3 EXECUTION

3.1 GENERAL

.1 Do work in accordance with recommendations of SMACNA duct liner standards as indicated in SMACNA HVAC Duct Construction Standards, Metal and Flexible, except as specified otherwise.

.2 Line inside of ducts where indicated.

.3 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.

.2 In addition to adhesive, install weld pins not less than 2 rows per surface and not more than 425 mm on centres.

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.

.3 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 SECTIONS

.1 Section 23 05 13 - Common Motor Requirements for HVAC Equipment.

.2 Section 23 05 48 - Vibration and Seismic Controls for HVAC Piping and Equipment.

.3 Section 23 05 53.01 – Mechanical Identification

.4 Section 23 33 00 - Air Duct Accessories.

1.2 REFERENCES

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

.1 ANSI/AMCA Standard 99-2010, Standards Handbook.

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

.3 ANSI/AMCA Standard 300-2008, Reverberant Room Method for Sound Testing of Fans.

.4 ANSI/AMCA Standard 301-1990, Methods for Calculating Fan Sound Ratings from Laboratory Test Data.

.2 Canada Green Building Council (CaGBC)

.1 LEED Canada 2009 for Design and Construction-2010, LEED Canada 2009 for Design and Construction Leadership in Energy and Environmental Design Green Building Rating System Reference Guide.

.3 The Master Painters Institute (MPI)

.1 Architectural Painting Specification Manual - current edition.

.1 MPI #18, Primer, Zinc Rich, Organic.

1.3 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data in accordance with Section 01 33 00.

.2 Provide :

.1 Fan performance curves showing point of operation, kW, and efficiency.

.2 Sound rating data at point of operation.

.3 Indicate:

.1 Motors, sheaves, bearings, shaft details.

.2 Supplied accessories.

1.4 CLOSEOUT SUBMITTALS

.1 Provide operation and maintenance data for incorporation into manual specified in Section 01 78 00.

1.5 EXTRA MATERIALS

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

.1 Spare parts to include:

.1 Matched sets of belts.

.2 Furnish list of individual manufacturer's recommended spare parts for equipment such as bearings and seals, and addresses of suppliers, together with list of specialized tools necessary for adjusting, repairing or replacing, for placement into operating manual.

1.6 MANUFACTURED ITEMS

.1 Catalogued or published ratings shall be those obtained from tests carried out by manufacturer or those ordered by him from independent testing agency signifying adherence to codes and standards in force.

Part 2 PRODUCTS

2.1 SYSTEM DESCRIPTION

.1 Performance Requirements:

.1 Catalogued or published ratings for manufactured items: obtained from tests carried out by manufacturer or those ordered by manufacturer from independent testing agency signifying adherence to codes and standards in force.

.2 Capacity: flow rate, external static pressure, bhp, efficiency, revolutions per minute, power, model, size, sound power data and as indicated on schedule.

.3 Fans: statically and dynamically balanced, constructed in conformity with ANSI/AMCA Standard 99.

.4 Sound ratings: comply with ANSI/AMCA Standard 301, tested to ANSI/AMCA Standard 300. Supply unit with ANSI/AMCA certified sound rating seal.

.5 Performance ratings: based on tests performed in accordance with ANSI/AMCA Standard 210. Supply unit with ANSI/AMCA certified rating seal, except for propeller fans smaller than 300 mm diameter.

2.2 FANS GENERAL

.1 Motors:

.1 In accordance with Section 23 05 13 ·supplemented as specified herein.

.2 For use with variable speed controllers.

.2 Accessories and hardware: matched sets of V-belt drives, adjustable slide rail motor bases, belt guards, coupling guards fan safety screens as indicated and as specified in Section 23 05 13, inlet or outlet dampers as indicated.

.3 Factory primed before assembly in colour standard to manufacturer.

.4 Scroll casing drains: as indicated.

.5 Bearing lubrication systems plus extension lubrication tubes where bearings are not easily accessible.

.6 Vibration isolation: to Section 23 05 48.

.7 Flexible connections: to Section 23 33 00.

2.3 INLINE CENTRIFUGAL FANS

.1 .1 Fan wheels:

.2 Welded aluminum construction.

.3 Backward inclined blades, as indicated.

.4 Complete with wheel cone matched to inlet cone.

.5 Fans to be direct drive.

.2 Housings:

.1 Volute with inlet cones: aluminum, for smaller wheels, braced, and with welded supports.

.2 Square heavy gauge galvanized steel or aluminum construction. Housing to include square inlet and outlet collars

.3 Two removable access panels or sufficient size to access and service all components.

2.4 CABINET FANS - GENERAL PURPOSE

.1 Fan characteristics and construction: as centrifugal fans.

.2 Cabinet hung single or multiple wheel with DWDI centrifugal fans in factory fabricated casing complete with vibration isolators and seismic control measures, motor, variable speed V-belt drive and guard casing.

Part 3 EXECUTION

3.1 FAN INSTALLATION

.1 Install fans as indicated, complete with resilient mountings specified in Section 23 05 48, flexible electrical leads and flexible connections in accordance with Section 23 33 00.

.2 Provide sheaves and belts required for final air balance.

.3 Bearings and extension tubes to be easily accessible.

.4 Access doors and access panels to be easily accessible.

END OF SECTION

Part 1 GENERAL

1.1 RELATED SECTIONS

.1 Section 25 30 01 – Building Controllers

.2 Section 25 90 01 – Site Requirements, Applications, and Systems Sequences of Operation

1.2 REFERENCES

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

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

.2 Canada Green Building Council (CaGBC)

.1 LEED Canada 2009 for Design and Construction-2010, LEED Canada 2009 for Design and Construction Leadership in Energy and Environmental Design Green Building Rating System Reference Guide.

.3 International Organization of Standardization (ISO)

.1 ISO 3741-2010, Acoustics-Determination of Sound Power Levels of Noise Sources Using Sound Pressure - Precision Methods for Reverberation Rooms.

.4 National Fire Protection Association (NFPA)

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

.5 Underwriter's Laboratories (UL)

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

1.3 SHOP DRAWINGS AND PRODUCT DATA

.1 Provide required information in accordance with Section 01 30 00 – Administrative Requirements.

.2 Submit schedule of all units supplied indicating size, maximum and minimum settings, and performance with respect to inlet static pressure; use identification marks to match those indicated on the Drawings.

.3 Submit shop drawings stamped and signed by professional engineer registered or licensed in the province of the Work indicating, but not limited to, the following:

.1 Capacity, pressure drop, noise rating and leakage.

.2 Discharge and radiated sound power level schedules for each of second through sixth octave bands with inlet pressures of 250 Pa to 1000 Pa at specified maximum airflow.

.3 Manufacturer's printed product literature, specifications and datasheets indicating units proposed for use on Project, and any modifications required by Project including:

.1 Product Data Sheets

.2 Equipment Schedule Sheets containing Room#, Tag#, Min/Max flows, Catalog# and other configuration data as required to provide a fully engineered LACS.

.3 Installation Instructions

.4 Project-specific Wiring Diagrams

.5 Points Lists

.4 Include schedule of all units supplied indicating size, maximum and minimum settings and performance with respect to inlet static pressure.

.5 Include discharge and radiated sound power level schedules with shop drawings, for each of second through sixth octave bands and inlet pressures of 250 Pa to 1000 Pa at specified maximum airflow.

.6 Submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

1.4 CLOSEOUT SUBMITTALS

.1 Provide maintenance data for incorporation into manual specified in Section 01 78 00.

1.5 CERTIFICATION

.1 Catalogued or published ratings shall be those obtained from tests carried out by manufacturer or those ordered by him from certified ADC (Air Diffusion Council) testing agency signifying adherence to codes and standards.

1.6 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 74 20.

1.7 EXTRA MATERIALS

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

.2 Furnish list of individual manufacturer's recommended spare parts for equipment such as bearings and seals, and addresses of suppliers, together with list of specialized tools necessary for adjusting, repairing or replacing, for placement into operating manual.

Part 2 PRODUCTS

2.1 SYSTEM DESCRIPTION

.1 Performance Requirements

1.1.1 Differential static pressure of the unit shall not exceed 30 Pa with inlet velocities of 10 m/s or less; Static pressure across the assembly with a 10 m/s or less inlet velocity shall not exceed 110 Pa with an attenuator but with no other accessories.

1.1.2 Unit operation shall be independent of inlet static pressure. Flow (within adjustable range) shall not vary by more than 5% for inlet static pressures between minimum specified and 1500 Pa.

1.1.3 Volume regulators shall be capable of maintaining minimum set flows within 5% at inlet velocities down to 3 m/s.

1.1.4 Unit air volumes shall be adjustable as follows:

1.1.4.1 Maximum - down to 40% unit capacity.
1.1.4.2 Minimum - between 70% and 25% of unit capacity or fully closed.

1.1.5 A 90° elbow immediately before the inlet shall not alter the maximum or minimum factory setting by more than 10%.

1.1.6 Unit shall be field adjustable to within 5% of actual flow. One set of any special tools or instruments required to field adjust units shall be provided to the owner.

1.1.7 Attenuator section of unit shall be factory lined with fiberglass cloth.

2.2 MANUFACTURED UNITS

.1 Terminal units of the same type to be product of one manufacturer.

.2 Refer to Air Terminal Unit Schedule on Drawings for specifications of terminal units.

2.3 VARIABLE VOLUME BOXES

.1 Pressure independent factory reset to airflow between zero and maximum air volume.

.2 Sizes, capacities, differential pressures and sound ratings: as indicated on schedules.

.3 Differential pressure not to exceed 25 Pa at inlet air velocity of 10 m/s.

.4 Sound ratings of assembly not to exceed 25 NC at 375 Pa.

.5 Complete with:

.1 Operator and controller.
.2 3ft Sound attenuator.
.3 Multiport outlet adapter: as indicated.

.6 Casing: constructed of 0.607 mm thick galvanized steel, internally lined with 13 mm, 0.7 kg density fibrous glass, in accordance with UL181 and ANSI/NFPA 90A. Mount control components inside protective metal shroud.

.7 Damper: galvanized steel with peripheral gasket and self lubricating bearings. Air leakage past closed damper not to exceed 2% of nominal rating at 750 Pa inlet static pressure, in accordance with Air Diffusion Council test procedure.

2.4 DAMPER OPERATORS

.1 Terminal unit damper operators shall be provided by the controls trade and factory installed by the terminal unit manufacturer.

Part 3 EXECUTION

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for air terminal units installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Departmental Representative.

.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 INSTALLATION

.1 Install in accordance with manufacturer's written instructions.

.2 Arrange for suitable ceiling access to units; provide access doors or locate above easily removable ceiling components.

.3 The BAS contractor shall install any required routers and repeaters in an accessible location in or around the designated critical or non-critical room.

.4 The BAS shall install an appropriately sized and fused 24 Vac transformer suitable for NEC Class II wiring.

.5 The BAS contractor shall supply all required reheat coil and radiation control valves for installation by the mechanical trade. Actuators shall be either proportional or floating point control. Floating point for reheat coil control valve only.

.6 All cable and conduit shall be furnished and installed by the BAS contractor. The BAS contractor shall terminate and connect all cables as required. The BAS shall utilize cables specifically recommended by the airflow controls supplier.

.7 The mechanical contractor shall install all airflow control devices in the ductwork and connect all airflow control valve linkages.

.8 The mechanical contractor shall provide and install any sound attenuating devices not provided by the airflow controls supplier.

.9 The mechanical contractor shall provide and install all reheat coils and duct transitions.

.10 The mechanical contractor shall install all reheat and radiation control valves.

.11 The mechanical contractor shall provide and install insulation as required.

.12 Each pressurization zone shall have either a dedicated, single-phase primary circuit or a secondary circuit disconnect.

3.3 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11.

.3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 20.

.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.4 SCHEDULE

.1 Refer to Air Terminal Units Schedule on Drawings.

END OF SECTION

Part 1 GENERAL

1.1 REFERENCES

.1 Canada Green Building Council (CaGBC)

.1 LEED Canada 2009 for Design and Construction-2010, LEED Canada 2009 for Design and Construction Leadership in Energy and Environmental Design Green Building Rating System Reference Guide.

1.2 PRODUCT DATA

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

.2 Indicate the following:

.1 Capacity.

.2 Throw and terminal velocity.

.3 Noise criteria.

.4 Pressure drop.

.5 Neck velocity.

.6 Size.

.7 Finish and Colour.

1.3 CERTIFICATIONS

.1 Catalogued or published ratings shall be those obtained from tests carried out by manufacturer or those ordered by him from independent testing agency signifying adherence to codes and standards.

1.4 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 74 20.

.2 Remove from site and dispose of packaging materials at appropriate recycling facilities.

.3 Dispose of corrugated cardboard, polystyrene, plastic, packaging material in appropriate on-site bin for recycling in accordance with site waste management program.

1.5 EXTRA MATERIALS

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

.2 Include:

.1 Keys for volume control adjustment.

.2 Keys for air flow pattern adjustment.

Part 2 PRODUCTS

2.1 GENERAL

.1 To meet capacity, pressure drop, terminal velocity, throw, noise level, neck velocity as indicated.

.2 Frames:

.1 Full perimeter gaskets.

.2 Plaster frames where set into plaster or gypsum board at all locations and as specified.

.3 Concealed fasteners.

.3 Concealed manual volume control damper operators where indicated.

.4 Colour: as indicated on mechanical schedules.

2.2 MANUFACTURED UNITS

.1 Grilles, registers and diffusers of same generic type to be product of one manufacturer.

2.3 SUPPLY GRILLES AND REGISTERS

.1 General: with opposed blade dampers.

2.4 RETURN AND EXHAUST GRILLES AND REGISTERS

.1 Type as indicated on mechanical schedules.

2.5 DIFFUSERS

.1 Type as indicated on mechanical schedules.

2.6 LINEAR GRILLES

.1 Type as indicated on mechanical schedules.

Part 3 EXECUTION

3.1 INSTALLATION

.1 Install in accordance with manufacturers instructions.

.2 Install with flat head screws in countersunk holes where fastenings are visible.

END OF SECTION

Part 1 GENERAL

1.1 REFERENCES

.1 ASTM International

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

.2 Canada Green Building Council (CaGBC)

.1 LEED Canada 2009 for Design and Construction-2010, LEED Canada 2009 for Design and Construction Leadership in Energy and Environmental Design Green Building Rating System Reference Guide.

.3 National Fire Protection Association (NFPA)

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

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

.5 Society of Automotive Engineers (SAE)

1.2 SYSTEM DESCRIPTION

.1 Performance Requirements:

.2 Catalogued or published ratings for manufactured items: obtained from tests carried out by manufacturer or those ordered by manufacturer from independent testing agency signifying adherence to codes and standards.

1.3 SUBMITTALS

.1 Product Data:

.1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00. Include product characteristics, performance criteria, and limitations.

.2 Submit two copies of Workplace Hazardous Materials Information System (WHMIS) Material Safety Data Sheets (MSDS).

.1 Indicate following:

.1 Pressure drop.

.2 Face area.

.3 Size and finish.

.4 Mounting arrangement.

.2 Quality assurance submittals: submit following in accordance with Section 01 33 00.

.1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.3 Test Reports:

.1 Submit certified data from independent laboratory substantiating acoustic and aerodynamic performance to ASTM E90.

1.4 QUALITY ASSURANCE

.1 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 35 30.

1.5 DELIVERY, STORAGE, AND HANDLING

.1 Packing, shipping, handling and unloading:

.2 Deliver, store and handle in accordance with Section 01 61 00.

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

.2 Waste Management and Disposal:

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

Part 2 PRODUCTS

2.1 FIXED LOUVRES – ALUMINUM – LVR-1

.1 Construction: welded with exposed joints ground flush and smooth.

.2 Material: extruded aluminum alloy AA 6063-T5.

.3 Blade: 6063-T5 extruded aluminum, 2mm minimum thickness, with reinforced boxes. K-style. Maximum blade length of 1500 mm. Space blades 150mm on centre.

.4 Frame, head, sill and jamb: 100 mm deep one piece extruded aluminum, minimum 2 mm thick with caulking slot integral to unit.

.5 Mullions: Concealed type allowing continuous line appearance.

.6 Fastenings: stainless steel SAE-194-8F with SAE-194-SFB nuts and resilient neoprene washers between aluminum and head of bolt, or between nut, ss washer and aluminum body.

.7 Screen: 19 mm mesh, 2 mm diameter wire aluminum birdscreen on inside face of louvres in formed U-frame.

.8 Finish: Power coat matte finish. Colour: Custom. Mechanical contractor to request existing wall from Departmental representative for colour matching.

2.2 FIXED LOUVRES – ALUMINUM – LVR-2

.1 Construction: welded with exposed joints ground flush and smooth.

.2 Material: extruded aluminum alloy AA 6063-T5.

.3 Blade: 6063-T5 extruded aluminum, 2mm minimum thickness, with reinforced boxes. K-style. Maximum blade length of 1500 mm. Space blades 150mm on centre.

.4 Frame, head, sill and jamb: 150 mm deep one piece extruded aluminum, minimum 2 mm thick with caulking slot integral to unit.

.5 Mullions: Concealed type allowing continuous line appearance.

.6 Fastenings: stainless steel SAE-194-8F with SAE-194-SFB nuts and resilient neoprene washers between aluminum and head of bolt, or between nut, ss washer and aluminum body.

.7 Screen: 19 mm mesh, 2 mm diameter wire aluminum birdscreen on inside face of louvres in formed U-frame.

.8 Finish: Power coat matte finish. Colour: Custom. Mechanical contractor to request Aluminum Composite Material wall sample from Departmental representative for colour matching.

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 In accordance with manufacturer's and SMACNA recommendations.

.2 Reinforce and brace as indicated.

.3 Anchor securely into opening. Seal with caulking to ensure weather tightness.

.4 Patch around openings made in existing structure. Repair existing siding and paint to match existing colour.

3.3 CLEANING

.1 Proceed in accordance with Section 01 74 11.

.2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 GENERAL

1.1 REFERENCES

.1 Canada Green Building Council (CaGBC)

.1 LEED Canada 2009 for Design and Construction-2010, LEED Canada 2009 for Design and Construction Leadership in Energy and Environmental Design Green Building Rating System Reference Guide.

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

.3 Underwriters' Laboratories of Canada (ULC)

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for an engineered chimney and stacks and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:

.1 Indicate following:

.1 Methods of sealing sections.

.2 Methods of expansion.

.3 Details of thimbles.

.4 Bases/Foundations.

.5 Supports.

.6 Guy details.

.7 Rain caps.

.8 Pressure drop calculation.

.4 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.5 Sustainable Design Submittals:

.1 LEED Canada submittals: in accordance with Section 01 35 21.

.2 Construction Waste Management:

.1 Submit project Waste Management Plan highlighting recycling and salvage requirements.

.2 Submit calculations on end-of-project recycling rates, salvage rates, and landfill rates demonstrating that 75% of construction wastes were recycled or salvaged.

1.3 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 and with manufacturer's written instructions.

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

.3 Storage and Handling Requirements:

.1 Store materials indoors 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 Management Plan related to Work of this Section and in accordance with Section 01 35 21.

.5 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding and packaging materials as specified in Construction Waste Management Plan in accordance with Section 01 74 20.

Part 2 PRODUCTS

2.1 BREECHINGS

.1 Shop fabricated 3.5mm thick stainless steel with sweep bends from boiler outlet to thimble or chimney as indicated.

2.2 FUELS: PRESSURE CHIMNEY AND BREECHING

.1 ULC labelled, 760 degrees C rated.

.2 Pre engineered Listed Special Vent or Listed, Factory Built Category IV type Chimney suitable for positive pressure & condensing application.

.3 Refer to drawings for routing.

2.3 ACCESSORIES

.1 Cleanouts: bolted, gasketted type, full size of breeching, as indicated.

.2 Barometric dampers: single acting, 70% of full size of breeching area.

.3 Hangers and supports: in accordance with recommendations SMACNA.

.4 Rain cap.

.5 Expansion sleeves with heat resistant caulking, held in place as indicated.

Part 3 EXECUTION

3.1 INSTALLATION - GENERAL

.1 Follow manufacturer's and SMACNA installation recommendations for shop fabricated components.

.2 Suspend breeching at 1.5 m centres and at each joint.

.3 Support chimneys at bottom, roof and intermediate levels as indicated.

.4 Install thimbles where penetrating roof, floor, ceiling and where breeching enters masonry chimney. Pack annular space with heat resistant caulking.

.5 Install flashings on chimneys penetrating roofs, as indicated.

.6 Install rain caps and cleanouts, as indicated.

3.2 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11.

.3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 20.

.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 American Boiler Manufacturers Association (ABMA)

.2 ASME

.1 ASME Boiler and Pressure Vessel Code (BPVC), Section VII-2013.

.3 Canada Green Building Council (CaGBC)

.1 LEED Canada 2009 for Design and Construction-2010, LEED Canada 2009 for Design and Construction Leadership in Energy and Environmental Design Green Building Rating System Reference Guide.

.4 CSA Group

.1 CAN1-3.1-77(R2011), Industrial and Commercial Gas-Fired Package Boilers.

.2 CSA B51-14, Boiler, Pressure Vessel, and Pressure Piping Code.

.3 CSA B139-09, Installation Code for Oil Burning Equipment.

.4 CSA B140.7-05(R2010), Oil Burning Equipment: Steam and Hot-Water Boilers.

.5 CSA B149.1-10, Natural Gas and Propane Installation Code.

.6 ANSI Z21.13-10/CSA 4.9-10, Gas-Fired Low-Pressure Steam and Hot Water Boilers.

.5 Electrical and Electronic Manufacturers Association of Canada (EEMAC)

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for heating boilers 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 Indicate on drawings:

.1 General arrangement showing terminal points, instrumentation test connections.

.2 Clearances for operation, maintenance, servicing, tube cleaning, tube replacement.

.3 Foundations with loadings, anchor bolt arrangements.

.4 Piping hook-ups.

.5 Equipment electrical drawings.

.6 Burners and controls.

.7 All miscellaneous equipment.

.8 Flame safety control system.

.9 Breeching and stack configuration.

.10 Stack emission continuous monitoring system to measure CO, O, NOx, SO, stack temperature and smoke density of flue gases.

.3 Engineering data to include:

.1 Boiler efficiency at 25%, 50%, 75%, 100%, of design capacity.

.2 Radiant heat loss at 100% design capacity.

.4 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.5 Sustainable Design Submittals:

.1 LEED Canada submittals: in accordance with Section 01 35 21.

.2 Construction Waste Management:

.1 Submit project Waste Management Plan highlighting recycling and salvage requirements.

.2 Submit calculations on end-of-project recycling rates, salvage rates, and landfill rates demonstrating that 75% of construction wastes were recycled or salvaged.

.3 Recycled Content:

.1 Submit listing of recycled content products used, including details of required percentages or recycled content materials and products, showing their costs and percentages of post-consumer and post-industrial content, and total cost of materials for project.

.4 Regional Materials: submit evidence that project incorporates required percentage 20% of regional materials and products, showing their cost, distance from project to furthest site of extraction or manufacture, and total cost of materials for project.

1.3 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00.

.2 Operation and Maintenance Data: submit operation and maintenance data for heating boilers for incorporation into manual.

1.4 QUALITY ASSURANCE

.1 Electrical Components, Devices and Accessories: Boilers must be listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

.2 I=B=R Performance Compliance: Condensing boilers must be rated in accordance with applicable federal testing methods and verified by AHRI as capable of achieving the energy efficiency and performance ratings as tested within prescribed tolerances.

.3 ASME Compliance: Condensing boilers must be constructed in accordance with ASME Boiler and Pressure Vessel Code, Section IV “Heating Boilers”.

.4 ASHRAE/IESNA 90.1 Compliance: Boilers shall have minimum efficiency according to "Gas and Oil Fired Boilers - Minimum Efficiency Requirements."

.5 DOE Compliance: Minimum efficiency shall comply with 10 CFR 430, Subpart B, Appendix N, "Uniform Test Method for Measuring the Energy Consumption of Furnaces and Boilers."

.6 UL Compliance: Boilers must be tested for compliance with UL 795, "Commercial-Industrial Gas Heating Equipment." Boilers shall be listed and labeled by a testing agency acceptable to authorities having jurisdiction.

.7 NOx Emission Standards: When installed and operated in accordance with manufacturer’s instructions, condensing boilers shall comply with NOx emissions of less than 20ppm, corrected to 3% oxygen at all firing rates. Certificate or report of compliance is to be supplied upon request.

.8 Comply with Provincial Regulations and identify units with appropriate CSA labelling.

.9 Provide factory tests to check construction, controls and operation of unit.

.10 Boiler shall be suitable for continuous low water temperatures as low as 21°C.

.11 Each boiler shall be CSA certified for at least 96% thermal efficiency and 98% combustion efficiency based on operating conditions specified for testing under ANSI Z21.13/CSA 4.9.

.12 The boiler manufacturer shall warrant each boiler, including boiler, trim, boiler control system, and all related components, accessories, and appurtenances against defects in workmanship and material for a period of twelve (12) months from date of start-up.

.1 The pressure vessel/heat exchanger shall carry a 10-year from shipment, non-prorated, limited warranty against any failure due to condensate corrosion, thermal stress, mechanical defects or workmanship.

.2 Manufacturer labeled control panels are conditionally warranted against failure for (2) two years from shipment.

.3 Heat exchanger and fuel burner shall be warranted for a period of five (5) years from date of start-up.

1.5 MAINTENANCE MATERIAL SUBMITTALS

.1 Extra materials:

.1 Submit maintenance materials in accordance with Section 01 78 00.

.1 Special tools for burners, access opening, handholes and Operation and Maintenance.

.2 Spare parts for 1 year of operation.

.3 Spare gaskets.

.4 Spare gauge glass inserts.

.5 Probes and sealants for electronic indication.

.6 Spare burner tips.

.7 Spare burner gun.

.8 Safety valve test gauge.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 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 Store and protect boiler and equipment from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

.4 Develop Construction Waste Management Plan related to Work of this Section and in accordance with Section 01 35 21.

.5 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding and packaging materials as specified in Construction Waste Management Plan in accordance with Section 01 74 20.

Part 2 PRODUCTS

2.1 GENERAL

.1 Manufacturers

.1 Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

.2 Manufacturers: Subject to compliance with requirements, provide products by one of the following:

.1 AERCO International

.2 Lochinvar Crest FB2500

.3 Viessmann Manufacturing Co. (US) Inc.

2.2 CONSTRUCTION

.1 Description: Boiler shall be dual fuel natural gas, fully condensing, fire tube design. Power burner shall have full modulation (the minimum firing rate shall not exceed 166,000 BTU/HR input. Boilers that have an input greater than 166,000 BTU/Hr at minimum fire will not be considered) and discharge into a positive pressure vent. Boiler efficiency shall increase with decreasing load (output), while maintaining setpoint. Boiler shall be factory-fabricated, factory-assembled and factory-tested, fire-tube condensing boiler with heat exchanger sealed pressure-tight, built on a steel base, including insulated jacket, flue-gas vent, combustion-air intake connections, water supply, return and condensate drain connections, and controlsBoiler shall be of a size to allow it be transported through a standard 36” wide door (with jambs removed) without dismantling any of the factory provided components.

.2 Heat Exchanger: The heat exchanger shall be constructed of 439 stainless steel fire tubes and tubesheets, with a one-pass combustion gas flow design. The fire tubes shall be 5/8” OD, with no less than 0.049” wall thickness. The upper and lower stainless steel tubesheet shall be no less than 0.25” thick. The pressure vessel/heat exchanger shall be welded construction. The heat exchanger shall be ASME stamped for a working pressure not less than 160 psig. Access to the tubesheets and heat exchanger shall be available by burner and exhaust manifold removal. Minimum access opening shall be no less than 10-inch diameter.

.3 Pressure Vessel: The pressure vessel shall have a maximum water volume of 58 gallons. The boiler water pressure drop shall not exceed 3 psig at 258 gpm. The boiler water connections shall be 4-inch flanged 150-pound, ANSI rated. The pressure vessel shall be constructed of SA53 carbon steel, with a 0.25-inch thick wall and 0.50-inch thick upper head. Inspection openings in the pressure vessel shall be in accordance with ASME Section IV pressure vessel code. The boiler shall be designed so that the thermal efficiency increases as the boiler firing rate decreases.

.4 Modulating Air/Fuel Valve and Burner: The boiler burner shall be capable of a 15-to-1 turndown ratio of the firing rate without loss of combustion efficiency or staging of gas valves. The burner shall produce less than 20 ppm of NOx corrected to 3% excess oxygen when firing on natural gas. The burner shall be metal-fiber mesh covering a stainless steel body with spark ignition and flame rectification. All burner material exposed to the combustion zone shall be of stainless steel construction. There shall be no moving parts within the burner itself. A modulating air/fuel valve shall meter the air and fuel input. The modulating motor must be linked to both the gas valve body and air valve body with a single linkage. The linkage shall not require any field adjustment. A variable frequency drive (VFD), controlled cast aluminum pre-mix blower shall be used to ensure the optimum mixing of air and fuel between the air/fuel valve and the burner.

.5 Dual Fuel Capability. The boiler shall include a combustion system with a dual fuel capability. The dual fuel unit shall be capable of operating on both Natural Gas and Propane. The boiler efficiency and turndown shall remain unchanged regardless of fuel source. The dual fuel system shall incorporate independent natural gas and propane gas trains, a fuel selector switch. This switching mechanism shall be such that it shall not be possible to flow both fuels simultaneously. The unit shall be calibrated to run on both fuel sources at start-up. No additional re-calibration shall be required when switching between fuel sources for a period of one year from the initial calibration.

.6 Minimum boiler efficiencies shall be as follows at a 20 degree delta:

EWT	100% Fire	50% Fire	7% Fire
160 °F	87%	87%	87%
140 °F	88%	88%	88%
120 °F	89%	90%	90.5%
100 °F	93.7%	95%	95%
80 °F	96%	98%	98.6%

.7 Exhaust Manifold: The exhaust manifold shall be of corrosion resistant cast aluminum or 316 stainless steel with an 8-inch diameter flue connection. The exhaust manifold shall have a collecting reservoir and a gravity drain for the elimination of condensation.

.8 Blower: The boiler shall include a variable-speed, DC centrifugal fan to operate during the burner firing sequence and pre-purge the combustion chamber.

.1 Motors: Blower motors shall comply with requirements specified in Division 23 Section "Common Motor Requirements for HVAC Equipment."

.2 Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require a motor to operate in the service factor range above 1.0.

.9 Ignition: Ignition shall be via spark ignition with 100 percent main-valve shutoff and electronic flame supervision.

.10 The boiler shall be designed such that the combustion air is drawn from the inside of the boiler enclosure, decoupling it from the combustion air supply and preheating the air to increase efficiency.

.11 Enclosure: The sheet metal enclosure shall be fully removable, allowing for easy access during servicing.

2.3 CONTROLS

.1 The boiler control system shall be segregated into three components: “C-More” Control Panel, Power Box and Input/Output Connection Box. The entire system shall be Underwriters Laboratories recognized.

.2 The control panel shall consist of six individual circuit boards using state-of-the-art surface-mount technology in a single enclosure. These circuit boards shall include:

- .1 A display board incorporating LED display to indicate temperature and a vacuum fluorescent display module for all message enunciation
- .2 A CPU board housing all control functions
- .3 An electric low-water cutoff board with test and manual reset functions
- .4 A power supply board
- .5 An ignition /stepper board incorporating flame safeguard control
- .6 A connector board
- .7 Each board shall be individually field replaceable.

.3 The combustion safeguard/flame monitoring system shall use spark ignition and a rectification-type flame sensor.

.4 The control panel shall be BACnet BTL certified.

.5 The controls shall annunciate boiler and sensor status and include extensive self-diagnostic capabilities that incorporate a minimum of eight separate status messages and 34 separate fault messages.

.6 The control panel shall incorporate three self-governing features designed to enhance operation in modes where it receives an external control signal by eliminating nuisance faults due to over-temperature, improper external signal or loss of external signal. These features include:

- .1 Setpoint High Limit: Setpoint high limit allows for a selectable maximum boiler outlet temperature and acts as temperature limiting governor. Setpoint limit is based on a PID function that automatically limits firing rate to maintain outlet temperature within a 0 to 10 degree selectable band from the desired maximum boiler outlet temperature.
- .2 Setpoint Low Limit: Allow for a selectable minimum operating temperature.
- .3 Failsafe Mode: Failsafe mode allows the boiler to switch its mode to operate from an internal setpoint if its external control signal is lost, rather than shut off. This is a selectable mode, enabling the control can to shut off the unit upon loss of external signal, if so desired.

.7 The boiler control system shall incorporate the following additional features for enhanced external system interface:

.1 System start temperature feature

.2 Pump delay timer

.3 Auxiliary start delay timer

.4 Auxiliary temperature sensor

.5 Analog output feature to enable simple monitoring of temperature setpoint, outlet temperature or fire rate

.6 Remote interlock circuit

.7 Delayed interlock circuit

.8 Fault relay for remote fault alarm

.8 Each boiler shall include an electric, single-seated combination safety shutoff valve/regulator with proof of closure switch in its gas train. Each boiler shall incorporate dual over-temperature protection with manual reset, in accordance with ASME Section IV and CSD-1.

.9 Each boiler shall have an oxygen monitoring system that will measure the oxygen content of the exhaust gases in real-time. Output of O2 information shall be displayed on the C-More control panel.

.10 Each boiler shall have integrated Boiler Sequencing Technology (BST), capable of multi-unit sequencing with lead-lag functionality and parallel operation. The system will incorporate the following capabilities:

.1 Efficiently sequence 2-to-8 units on the same system to meet load requirement.

.2 Integrated control and wiring for seamless installation of optional isolation valve. When valves are utilized, the system shall operate one motorized valve per unit as an element of load sequencing. Valves shall close with decreased load as units turn off, minimum of one must always stay open for recirculation.

.3 Automatically rotate lead/lag amongst the units on the chain and monitor run hours per unit and balance load in an effort to equalize unit run hours.

.4 Designated master control, used to display and adjust key system parameters.

.5 Automatic bump-less transfer of master function to next unit on the chain in case of designated master unit failure; master/slave status should be shown on the individual unit displays.

.6 Designated master control, used to display and adjust key system parameters.

2.4 ELECTRICAL POWER

.1 Single-Point Field Power Connection: Factory-installed and factory-wired switches, motor controllers, transformers and other electrical devices shall provide a single-point field power connection to the boiler.

2.5 VENTING

.1 The exhaust vent must be UL Listed for use with Category IV appliances and compatible with operating temperatures up to 230°F, condensing flue gas service. UL-listed vents of Al 29-4C stainless steel must be used with boilers.

.1 The minimum exhaust vent duct size for each boiler is eight-inch diameter.

.2 Combustion-Air Intake: Boilers shall be capable of drawing combustion air from the outdoors via a metal or PVC duct connected between the boiler and the outdoors.

.3 The minimum ducted combustion air duct size for each boiler is eight-inch diameter.

.4 Common vent and common combustion air must be an available option for boiler installation. Consult manufacturer for common vent and combustion air sizing.

.5 Follow guidelines specified in manufacturer's venting guide.

2.6 BOILER SAFETY AND TRIM DEVICES

.1 Boiler safety and trim devices shall be as follows:

.1 Safety relief valve shall be provided in compliance with the ASME code Section VIII release valve ships installed on the boiler and is set @ 150 #. The section IV relief valve can be ordered at different ratings up to 150 #.

.2 Water pressure/temperature gauge.

.3 Low Water/Flow cutoff.

.4 Manual reset high limit water temperature controller.

.5 Operating temperature control to control the sequential operation of the burner.

.6 High and Low Gas Pressure switches.

.7 Flame rod (rectification) system.

.8 Air pressure switches monitoring pre-mix combustion and flue gas pressure.

.9 Provide pressure switch monitoring in combustion air duct to assure boiler is not operational with a blocked intake

2.7 SOURCE QUALITY CONTROL

.1 Burner and Hydrostatic Test: Factory adjust burner to eliminate excess oxygen, carbon dioxide, oxides of nitrogen emissions and carbon monoxide in flue gas, and to achieve combustion efficiency. Perform hydrostatic testing.

.2 Test and inspect factory-assembled boilers, before shipping, according to ASME Boiler and Pressure Vessel Code.

.1 If boilers are not factory assembled and fire-tested, the local vendor is responsible for all field assembly and testing.

2.8 CARBON MONOXIDE (CO) MONITORING SYSTEM

.1 Honeywell/Vulcain Model E3SASCO surface mounted, Carbon Monoxide (CO) monitoring system installed as a standalone device and complete with the following:

.1 24 Vac nominal (17-27Vac) or 24 Vdc nominal (20-38 Vdc), 0.35A, power requirement.

.2 -40 to 50 degrees C (-40 to 122 degrees F) operating temperature

.3 Electrochemical cell Carbon Monoxide (CO) sensor type

.4 8 character, 2 line backlit LCD display

.5 General alarm output to BAS.

.6 Visual indicators:

.1 Green LED: Power

.2 Amber LED 1: Alarm/Fault

.3 Amber LED 2: Alarm/Fault

.7 Integral audible alarm: >85 dBA at 3m (10ft.)

.8 Accuracy: +/- 3% of full scale at 25 degrees C

.2 Sensor alarm levels to activate based on the following parameters. Audible Alarm shall be initiated at Second Alarm Setpoint:

TOXIC GASES	FIRST ALARM SETPOINT (TLV-TWA)	SECOND ALARM SETPOINT (TLV-STEL)	SENSOR LOCATION	RADIUS OF COVERAGE
Carbon Monoxide (CO)	25 ppm	100 ppm	3-5 ft. above the floor	50 feet

Part 3 EXECUTION

3.1 HOUSEKEEPING PADS

1.1.1 Mount boilers on 100 mm housekeeping pads.

3.2 VENT INSTALLATION

1.1.2 Install vents, complete with accessories and appurtenances, in accordance with CAN/CSA B149.1, Building Code, Manitoba Gas Notices – Fourth Edition-2010, manufacturer's instructions.

1.1.3 Provide the appropriate flue and stack for gas fired equipment. Coordinate the supply of the equipment with the manufacturer of gas fired equipment to ensure that the appropriate flue or stack is provided. It is the contractor's responsibility to provide the appropriate flue or stack for the intended application and in compliance with all codes. Failure to provide the appropriate flue and stack shall result in the removal of the flue and stack and replacement with appropriate flue and stack at no extra cost to the contract.

1.1.4 Do not penetrate flue gas chamber of vent with screws or mechanical fasteners.

1.1.5 Install vent with positive slope upward from appliance.

1.1.6 Provide barometric damper as required by successful appliance manufacturer and system design.

1.1.7 Support horizontal flue sections in place by means of steel band hoops conforming to the flue diameter and hanger rods attached to the top of the hoop and the structure. Support spacing shall be in accordance with the flue manufacturer's recommendations.

1.1.8 Support vertical sections at bottom, roof and intermediate levels.

1.1.9 Install cleanout at base of chimney.

1.1.10 Install thimbles where penetrating roof, floor, ceiling and where breeching enter masonry chimney.

1.1.11 Provide stack flashing collars, install and flash into roof construction. Install counter flashing pieces over the collars.

1.1.12 Install rain cap on chimney outlet. Confirm the height requirements of the stack above the roof with the Governing Authorities prior to installation.

3.3 SYSTEM START-UP

.1 Provide start-up service, make adjustments, test efficiency and instruct operators. Submit detailed start-up report.

3.4 FIELD QUALITY CONTROL

.1 Perform tests and inspections and prepare test reports.

.1 Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies and equipment installations, including connections, and to assist in testing.

.2 Tests and Inspections

.1 Perform installation and startup checks according to manufacturer's written instructions.

.2 Perform hydrostatic test. Repair leaks and retest until no leaks exist.

.3 Start units to confirm proper motor rotation and unit operation. Adjust air-fuel ratio and combustion.

.4 Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

.1 Check and adjust initial operating set points and high- and low-limit safety set points of fuel supply, water level and water temperature.

.2 Set field-adjustable switches and circuit-breaker trip ranges as indicated.

.5 Remove and replace malfunctioning units and retest as specified above.

.6 Occupancy Adjustments: When requested within 2 months of date of Substantial Completion, provide on-site assistance adjusting system to suit actual occupied conditions. Provide up to two visits to Project during other than normal occupancy hours for this purpose.

.7 Performance Tests:

.1 The boiler manufacturer is expected to provide partial load thermal efficiency curves. These thermal efficiency curves must include at least three separate curves at various BTU input levels. If these curves are not available, it is the responsibility of the boiler manufacturer to complete the following performance tests:

.1 Engage a factory-authorized service representative to inspect component assemblies and equipment installations, including connections, and to conduct performance testing.

.2 Boilers shall comply with performance requirements indicated, as determined by field performance tests. Adjust, modify, or replace equipment to comply.

.3 Perform field performance tests to determine capacity and efficiency of boilers.

.4 a. Test for full capacity.

.5 b. Test for boiler efficiency at low fire 20, 40, 60, 80, 100, 80, 60, 40 and 20 percent of full capacity. Determine efficiency at each test point.

.6 Repeat tests until results comply with requirements indicated.

.7 Provide analysis equipment required to determine performance.

.8 Provide temporary equipment and system modifications necessary to dissipate the heat produced during tests if building systems are not adequate.

3.5 MANUFACTURER'S INSTRUCTIONS

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

3.6 INSTALLATION

.1 Install in accordance with ASME Boiler and Pressure Vessels Code, regulations of Province having jurisdiction, except where specified otherwise, and manufacturers recommendations.

.2 Make required piping connections to inlets and outlets recommended by boiler manufacturer.

.3 Maintain clearances as indicated or if not indicated, as recommended by manufacturer for operation, servicing and maintenance without disruption of operation of any other equipment/system.

.4 Mount unit level using specified vibration isolation in Section 23 05 48.

.5 Pipe hot water relief valves full size to nearest drain.

.6 Pipe steam relief valve through roof with drip pan elbow piped to nearest drain.

.7 Pipe blowdown/drain to blowdown tank/floor drain.

.8 Natural gas fired installations: in accordance with CSA B149.1.

.9 LP gas installations - in accordance with CSA B149.1.

.10 Oil fired installations - in accordance with CSA B139.

3.7 MOUNTINGS AND ACCESSORIES

.1 Safety valves and relief valves:

.1 Run separate discharge from each valve.

.2 Terminate discharge pipe as indicated.

.3 Run drain pipe from each valve outlet and drip pan elbow to above nearest drain.

.2 Blowdown valves:

.1 Run discharge to terminate as indicated.

3.8 FIELD QUALITY CONTROL

.1 Commissioning:

.1 Manufacturer to:

.1 Certify installation.

.2 Start up and commission installation.

.3 Carry out on-site performance verification tests.

.4 Demonstrate operation and maintenance.

.2 Provide Departmental Representative at least 24 hours notice prior to inspections, tests, and demonstrations. Submit written report of inspections and test results.

3.9 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11.

.3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 20.

.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 American Society of Mechanical Engineers (ASME)

.1 ASME Boiler and Pressure Vessel Code, 2010.

.2 Canada Green Building Council (CaGBC)

.1 LEED Canada For New Construction and Major Renovations 2009.

.2 LEED Canada For Core and Shell 2009.

.3 CSA International

.1 CSA B51-09, Boiler, Pressure Vessel, and Pressure Piping Code.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit submittals in accordance with Section 01 33 00.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for heat exchangers and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:

.1 Shop drawings to indicate project layout, including layout and dimensions of heat exchangers and system.

.1 Material construction.

.2 Gasket type.

.3 Entering, leaving temperatures, flow and pressure drops.

.4 Fouling factor.

.5 Indicate manufacturer's recommended clearances.

.4 Test Reports: submit certified test reports from approved independent testing laboratories indicating compliance with specifications for specified performance characteristics and physical properties.

.5 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.6 Manufacturer's Instructions: submit manufacturer's installation instructions.

.7 Sustainable Design Submittals:

.1 LEED Canada-NC Submittals: in accordance with Section 01 35 21.

.2 Construction Waste Management:

.1 Submit project Waste Management Plan highlighting recycling and salvage requirements.

.2 Submit calculations on end-of-project recycling rates, salvage rates, and landfill rates demonstrating that 75% of construction wastes were recycled or salvaged.

1.3 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00.

.2 Operation and Maintenance Data: submit operation and maintenance data for heat exchangers for incorporation into manual.

1.4 MAINTENANCE MATERIAL SUBMITTALS

.1 Extra Stock Materials:

.1 Submit in accordance with Section 01 78 00.

.2 Supply following spare parts:

.1 Head gaskets.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 and with manufacturer's written instructions.

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

.3 Storage and Handling Requirements:

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

.2 Store and protect heat exchangers from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

.4 Develop Construction Waste Management Plan related to Work of this Section and in accordance with Section 01 35 21.

Part 2 PRODUCTS

2.1 EQUIPMENT

.1 Plate Type Heat Exchanger

.1 Carbon steel frame consisting of one stationary plate cover with inlet and outlet flanged connections, moveable plate cover, upper carrying bar, lower guiding bar, and support column.

.2 Plates: Corrugated type 304 stainless steel. 0.4 mm thick minimum. Plate thickness to meet pressure rating of 150psi and shall be selected to withstand full operating pressure in one channel with atmospheric pressure in the adjoining channel.

.3 Gaskets: Base selection on suitability for operating conditions, resistance to water treatment chemicals, including chlorine and boron nitrite compounds, and ease of gasket removal and replacement. Glued or clip on gaskets are acceptable.

.4 Offset bolt pattern connections are not acceptable.

.5 Single Pass arrangement. Multiple pass arrangement will not be accepted.

.6 Do not exceed the specified pressure losses which are total across the heat exchangers including nozzle loss.

Part 3 EXECUTION

3.1 INSTALLATION

.1 General: install level and firmly anchored to supports in accordance with manufacturer's recommendations.

.2 Provide welded structural steel stands for floor mounting of heat exchangers. Bolt stand to floor.

.3 Ensure installation permits removal of plates. Follow manufacturers suggestions for plate swing area.

.4 Refer to drawings for details of installation and piping connections.

.5 Provide line size strainers upstream of all heat exchangers.

.6 Provide 100mm housekeeping pads

3.2 APPURTENANCES

.1 Install with safety relief valve piped to drain vacuum breaker steam trap hose bib drain valve.

.2 Install thermometer wells with thermometers on inlet and outlet of primary and secondary side.

.3 Install pressure gauge on steam inlet.

3.3 PERFORMANCE

.1 Refer to Heat Exchanger Schedules.

END OF SECTION

Part 1 GENERAL

1.1 REFERENCES

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

.1 ANSI/ASHRAE 90.1-2010, (I-P) Energy Standard for Buildings Except Low-Rise Residential Buildings.

.2 ANSI/ASHRAE 52.2-2007, Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size.

.2 American National Standards Institute (ANSI)

.1 ANSI/AMCA 210-07, Laboratory Methods of Testing Fans for Aerodynamic Performance Ratings.

.2 ANSI/AHRI 1060-2011, Performance Rating of Air-to-Air Heat Exchangers for Energy Recovery Ventilation Equipment.

.3 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-1.181-99, Ready-Mixed Organic Zinc-Rich Coating.

.4 Underwriter’s Laboratories (UL)

.1 UL 1995 – 2011, Heating and Cooling Equipment

.5 National Fire Protection Agency (NFPA)

.1 NFPA 90A -2012, Installation of Air Conditioning and Ventilating Systems

.6 Master Painters Institute (MPI)

.1 MPI-INT 5.3-2007, Galvanized Metal.

1.2 RELATED SECTIONS

.1 Section 23 05 53.01 – Mechanical Identification

.2 Section 23 84 13 – Humidifiers

.3 Section 25 90 01 – Site Requirements, Applications and Systems Sequences of Operation

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00.

.2 Product Data:

.1 Provide manufacturer's printed product literature and datasheets for insulation, filters, adhesives, and paints, and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:

.1 Indicate following:

.1 Unit performance. Indicate all parameters as indicated in mechanical schedules.

.2 Component arrangement

.3 Fan construction, motor, operating point on performance curve

.4 Enthalpy wheel performance at summer and winter operating conditions

.5 Air handling unit cabinet and door construction, dimensions and weights. Include all necessary service clearances

.6 Supply Air, Return Air, Exhaust Air, and Outdoor Air connection Points

.7 Filters

.8 Dampers

.9 Preheat Coil, DX expansion coil, and drain pan construction

.10 Water source heat pump performance and construction

.11 Factory mounted controls

.12 Work to be provided by others

1.4 CLOSEOUT SUBMITTALS

.1 Provide maintenance data for incorporation into manual specified in Section 01 78 00.

.2 Include following:

.1 Approved equipment shop drawings

.2 Recommended service and preventative maintenance information

.3 Commissioning and testing reports

1.5 MAINTENANCE MATERIAL SUBMITTALS

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

.2 Provide one spare set of filters.

.3 Provide list of individual manufacturer's recommended spare parts for equipment such as bearings and seals, and addresses of suppliers, together with list of specialized tools necessary for adjusting, repairing or replacing, for placement into operating manual.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle in accordance with Section 01 61 00.

.2 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

.3 Packaging Waste Management: remove for reuse of pallets, crates, padding, and packaging materials in accordance with Section 01 74 20.

Part 2 PRODUCTS

2.1 GENERAL

.1 A packaged energy recovery ventilator capable of transferring sensible and latent energy with supplementary heating and cooling. Energy recovery shall be through an energy recovery wheel installed within the unit. System to include:

- .1 Enthalpy Wheel and wheel drive system
- .2 Ventilation air fan
- .3 Exhaust air fan
- .4 Heating, Cooling, and Preheat coils
- .5 Dampers
- .6 Temperature Sensors and Controls.
- .7 Water source heat pumps
- .8 Filters

.2 All components to be factory assembled and run tested.

.3 Unit shall be constructed in accordance with UL 1995, ASHRAE 90.1, and NFPA 90A. Unit shall be listed for use within Canada. Airflow data shall comply with ANSI/AMCA 210.

.4 Unit nameplate shall be as indicated in Section 23 05 53.01.

2.2 CASINGS

.1 Heavy gauge galvanized steel panels with galvanized steel frame reinforced and braced for rigidity.

- .1 Paint cabinet with baked on enamel paint

.2 Removable panels shall be provided to access all internal components for necessary maintenance.

.3 Unit frame to include 150mm base rails. Unit shall have provisions for rigging and lifting integrated into the base rails of the unit.

.4 Cabinet shall be insulated throughout with a minimum of 25mm insulation. Provide galvanized steel liner.

2.3 DRAIN PANS

.1 Construction: stainless steel. Rounded corners.

.2 Drain connection: in bottom at low point.

.3 Installation: slope without sag minimum 1% to ensure no standing water at any time or at any point.

2.4 FANS

.1 Fans to be selected to operate on a stable, efficient part of the fan curve when delivering air quantities scheduled against static of the system.

.2 Fan blades shall be statically and dynamically balanced and tested prior to shipment. Fan discharges and intakes to be as indicated on mechanical drawings.

.3 Supply and exhaust fans to be forward-curved, DWDI. Fan shaft to be solid steel, turned, ground, polished, and finished off with a corrosion resistant coating. Fan wheels shall be keyed to the shaft and have pillow block bearings.

.4 Fan drives shall be designed for a 1.3 service factor. Fan shall be equipped with an adjustable motor sheave. Drives are to be factory mounted with final alignment and belt adjustment completed before unit startup.

.5 Maximum sound power levels, as indicated.

.6 Mount fans on open spring vibration isolation mounts.

2.5 MOTORS

.1 Motors shall be continuous duty and matched to the fan loads. Motors shall have ODP enclosures and include starters and overload protection.

.2 Motors shall meet ASHRAE 90.1 for efficiency.

.3 Motor selection must include a 1.15 service factor.

.4 Energy wheel drive motor shall have internal overload protection.

2.6 ENTHALPY WHEEL

.1 Enthalpy recovery performance for the wheel shall be certified by AHRI to AHRI Standard 1060. Wheels tested in independent labs and rated in accordance to AHRI Standard 1060 without AHRI certification are not acceptable

.2 Enthalpy wheel shall conform to the requirements of NFPA-90A.

.3 Enthalpy wheel cassette shall be complete with face seal and perimeter seal to minimize exhaust air transfer ratio when tested in accordance with AHRI Standard 1060. Exhaust air transfer ratio values must be certified to AHRI.

.4 Enthalpy wheel shall be self cleaned by two counter flow airstreams and come equipped in slide out cassette for easy removal for maintenance.

.5 Enthalpy wheel shall have permanently sealed ball bearings with 200,00 hour L-10 life.

2.7 DAMPERS

.1 Unit shall include an outside air motorized damper and exhaust air motorized damper.

.2 Dampers shall be insulated with a leakage not to exceed 25.3 $l/s/m^2$ at 250 Pa. Dampers shall be provided with extruded EPDM gasketing on the leading edges of the damper blades.

.3 Dampers shall be parallel blade, normally closed.

2.8 FILTER BOX

.1 Provide blank-off plates and gaskets to prevent air bypass where required.

.2 Filters:

.1 Minimum Efficiency Reporting Value (MERV) value 8 filtration media to ASHRAE 52.2 to be used on:

.1 Supply pre-filter.

.2 Minimum Efficiency Reporting Value (MERV) value 13 filtration media to ASHRAE 52.2 to be used on:

.1 Supply final filter.

.3 Immediately prior to occupancy, replace filtration media with new filtration media.

2.9 COILS

.1 Heating and Cooling Coil

.1 Units shall be equipped with an integrated Water Source Heat Pump section which shall be suitable for cooling tower/boiler loop applications.

.2 To be UL and CSA approved.

.3 Evaporator coil shall include cooling and heating stages in quantities sufficient to meet the scheduled cooling and heating capacities.

.4 Reversible refrigerant circuits shall include externally equalized thermostatic expansion valve and reversing valve.

.5 Condenser shall be coaxial tube-in-tube with copper inner tubes and steel outer tubes or brazed steel plates. Condenser shall be selected with 2.7°C sub-cooling and have maximum working pressures of 2760 kPa on the water side and 4550 kPa on the refrigerant side.

.6 Water connections to be NPT type and mounted external to the unit.

.7 Refrigeration system shall incorporate a single variable speed compressor.

.8 Unit to be charged with R410a refrigerant, factory run and leak tested with all necessary controls for operation.

.9 Unit shall include refrigerant high and low pressure gauge connections.

.10 Unit shall include refrigerant suction and discharge valves.

.2 Preheat Coil:

.1 Casings: 1.5mm thick galvanized sheet steel.

.1 Supports of galvanized steel channel.

.2 Blank-off plates. Insulated sandwich construction.

.2 Coil: cleanable fins.

.1 Tubes: copper.

.2 Fins: aluminum.

.3 Headers: cast brass.

.4 Pressure tests: 1.7 MPa.

.3 Ratings: ARI certified.

2.10 CONTROLS

.1 A recessed integral electrical control compartment shall be furnished on the side of the unit. All components shall be factory-mounted and wired to a labeled terminal strip. All components and wiring shall be identified using printed self-adhesive labels, consistent with the numbering used in the wiring diagrams.

.2 Unit shall be equipped with preheat frost prevention to prevent frost from forming on the enthalpy wheel and allow for continuous ventilation. Unit shall come equipped with sensing and control devices for modulating control of preheat coil.

.1 Control valve provided by Controls Contractor.

.3 Unit shall come equipped with a factory-installed, programmed and run tested DDC Controls Package which shall include a stand-alone microprocessor-based DDC controller and necessary sensors and interfaces to provide control of post-conditioning and pre-conditioned functions and unit operation.

.4 An intelligent programmable interface device with remote temperature sensor shall be included for communication, display, setpoint control and to allow for servicing. Interface device to be unit mounted. Remote temperature sensor to be installed in S/A discharge duct downstream of unit by Division 25.

.5 The DDC controller shall be native BACnet for communication with BAS. Interoperability shall be tested and approved by the BACnet Testing Laboratory. Minimum points to be provided for communication with BAS are as follows:

.1 Outside air temperature
.2 Supply air temperature
.3 Return air temperature
.4 Exhaust air temperature
.5 Outside air humidity
.6 Return air humidity
.7 Supply blower operation
.8 Cooling setpoint
.9 Cooling temperature band
.10 Heating setpoint
.11 Heating temperature band
.12 Damper positions

.6 Safety controls for heat pump refrigeration circuit shall be auto reset on the low pressure side and manually reset on the high pressure side.

.7 Provide unit with low leaving water temperature (freeze stat) safety switch.

.8 Provide device and contacts to provide a 24 VAC signal when filters require replacing.

.9 Unit shall come equipped with a wheel rotation sensor. A 24 VAC signal shall be provided if the enthalpy wheel fails.

.10 Provide unit with a factory installed thermostat to control free cooling.

.11 Include provision to wire a field supplied motorized on/off 2-way water shut-off valve. Valve shall be interlocked with unit to turn off water flow when the unit compressor is off.

.12 All unit safety controls shall be factory mounted and wired, requiring only field installation of remote sensing devices.

.13 Interlock exhaust air and outside air damper position with fan operation. A signal shall be sent if the dampers fail.

.14 Refer to Section 25 90 01 for Sequences of Operation.

2.11 HUMIDIFIERS

.1 In accordance with Section 23 84 13.

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 INSTALLATION

.1 Provide appropriate protection apparatus.

.2 Install units in accordance with manufacturer's instructions and as indicated.

.3 Ensure adequate clearance for servicing and maintenance.

.4 Ducts to be connected to unit inlet and outlet collars with flexible duct collars to Section 23 33 00

3.3 FANS

.1 Install fan sheaves required for final air balance.

3.4 DRIP PANS

.1 Install deep seal P-traps on drip lines.

.1 Depth of water seal to be 1.5 times static pressure at this point.

3.5 CLEANING

.1 Clean in accordance with Section 01 74 11.

.2 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 20.

END OF SECTION

Part 1 GENERAL

1.1 RELATED SECTIONS

.1 Section 23 07 15 – Thermal insulation for Piping

.2 Section 23 23 00 – Copper Tubing and Fittings Refrigerant

.3 Section 25 30 02 – Field Control Devices

.4 Section 25 90 01 – Site Requirements, Applications and Systems Sequences of Operation

1.2 REFERENCES

.1 American National Standards Institute/Air-Conditioning and Refrigeration Institute (ANSI/ARI)

.1 ANSI/ARI 210/240-2008, Unitary Air Conditioning and Air-Source Heat Pump Equipment.

.2 Air-Conditioning and Refrigeration Institute (ARI)

.1 ARI 320-1998, Standard for Water-Source Heat Pumps.

.3 CSA International

.1 CAN/CSA-C656-05(R2010), Performance Standard for Split-System and Single Package Central Air Conditioners and Heat Pumps.

.2 CAN/CSA-C13256-2001(R2011), Water-Source Heat Pumps-Testing and Rating for Performance, Part 1 Water-to-Air and Brine-to-Air Heat Pumps.

.3 CAN/CSA- B52-05 (R2009), Mechanical Refrigeration Code.

.4 Environment Canada, (EC) / Environmental Protection Services (EPS)

.1 EPS 1/RA/2-1996, Code of Practice for Elimination of Fluorocarbons Emissions from Refrigeration and Air Conditioning Systems.

.2 Environment Canada-1994, Ozone-Depleting Substances Alternatives and Suppliers List.

.5 National Fire Protection Association (NFPA)

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

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for:

.1 Water-Source Outdoor Units

.2 Indoor Fan Coil Units

.3 Air-Source Outdoor Units

.4 Refrigerant Piping Accessories

.5 Heat Recovery Units

.6 Standalone LCD controller and Wiring Diagrams

.7 BACnet interface Gateway

.2 Shop Drawings:

.1 Indicate on drawings:

.1 Unit Tag Identification

.2 Dimensions and Weights

.3 Performance Characteristics and Operating Conditions

.4 Colour and Finish

.5 Electrical Characteristics

.6 Required Field Coordination

.7 Equipment Connections

.8 Total Refrigerant Charge

.9 Refrigerant pipe routing and size.

.10 Location of controllers and components require for operation.

.2 Water-cooled and Air-cooled VRF system manufacturer to provide complete piping layout and system schematic for review. Layout to be completed with manufacturer’s selection software and drawn on floor plans provided by Department Representative.

1.4 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00.

.2 Operation and Maintenance Data: submit operation and maintenance data for incorporation into manual.

.3 Manufacturer’s limited warranty.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 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 equipment from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

.4 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding and packaging materials in accordance with Section 01 74 20.

1.6 WARRANTY

.1 All equipment shall be provided with a limited manufacturer’s warranty for a period of one year after the date of installation or 18 months from date of delivery, whichever is shorter.

.2 An extended warranty including 1 additional year parts and 5 additional years compressor shall be provided upon submission to the manufacturer and acceptance by the manufacturer of proper installation with documentation including:

.1 Selection output and layout of the VRF system.

.2 60 minutes of operation history upon commissioning from the VRF service tool.

.3 Completed commissioning report as per the VRF equipment manufacturer.

1.7 QUALITY ASSURANCE

.1 The units shall be listed by Electrical Testing Laboratories (ETL) and bear the ETL label.

.2 All wiring shall be in accordance with the National Electrical Code (N.E.C.).

.3 The units shall be manufactured in a facility registered to ISO 9001 and ISO14001 which is a set of standards applying to environmental protection set by the International Standard Organization (ISO).

.4 All units must meet or exceed the 2010 Federal minimum efficiency requirements and the proposed ASHRAE 90.1 efficiency requirements for VRF systems. Efficiency shall be published in accordance with the DOE alternative test procedure, which is based on the Air-Conditioning, Heating, and Refrigeration Institute (AHRI) Standards 340/360, 1230 and ISO Standard 13256-1.

.5 A full charge of R-410A for the condensing unit only shall be provided in the condensing unit.

Part 2 PRODUCTS

2.1 DESCRIPTION

.1 System shall be a VRF(Variable Refrigerant Flow) capable of heat recovery and simultaneous cooling and heating. System shall be air cooled or water cooled as indicated on mechanical drawings and equipment schedules.

.2 System shall consist of outdoor units, heat recovery units, indoor units, and controls by the equipment manufacturer. Equipment controls shall be capable of operating as a stand alone system and communicating with the building automation system with the BACnet communication protocol.

.3 Every indoor unit shall be independently capable of operating in either heating or cooling mode regardless of the mode of the other indoor units.

2.2 REFRIGERANTS

.1 Type of Refrigerant: R-410a.

2.3 AIR-SOURCE HEAT PUMP

.1 General:

.1 The variable capacity, heat pump heat recovery air conditioning system shall be a Variable Refrigerant Flow zoning system.

.2 The Heat Recovery system shall consist of an outdoor unit, BC (Branch Circuit) Controller, multiple indoor units, and DDC (Direct Digital Controls). Each indoor unit or group of indoor units shall be capable of operating in any mode independently of other indoor units or groups. System shall be capable of changing mode (cooling to heating, heating to cooling) with no interruption to system operation. To ensure owner comfort, each indoor unit or group of indoor units shall be independently controlled and capable of changing mode automatically when zone temperature strays 1.8 degrees F from set point for ten minutes. The sum of connected capacity of all indoor air handlers shall range from 50% to 150% of outdoor rated capacity.

.3 System components shall be from a single manufacturer.

.4 Unit control boards shall perform all functions required to effectively and efficiently operate the VRF system and communicate from outdoor unit to indoor units.

.5 Outdoor unit shall be completely factory assembled, piped and wired. Each outdoor unit shall be run tested at the factory.

.6 Outdoor unit shall have the ability to operate with an elevation difference of up to 50m above or 40m below the indoor units.

.7 The outdoor unit shall be capable of operating in heating only mode down to -20°C and up to 16°C ambient wet bulb without additional low ambient controls.

.8 The outdoor unit shall be capable of operating in cooling only mode down to -28°C and up to 48°C ambient dry bulb.

.9 The outdoor unit shall have an oil separator for the compressor and controls to ensure sufficient oil supply is maintained for the compressor.

.10 Field installed refrigerant piping between outdoor and indoor units to be insulated as specified in section 23 07 15 or as per manufacturer recommendations, whichever is more stringent.

.2 Performance data: as indicated in mechanical schedules

.3 Frame:

.1 Shall be constructed with galvanized steel, bonderized and be finished with powder coat baked enamel paint.

.4 Compressor:

.1 Welded hermetic digitally controlled inverter driven rotary compressor. Crankcase heater shall be factory mounted on the compressor. Compressor shall be mounted to avoid the transmission of vibration.

.2 Compressor shall have an inverter to modulate capacity.

.3 Other components to include:

.1 Accumulator

.2 High pressure safety switch

.3 Over-current protection

.4 Subcooling heat exchanger

.5 Internal thermal overload

.5 Fan:

.1 Condenser fans shall be direct drive, variable speed.

.2 All fan motors shall have inherent protection, have permanently lubricated bearings and be variable speed.

.3 All fans shall be provided with a raised guard to limit contact with moving parts.

.6 Coil:

.1 The outdoor coil shall be of nonferrous construction with louvered fins on copper tubing.

.2 The coil fins shall have a factory applied corrosion resistant, hydrophilic coating.

.3 The coil shall be protected with an integral metal guard.

.4 Refrigerant flow from the outdoor unit shall be controlled by means of a digitally controlled inverter driven rotary compressor.

.7 Refrigeration piping:

.1 Between outdoor unit, compressor section and indoor coil, complete with refrigerant metering devices and valves.

.2 Refer to Section 23 23 00.

.8 Electrical:

.1 Unit to be capable of operation within voltage limits of +/- 10% rated voltage.

.2 Outdoor unit shall be controlled by integral microprocessors.

.3 The control circuit between the indoor units and the outdoor unit shall be 24VDC. Communication shall be using 2-conductor, stranded, shield cable for RS485 daisy chain.

.9 Controls:

.1 Individual indoor units connected to air cooled condensing unit shall be controlled with individual remote mounted thermostats.

.2 Thermostats shall be supplied by VRF equipment manufacturer.

.3 Unit shall be capable of interfacing with building automation system. The following points shall be provided:

.1 Start/Stop

.2 Cool or Heat Changeover

.3 Status

.4 Error/Alarm

2.4 OUTDOOR UNIT

.1 The outdoor units shall be equipped with multiple circuit boards that interface to the controls system and shall perform all functions necessary for operation. Each outdoor unit module shall be completely factory assembled, piped and wired and run tested at the factor.

.1 The model nomenclature and unit requirements are shown below. All units requiring a factory supplied twinning kits shall be piped together in the field, without the need for equalizing line(s). If an alternate manufacturer is selected, any additional material, cost, and labor to install additional lines shall be incurred by the contractor.

.2 Outdoor unit shall have a sound rating no higher than 60 dB(A) individually or 64 dB(A) twinned. Units shall have a sound rating no higher than 50 dB(A) individually or 53 dB(A) twinned while in night mode operation. If an alternate manufacturer is selected, any additional material, cost, and labor to meet published sound levels shall be incurred by the contractor.

.3 Both refrigerant lines from the outdoor unit to the BC (Branch Circuit) Controller (Single or Main) shall be insulated in accordance with the installation manual.

.4 There shall be no more than 3 branch circuit controllers connected to any one outdoor unit.

.5 Outdoor unit shall be able to connect to up to 50 indoor units depending upon model.

.6 The outdoor unit shall have an accumulator with refrigerant level sensors and controls.

.7 The outdoor unit shall have a high pressure safety switch, over-current protection, crankcase heater and DC bus protection.

.8 The outdoor unit shall have the ability to operate with a maximum height difference of 164 feet and have total refrigerant tubing length of 1804-2625 feet. The greatest length is not to exceed 541 feet between outdoor unit and the indoor units without the need for line size changes or traps.

.9 The outdoor unit shall be capable of operating in heating mode down to -4°F ambient temperatures or cooling mode down to 23°F ambient temperatures, without additional low ambient controls. If an alternate manufacturer is selected, any additional material, cost, and labor to meet low ambient operating condition and performance shall be incurred by the contractor.

.10 The outdoor unit shall have a high efficiency oil separator plus additional logic controls to ensure adequate oil volume in the compressor is maintained.

.11 Unit must defrost all circuits simultaneously in order to resume full heating more quickly. Partial defrost which may extend “no or reduced heating” periods shall not be allowed.

.2 Frame and Casing:

.1 The frame shall be constructed with galvanized steel, bonderized, and finished with powder coat baked enamel paint.

.2 The outdoor unit case is constructed from 19-gauge metal, and is cleaned and finished with a baked enamel finish.

.3 Provide standard manufacturer support fames.

.3 Fan:

.1 Each outdoor unit module shall be furnished with one direct drive, variable speed propeller type fan. The fan shall be factory set for operation under 0 in. WG external static pressure, but capable of normal operation under a maximum of 0.24 in. WG external static pressure via dipswitch.

.2 All fan motors shall have inherent protection, have permanently lubricated bearings, and be completely variable speed.

.3 All fan motors shall be mounted for quiet operation.

.4 All fans shall be provided with a raised guard to prevent contact with moving parts.

.5 The outdoor unit shall have vertical discharge airflow.

.4 Refrigeration system:

.1 Field installed refrigerant piping between heat recovery unit, outdoor units, and indoor units to be insulated as specified in section 23 07 15 or as per manufacturer recommendations, whichever is more stringent.

.2 Outdoor unit shall be provided with factory installed components including:

.1 Refrigerant strainer;

.2 Check valves;

.3 Oil separator;

.4 Accumulator;

.5 Hot gas bypass valve;

.6 Liquid injection valve;

.7 4-way reversing valve;

.8 Electronic expansion valve;

.9 High and low side charging ports;

.10 Integral subcooler with electronic expansion valve;

.11 Service valves;

.12 Interconnecting piping;

.3 Refrigerant oil level in the compressor is maintained using a two-stage oil control system. The high-pressure discharge vapor leaves the compressor and immediately enters the oil separator designed to extract oil from the refrigerant gas stream. The oil separator has no moving parts. A gravity drain returns captured oil back to the compressor sump. The water source unit microprocessor is programmed to flush the refrigerant piping for a minimum period of three minutes after six hours of compressor operation.

.5 Coil:

.1 The outdoor coil shall be of nonferrous construction with lanced or corrugated plate fins on copper tubing.

.2 The coil fins shall have a factory applied corrosion resistant blue-fin finish.

.3 The coil shall be protected with an integral metal guard.

.4 Refrigerant flow from the outdoor unit shall be controlled by means of an inverter driven compressor.

.5 The outdoor coil shall include 4 circuits with two position valves for each circuit, except for the last stage.

.6 Compressor:

.1 Each outdoor unit module shall be equipped with one inverter driven scroll hermetic compressor. Non inverter-driven compressors, which cause inrush current (demand charges) and require larger wire sizing, shall not be allowed.

.2 A crankcase heater(s) shall be factory mounted on the compressor(s).

.3 The outdoor unit compressor shall have an inverter to modulate capacity. The capacity shall be completely variable with a turndown of 19%-5% of rated capacity, depending upon unit size.

.4 The compressor will be equipped with an internal thermal overload.

.5 The compressor shall be mounted to avoid the transmission of vibration.

.6 Field-installed oil equalization lines between modules are not allowed. Prior to bidding, manufacturers requiring equalization must submit oil line sizing calculations specific to each system and module placement for this project.

.7 Controls

.1 The outdoor unit shall have the capability of up to 8 levels of demand control for each refrigerant system

2.5 BRANCH CIRCUIT (BC) CONTROLLERS

.1 General:

.1 The BC (Branch Circuit) Controllers shall include multiple branches to allow simultaneous heating and cooling by allowing either hot gas refrigerant to flow to indoor unit(s) for heating or subcooled liquid refrigerant to flow to indoor unit(s) for cooling. Refrigerant used for cooling must always be subcooled for optimal indoor unit LEV performance; alternate branch devices with no subcooling risk bubbles in liquid supplied to LEV and are not allowed.

.2 The BC (Branch Circuit) Controllers shall be specifically used with R410A systems. These units shall be equipped with a circuit board that interfaces to the controls system and shall perform all functions necessary for operation. The unit shall have a galvanized steel finish. The BC Controller shall be completely factory assembled, piped and wired. Each unit shall be run tested at the factory. This unit shall be mounted indoors, with access and service clearance provided for each controller. The sum of connected capacity of all indoor air handlers shall range from 50% to 150% of rated capacity.

.2 Casing and Construction:

.1 The casing shall be fabricated of galvanized steel.

.2 Each cabinet shall house a liquid-gas separator and multiple refrigeration control valves.

.3 The unit shall house two tube-in-tube heat exchangers.

.3 Refrigerant:

.1 R410A refrigerant shall be required.

.4 Refrigerant Valve:

.1 The unit shall be furnished with multiple branch circuits which can individually accommodate up to 54,000 BTUH and up to three indoor units. Branches may be twinned to allow more than 54,000 BTUH.

.2 Each branch shall have multiple two-position valves to control refrigerant flow.

.3 Service shut-off valves shall be field-provided/installed for each branch to allow service to any indoor unit without field interruption to overall system operation.

.4 Linear electronic expansion valves shall be used to control the variable refrigerant flow.

.5 Integral Drain Pan

.1 An Integral drain pan and drain shall be provided

.6 Electrical:

.1 The unit electrical power shall be 208/230 volts, 1 phase, 60 Hertz.

.2 The unit shall be capable of satisfactory operation within voltage limits of 187-228 (208V/60Hz) or 207-253 (230/60Hz).

.3 The BC Controller shall be controlled by integral microprocessors

.4 The control circuit between the indoor units and outdoor units shall be 24VDC completed using a 2-conductor, twisted pair shielded cable to provide total integration of the system.

2.6 INDOOR UNIT (CEILING CONCEALED DUCTED)

.1 General:

.1 The ceiling-concealed ducted indoor fan coil design that mounts above the ceiling with a 2-position, field adjustable return and a fixed horizontal discharge supply and shall have a modulating linear expansion device.

.2 The indoor unit shall be factory assembled, wired and run tested. Contained within the unit shall be all factory wiring, piping, electronic modulating linear expansion device, control circuit board and fan motor. The unit shall have a self-diagnostic function, 3-minute time delay mechanism, and an auto restart function. Indoor unit and refrigerant pipes shall be charged with dehydrated air before shipment from the factory.

.2 Unit Cabinet

.1 The unit shall be, ceiling-concealed, ducted.

.2 The cabinet panel shall have provisions for a field installed filtered outside air intake.

.3 Fan

.1 Models shall feature external static pressure settings from 0.14 to 0.60 in. WG.

.2 The indoor unit fan shall be an assembly with one or two Sirocco fan(s) direct driven by a single motor.

.3 The indoor fan shall be statically and dynamically balanced and run on a motor with permanently lubricated bearings.

.4 The indoor fan shall consist of three (3) speeds, High, Mid, and Low plus the Auto-Fan function

.5 The indoor unit shall have a ducted air outlet system and ducted return air system.

.4 Filter:

.1 Return air shall be filtered by means of a standard factory installed return air filter.

.2 Return filter box (rear placement) with high-efficiency filter shall be available for all indoor units.

.5 Coil:

.1 The indoor coil shall be of nonferrous construction with smooth plate fins on copper tubing.

.2 The tubing shall have inner grooves for high efficiency heat exchange.

.3 All tube joints shall be brazed with phos-copper or silver alloy.

.4 The coils shall be pressure tested at the factory.

.5 A condensate pan and drain shall be provided under the coil.

.6 The condensate shall be gravity drained from the fan coil.

.7 Both refrigerant lines to the indoor units shall be insulated in accordance with the installation manual.

.6 Condensate Pump:

.1 Provide unit with factory mounted or field installed condensate pump. Condensate pump performance to be 6lph at 3m head.

.2 Electrical and installation requirements to be coordinated with electrical contractor and mechanical contractor.

.3 Condensate pump electrical power shall be 208V, 1-phase, 60 Hz.

.7 Electrical:

.1 The unit electrical power shall be 208/230 volts, 1-phase, 60 hertz.

.2 The system shall be capable of satisfactory operation within voltage limits of 187-228 volts (208V/60Hz) or 207-253 volts (230V/60Hz).

.8 Controls:

.1 This unit shall use controls to perform functions necessary to operate the system.

.2 Indoor unit shall compensate for the higher temperature sensed by the return air sensor compared to the temperature at level of the occupant when in HEAT mode. Disabling of compensation shall be possible for individual units to accommodate instances when compensation is not required.

.3 Control board shall include contacts for control of external heat source. External heat may be energized as second stage with 1.8°F – 9.0°F adjustable deadband from set point.

.4 Indoor unit shall include no less than four (4) digital inputs capable of being used for customizable control strategies.

.5 Indoor unit shall include no less than three (3) digital outputs capable of being used for customizable control strategies.

2.7 WALL-MOUNTED INDOOR UNIT

.1 General:

.1 Wall-mounted indoor units shall protrude from the wall no more 250mm.

.2 Shall be designed for use with R410a refrigerant.

.3 Shall be of the same manufacturer of simultaneous heating and cooling heat pump VRF systems.

.4 Shall communicate with the outdoor unit and heat recovery units using daisy chain communication.

.5 Field installed refrigerant piping between heat recovery unit, outdoor units, and indoor units to be insulated as specified in section 23 07 15 or as per manufacturer recommendations, whichever is more stringent.

.2 Indoor Unit

.1 Shall be factory assembled, wired and run tested.

.2 The indoor unit shall be factory wired and piped with its own electronic expansion device, control circuit board, fan and motor.

.3 The indoor unit shall have a self-diagnostic function and auto restart function.

.4 The indoor unit shall be filled with a dry nitrogen gas charge from the factory.

.3 Unit Cabinet

.1 The unit casing shall have a white finish.

.2 Multi direction refrigerant piping up to four directions.

.3 Multi direction drain piping up to two directions.

.4 The indoor unit shall attach to a separate back plate that secures the unit to the wall.

.4 Filter:

.1 Return air shall be filtered with a factory supplied removable, washable filter.

.5 Fan:

.1 The indoor unit fan shall be an assembly with one cross flow fan direct driven by a single motor.

.2 The indoor fan shall be statically and dynamically balanced.

.3 Motor shall have permanently lubricated bearings.

.4 Provided fan settings shall be Low, Med, High, Power Cool (Cooling Mode), and Auto.

.5 Fan shall have a selectable Auto fan setting that will adjust the fan speed based on the difference between controller set-point and space temperature.

.6 A manually adjustable guide vane shall be factory installed allowing the ability to control the direction of airflow from side to side.

.6 Coil:

.1 The indoor unit coil shall be nonferrous with louvered fins on copper tubing.

.2 The tubing shall have inner grooves.

.3 Coils shall be pressure tested at the factory.

.4 A condensate drain pan shall be factory installed below the coil.

.7 Condensate Pump:

.1 Provide unit with factory mounted or field installed condensate pump. Condensate pump performance to be 6lph at 3m head.

.2 Electrical and installation requirements to be coordinated with electrical contractor and mechanical contractor.

.3 Condensate pump electrical power shall be 208V, 1-phase, 60 Hz.

.8 Electrical:

.1 The indoor unit electrical power shall be 208/230V, 1-phase, 60 Hz.

.2 The indoor unit shall be capable of operation within the voltage limits of +/- 10% of the rated voltage.

.9 Controls:

.1 Unit shall use controls provided by the manufacture to perform all functions necessary to operate the system effectively and efficiently and communicate with the outdoor unit over a RS485 daisy chain communication system.

.2 Provide with wall mounted temperature sensor manufactured by VRF equipment manufacturer or thermostat as indicated on floor plans.

2.8 CONTROLLERS

.1 The control system shall consist of a low voltage communication network of unitary built-in controllers with on-board communications and a web-based operator interface. A web controller with a network interface card shall gather data from this system and generate web pages accessible through a conventional web browser on each PC connected to the network. Operators shall be able to perform all normal operator functions through the web browser interface.

.2 System controls and control components shall be installed in accordance with the manufacturer's written installation instructions.

.3 Furnish energy conservation features such as optimal start, night setback, request-based logic, and demand level adjustment of overall system capacity as specified in the sequence.

.4 System shall provide direct and reverse-acting on and off algorithms based on an input condition or group conditions to cycle a binary output or multiple binary outputs.

.5 Provide capability for future system expansion to include monitoring and use of occupant card access, lighting control and general equipment control.

.6 System shall be capable of email generation for remote alarm annunciation.

.7 Control system start-up shall be a required service to be completed by the manufacturer or a duly authorized, competent representative that has been factory trained in controls system configuration and operation. The representative shall provide proof of certification. This certification shall be included as part of the equipment and/or controls submittals. This service shall be equipment and system count dependent and shall be a minimum of one (1) eight (8) hour period to be completed during normal working hours.

.8 The Controls Network shall be capable of supporting remote controllers, centralized controllers, an integrated web based interface, graphical user workstation, and system integration to Building Management Systems via BACnet®

.9 The CONTROL shall operate at 30VDC. Controller power and communications shall be via a common non-polar communications bus.

.10 Wiring:

.1 Control wiring shall be installed in a daisy chain configuration from indoor unit to indoor unit, to the BC controller (main and subs, if applicable) and to the outdoor unit. Control wiring to remote controllers shall be run from the indoor unit terminal block to the controller associated with that unit.

.2 Control wiring for centralized controllers shall be installed in a daisy chain configuration from outdoor unit to outdoor unit, to the system controllers (centralized controllers and/or integrated web based interface), to the power supply.

.3 The centralized controller shall be capable of being networked with centralized controllers for centralized control.

.11 Wiring type:

.1 Wiring shall be 2-conductor (16 AWG), twisted, stranded, shielded wire

.2 Network wiring shall be CAT-5 with RJ-45 connection

.12 Controls Network

.1 The Controls Network consists of remote controllers, centralized controllers, and/or integrated web based interface communicating over a high-speed communication bus..

.13 System to be preprogrammed by manufacturer with all operating points and user adjustable settings for indoor and outdoor units.

.14 System shall be capable of reading the following points on indoor units:

.1 ON/OFF

.2 Operation Mode

.3 Fan Speed

.4 User Mode

.5 Room Temperature

.6 Filter Status

.7 Alarm

.8 Error Code

.15 System shall be capable of read/writing the following points on indoor units:

.1 ON/OFF

.2 Operation Mode

.3 User Mode

.4 Fan Speed

.5 Set Room Temperature

.6 Filter Status Reset

Part 3 EXECUTION

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for VRF system installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Departmental Representative.

.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 INSTALLATION

.1 Install where indicated and in accordance with manufacturer's instructions.

.2 Install air source outdoor units on exterior concrete pad. For climates that experience snowfall, mount the outdoor unit a minimum of 12” above the average snowfall line. In climates where this height requirement proves unfeasible, the outdoor units may be installed at the average snowfall line provided regular snow removal in the area surrounding the units keeps the snow line below the bottom of the units.

.3 Inlet water piping to outdoor unit to be provided with a 50 mesh strainer. Strainer to be provided by and installed by Division 23.

.4 Secure with hold-down bolts in accordance with manufacturer's recommendations.

.5 Make duct connections through flexible connections.

.6 Level unit with fans running. Align duct work flexible connections. Misalignment with fan stopped not to strain or damage flexible connection.

.7 Make piping connections.

.8 Nothing to obstruct ready access to components or to prevent removal of components for servicing.

.9 Provide refrigerant isolation valves on heat recovery box ports that connect to other heat recovery boxes or outdoor condensing units.

.10 Components / Piping:

.1 Installing contractor shall provide and install all accessories and piping for a fully operational system. Refer to manufacturer’s installation manual for full instructions.

.2 Traps, filter driers, and sight glasses are NOT to be installed on the refrigerant piping or condensate lines.

.3 Standard ACR fittings rated for use with R410A are to be used for all connections. Proprietary manufacturer-specific appurtenances are not allowed.

.4 Refrigerant pipe shall be made of phosphorus deoxidized copper, and has two types.

.1 ACR “Annealed”: Soft copper pipe, can be easily bent with human's hand.

.2 ACR “Drawn Temper”: Hard copper pipe (Straight pipe), being stronger than Type-O pipe of the same radical thickness.

.5 The maximum operation pressure of R410A air conditioner is 4.30 MPa . The refrigerant piping should ensure the safety under the maximum operation pressure. Refer to recommend piping specifications

.6 Flare connection should follow dimensions provided in manufacturer’s installation manuals.

.7 The manufacturer service representative to visit the site at least two times at the time of refrigeration piping to observe that manufacturer installation instruction is followed by the contractor.

.11 Insulation:

.1 Refrigerant lines, as well as any valves, shall be insulated end to end with ½” closed-cell pipe insulation for piping up to 1”in diameter, or ¾” for piping 1-1/8” and larger, with a thermal conductivity no less than 0.27 BTU-in/hr sq.ft oF. If state or local codes require insulation other than that specified above, the greater insulation shall be used.

.12 Electrical:

.1 Installing contractor shall coordinate electrical requirements and connections for all power feeds with electrical contractor.

.13 Third Party Controls:

.1 Installing contractor shall coordinate all BAS/BMS control requirements and connections with controls contractor.

3.3 DRAIN PANS

.1 Install so that no water can accumulate. Arrange easy access for cleaning.

.2 Include internal or external trap for proper draining.

3.4 START-UP AND COMMISSIONING

.1 Prior to connecting equipment to condenser loop and start up, condenser water piping to be thoroughly cleaned and appropriate water treatment systems in place and operating.

.2 Have manufacturer certify installation.

.3 Have manufacturer present tests and start up units and certify performance.

.4 Submit written start-up and commissioning reports to Departmental Representative.

3.5 CLOSEOUT ACTIVITIES

.1 Manufacturer to deliver verbal and written instructions to operating personnel.

3.6 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11.

.3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 20.

.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.7 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by VRF system installation.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 This Section includes requirements for supply and installation of radiant heating units consisting of the following:

.1 Baseboard radiation

.2 Wall fin radiation

.3 Convectors

.4 Unit heaters

.5 Unit ventilators

.6 Radiant ceiling panels

.7 Related accessories and specialties

1.2 RELATED REQUIREMENTS

.1 Section 09 21 16 – Gypsum Board Assemblies: Sound rating materials for fin radiation units penetrating sound rated wall systems edge trims and profiles for support of radiant panels in suspended gypsum board ceiling systems.

.2 Section 09 51 00 – Acoustical Panel Ceilings: Edge trims and profiles for support of radiant panels in suspended acoustic panel ceiling systems.

.3 Section 20 05 10 – Pipe and Pipe Fittings for Mechanical Systems

.4 Section 20 05 23 – Valves for Mechanical Systems

.5 Section 20 07 00 – Piping and Equipment Insulation for Mechanical Systems

1.3 REFERENCE STANDARDS

.1 American National Standards Institute (ANSI):

.1 ANSI/AHRI 410-2001, Forced-Circulation Air-Cooling and Air-Heating Coils

1.4 ADMINISTRATIVE REQUIREMENTS

.1 Coordination: Coordinate work of this Section with work associated with wall and ceiling construction for compatible materials and functioning systems ; coordinate with architectural reflected ceiling drawings and room finish schedules to determine location, quantity and finish of radiant panels, and placement of trims and mouldings for support of radiant panels.

1.5 SUBMITTALS

.1 Provide required information in accordance with Section 01 33 00 – Submittal Procedures.

.2 Action Submittals: Provide the following submittals before starting any work of this Section:

.1 Product Data: Submit copies of manufacturer's standard product literature and data sheets indicating finishes, product characteristics, performance criteria and limitations of installation and include following for unit heaters:

.1 Filters, fan accessibility

.2 Suspension, Anchoring of cabinet

.3 Physical size

.4 Thermostat, transformer, controls where integral

.5 Replacement data for motor element

.6 Finish

.7 kW rating, voltage, phase

.8 Cabinet material thicknesses

.2 Shop Drawings:

.1 Unit Heaters: Submit Shop Drawings indicating installation and the following:

.1 Equipment, capacity and piping connections

.2 Dimensions, internal and external construction details, recommended method of installation with proposed structural steel support, sizes and location of mounting bolt holes

.2 Radiation and Radiant Panels: Submit shop drawings indicating layouts and complete details of areas where are required including the following:

.1 Coordinate shop drawings with interferences arising from work of adjacent construction

.2 Indicate locations of supply and return hook-ups

.3 Interconnection details between each zone

.4 Dimensions, internal and external construction details, recommended method of installation with proposed structural steel support, sizes and location of mounting bolt holes

.5 Special enclosures

.3 Schedules:

.1 Radiation: Submit schedule of radiation heating Elements and enclosures; indicate length and number of pieces of element and enclosure; corner pieces; end caps; cap strips; access doors; pilaster covers, and a comparison of specified heat required to actual heat output provided.

.2 Radiant Panels: Submit schedule of radiant panels indicating location, size, and comparison of specified heat required to actual heat output provided.

.4 Samples: Submit 1200 mm length of radiation enclosure and radiant panel module, and additional components indicating securing methods to structure and connection to adjacent enclosures and panels.

1.6 QUALITY ASSURANCE

.1 Qualifications: Provide proof of qualifications when requested by Departmental Representative:

.1 Manufacturer: Obtain products from manufacturers that are regularly engaged in manufacture of specified units and having catalogue performance data and certified test data confirming performance for installed products.

.2 Installer: Perform installation using personnel experienced in work of similar extent and complexity as that indicated for this project.

Part 2 Products

2.1 PERFORMANCE REQUIREMENTS

.1 Refer to equipment schedules.

2.2 UNIT HEATER UNITS

.1 Unit Heaters:

.1 Coils: Seamless copper tubing, nominal minimum 0.5 mm wall thickness, silver brazed to steel headers, with evenly spaced aluminum fins mechanically bonded to tubing.

.2 Casing: Nominal minimum 1.2 mm steel with threaded connections for hanger rods.

.3 Fan: Direct drive propeller type, statically and dynamically balanced. Horizontal models complete with sleeve bearings and fan guard; vertical models complete with grease lubricated ball bearings.

.4 Wiring: Factory installed, CSA approved.

.5 Enclosure Finish: Factory apply baked primer coat on metal surfaces of enclosure or cabinet of all baseboard, wall fin, convectors, unit heaters, cabinet unit heaters and unit ventilators; colour white.

.2 Cabinet Unit Heaters:

.1 Coils: Evenly spaced aluminum fins mechanically bonded to copper tubes, designed for maximum operating limits of 1380 kPa.

.2 Cabinet: Nominal minimum 1.2 steel with rounded exposed corners and edges, easily removed panels, glass fibre insulation, integral air outlet and inlet grilles.

.3 Fans: Centrifugal forward curved double width wheels, statically and dynamically balanced, direct driven on sleeve bearings resiliently mounted, having three speed solid state motor switches supplied by mechanical wired by electrical; include split capacitor motors.

.4 Wiring: Factory installed, CSA approved.

.5 Filters: Easily removed 25 mm thick glass fibre throw-away or permanent washable type filtering air before coil.

.6 Enclosure Finish: Factory apply baked primer coat on metal surfaces of enclosure or cabinet of all baseboard, wall fin, convectors, unit heaters, cabinet unit heaters and unit ventilators; colour coordinate with interior design.

2.3 RADIANT CEILING PANEL HEATING UNITS

.1 Active Radiant Panels: Fabricated from nominal minimum 2.7 mm thick extruded aluminum non-perforated face plate with; having nominal 13 mm diameter copper tubing mechanically bonded to face plate using aluminum saddle clip extending greater than half way around tube diameter, with non-hardening conductive paste placed between copper tubing and aluminum face plate; use of adhesive or clips to attach copper tubing will not be acceptable and as follows:

.1 Non-Active Panels: Matching active radiant panels in appearance, configuration and backing insulation materials

.2 Face Plate Profile: V-Grooved

.3 Configuration: Linear, double pass type, mounted at exterior perimeter of areas Modular, multiple pass type, mounted within suspended ceiling grid.

.2 Backing Insulation: Foil backed to prevent fibre erosion in plenum spaces, minimum 25 mm thickness x 48 kg/m^3 glass fibre semi-rigid insulation board having a nominal KSI 0.072 W/m-°C, meeting requirements of ULC S702, refer to Section 20 07 00 for additional information.

.3 Finish: Manufacturer's standard white color, with silk screen pattern to mimic acoustic ceiling panel finish; refer to Section 09 06 00 – Schedule of Finishes where multiple finish configurations are required].

2.4 ACCESSORIES

.1 Provide all necessary piping and piping connections, control valves, piping connections, trims and accessories required to install radiant panels in ceilings specified for project; coordinate with architectural finishes and provide all required accessories and trim to finishing trades, coordinate with Section 20 05 10 and Section 20 05 23 for additional information.

Part 3 Execution

3.1 INSTALLATION

.1 Contractor shall consider purchasing pre-assembled shut-off and automatic balancing valve kits. Requirement for automatic balancing valve remains even if contractor chooses to field assemble all connections.

.2 Provide each terminal heat transfer unit with shut-off valve on supply and automatic balancing valve on return piping.

.3 Provide each unit at high points with easily accessible manual air vent. If not easily accessible, extend vent to exterior surface of cabinet for easy servicing.

.4 Copper tube elements to be joined by sweat solder joints using 95-5 solder for working pressure of 345 kPa and less, and silver brazing for higher pressures.

.5 Grade piping to allow for air elimination. Radiant Ceiling Panels are to be installed with extreme care and caution so as not to soil the panel face. Panel supplier is to provide adequate instructions to all contractors involved of proper installation procedures and reflected ceiling drawings showing location of all panels.

.6 Do not install finished ceiling surface panels and/or sound absorbing element until all glazing has been completed and all exterior openings are closed in.

.7 All heating system piping shall be thoroughly cleaned, flushed, drained and refilled before radiant panels are connected to the system.

.8 Submit complete (scale) drawings showing layouts, interconnections and circuiting details for areas where radiant panels are indicated. These drawings shall be coordinated with and interference shall be cleared with other trades. Shop drawings shall indicate locations of supply and return hook-ups in addition to interconnection details for each zone.

.9 Radiant panels shall run continuous from wall-to-wall and shall be field trimmed to length, ensuring adequate expansion allowance while maintaining panel end coverage by architectural mouldings. Inactive filler panels will be permitted only where indicated on drawings.

.10 Interconnecting of radiant panels by the mechanical contractor shall consist of 12.7 mm OD (9.5 mm nominal) Type "L", soft copper tubing or other devices as recommended by the manufacturer (i.e. 360 deg. interconnecting loops and 180 deg. return U-bends). Multiple panels shall be circuited to ensure serpentine flow over complete length of zone. Individual serpentine panels coils connected in series are unacceptable for multiple-panel zones, except where noted otherwise in mechanical drawings.

.11 Test data to be based on a panel installed in ceiling with 21°C ambient air temperature and 19.5°C AUST (average unheated surface temperature), with natural convection. Certified test data shall clearly indicate AUST.

END OF SECTION

1.1 GENERAL

1.2 SUMMARY

.1 This section includes the requirements for variable frequency drives (VFD).

.2 Scope of work is to provide variable frequency drives complete with controls for equipment as identified in the motor schedule.

.3 Coordination with Contractor, delivery dates, equipment start up and technical support for the installing contractor.

1.3 REFERENCE STANDARDS

.1 American National Standards Institute (ANSI)

.2 Institute of Electrical and Electronics Engineers (IEEE):

.1 IEEE 519-1992, IEEE Recommended Practices and Requirements for Harmonic Control in Electrical Power Systems

.3 Canadian Standards Association (CSA):

.1 CSA C22.1-09, Canadian Electrical Code, Part I (21st Edition), Safety Standard for Electrical Installations

.2 CAN3 Z299.3-85 (R2006), Quality Assurance Program - Category 3

.4 National Electrical Manufacturers Association (NEMA):

.1 NEMA MG2-2007 Safety Standard for Construction and Guide for Selection, Installation, and Use of Electric Motors and Generators

.2 NEMA 250-2008, Enclosures for Electrical Equipment (1000 Volts Maximum)

1.4 DESIGN REQUIREMENTS

.1 Design adjustable frequency controller to operate standard squirrel cage induction motor with a 1.15 SF; with harmonic loading not exceeding a motor service factor of 1.0.

.2 The drives shall be BTL certified controller. Contractor to provide all BACnet input and output variables.

1.5 QUALITY ASSURANCE

.1 Factory Testing:

.1 VFD units are to be factory tested, including a full load heat run test, prior to shipment.

.2 Provide certified copies of production test results required by CSA and NEMA, prior to acceptance of the equipment.

.2 Field Testing:

.1 The VFD supplier shall provide on site startup, fine tuning, commissioning and operator training.

.2 Allow for all costs and labour for as many trips as necessary to complete requirements.

.3 Conduct harmonic analysis of VFD units upon completion of fine tuning and commissioning phase of the installation for both input and output voltages and current. The harmonic analysis is to be conducted at 50%, 75% and 100% speed under normal load conditions and perform a Fourier (FFT) transform analysis spectrum for each waveform covering the fundamental to the 50th harmonic for each VFD on this project.

.4 Should the waveform analysis indicate that either the input or output voltage and current levels exceed NEMA Standard for electric motors and IEEE 519, the VFD supplier shall provide all the necessary line filtering equipment to correct the harmonic distortion. The VFD supplier shall include all associated costs for line filtering equipment in the tender price.

.3 Provide certified copies of all production test results required by CSA and NEMA.

1.6 SUBMITTALS

.1 Provide required information in accordance with Section 01 33 00 – Submittal Procedures.

.2 Full shop drawings of all equipment to be submitted for review prior to manufacture.

.3 Provide as built shop drawings for each unit upon completion of installation.

.4 Contractor to provide all BACnet input and output variables.

Part 2 Products

2.1 MANUFACTURERS

.1 Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include; but are not limited to, the following:

.1 ABB

.2 Graham/Danfoss

.3 Siemens

2.2 DESIGN REQUIREMENTS

.1 Design adjustable frequency controller to operate standard squirrel cage induction motor with a 1.15 SF; with harmonic loading not exceeding a motor service factor of 1.0.

2.3 DESCRIPTION

.1 Variable speed controller shall be electronic adjustable frequency and voltage output unit. The variable frequency drive shall be PWM type. All units shall be CSA approved and manufactured to CSA Z299.3.

.2 The drive shall be rated for continuous duty while operating a NEMA design induction motor of the sizes and operating voltages as shown in the following schedules and indicated on the drawings. Drive output shall be sized for a 1.15 motor service factor.

The VFD shall have a current rating at least 10% in excess of the motor full load amp rating. An overload service factor of 110% for thirty minutes or 150% for one minute duty must be supplied to ensure adequate safety margins.

.3 The VFD shall have a fixed bridge type converter (PWM) with a minimum of a 98% input displacement power factor over a 10 to 100% speed range. The efficiency shall be a minimum of 97% for all inverters when operated at full speed and load.

.4 Input voltage shall be as indicated on motor schedules and drawings, line voltage variation (±10%). Line frequency variation ±5%. Vary output voltage with motor speed to nominal motor voltage. Modulate output speed through a 10:1 range. Speed stability shall be ±1%. Drive shall match torque characteristic of load.

.5 Input frequency setting signal will be an isolated 4 to 20 mA DC. Output speed monitoring signal shall be galvanic isolated 4 to 20 mA DC. The VFD shall come with An integral BTL (BACnet Testing Laboratory) certified interface controller.

.6 Provide drive with individual NEMA Type 1 enclosure, drip proof suitable for wall or free standing installation. Forced air cooled enclosures shall have filters on all air inlet openings. Filter media is to be chemical treated. Tackifier type.

.7 Colour: Colour of VFD unit to be selected by Departmental Representative during shop drawing submission process.

.8 Protective devices to be incorporated are:

.1 3 pole MCB to provide overcurrent protection set at not more than 150% of drive input rating for a given motor size. Molded case breaker shall have (30) kA IC symmetrical rating to be coordinated with drive's electronic protection circuits. Circuit Breaker to have lock-off facilities. Confirm IC symmetrical rating as noted on drawings.

.2 Fast acting electronic circuit board protective fuses for protection of electronic components.

.3 Line filter in the drive input to protect electronic components from transient voltage conditions.

.4 Integral electronic motor overload protection adjustable up to 150% of motor rating for 60 seconds.

.5 Overcurrent instantaneous trip 250%.

.6 Short-circuit protection.

.7 Ground fault protection.

.8 Overvoltage DC bus monitor/protection.

.9 Undervoltage protection.

.10 Loss of phase and phase unbalance protection.

.11 Inverter over-temperature protection.

.12 Capable of running without motor.

.13 Output filter package to limit motor voltage to 1200 volts maximum, at motor terminals.

.14 Long lead (motor feeder) filter package.

.15 Thermister relay(s) as required.

.16 BACnet Compatibility.

.9 Operation Features:

.1 Regenerative braking.
.2 Fault shutdown.
.3 Automatic restart following power outage.
.4 Ability to disconnect motor load for setup or trouble.
.5 Manual speed control potentiometer.
.6 Adjustable maximum and minimum speed.
.7 Acceleration and deceleration time adjustment.
.8 Controller “stop” interlock from a NC dry contact.
.9 Hand/Off/Auto selection switch or key pad.
.10 Drive fault contact (Form C).
.11 Stop/start push buttons or key pad.
.12 Standard bypass.
.13 Transient voltage protection.
.14 Space heater.
.15 Provide seven (7) dry “c” type contacts programmable for any combination of the following:
.1 Running (output frequency being generated).
.2 Fault lockout.
.3 Stopped.
.4 Overspeed.
.5 At speed.
.6 Under speed.
.7 Forward/Reverse.
.8 Low reference.
.9 Manual/Auto Mode.
.10 Local/Remote Mode.
.16 Soft Start sequence.

.10 Environmental capabilities: The drive shall operate without mechanical or electrical damage under any combination of conditions as follows:

.1 Ambient temperature -0° to 40°C.
.2 Humidity 0 to 90% (non condensing).
.3 Vibration up to 0.5 G.
.4 Altitude 0 to 1000 m.

.11 Diagnostic and indicating features:

.1 Power ON indication.
.2 Percentage speed indicator.
.3 Overload indication.
.4 Short circuit indication.
.5 Ground fault indication.
.6 Overvoltage indication.

.7 Undervoltage indication.

.8 High temperature (controller).

.9 AC voltmeter (output).

.10 AC ammeter (output).

.11 Inverter ready.

.12 Inverter fault.

.13 External fault.

.12 Cooling System:

.1 VFD Supplier to provide adequate cooling devices for VFD equipment.

.13 Emergency Distribution:

.1 The VFD may be supplied from an emergency distribution system which is subjected to a short power interruptions during test of the emergency generator system. The VFD shall be designed to continuously operate through this test mode.

.2 VFD suppliers shall verify that this condition will not cause damage to their equipment and that they will be able to ride-through this disturbance without any operational shutdowns.

.14 Control wiring shall be TEW 105°C rise.

.15 Terminal blocks for remote interface.

.16 Provide wire markers at both ends of all control wires.

.17 Note that shop drawings must clearly indicate all standard and optional features allowed for in this specification.

.18 Drive components to be flush mounted in free-standing enclosure, front cover includes:

.1 Disconnect operator.

.2 Power ON indicator.

.3 Percent speed indicator.

.4 Selector switch (HOA) or key pad entry.

.5 Manual speed adjust potentiometer or key pad entry.

.6 Fault indicator.

.19 Maintenance:

.1 VFD supplier shall provide four copies of operation and maintenance manuals.

.2 Operation and maintenance manuals are to include a list of authorized service depots, spare parts lists and recommended spare parts.

.3 VFD supplier is to include a preventative maintenance program (PMP) for a one year period. The PMP is to be broken down to daily, weekly, monthly and annual service periods. Each service period is to include all manufacturer recommended maintenance tasks which should be completed in each period. A maintenance check list is to be cross referenced to the maintenance period and maintenance task.

.20 Warranty:

.1 The VFD supplier shall provide warranty coverage for a period of twelve (12) months upon the contractor being granted Final Acceptance and the warranty period has commenced.

.2 VFD supplier shall be responsible for all costs during the warranty period for materials, design, labour and installation costs for installation of harmonic, EMI or RFI filters required to prevent interference to any other equipment on the project which is caused by the operation of the VFD's.

.3 VFD supplier shall be responsible for electric motor failures costs such as rewinding, replacement, labour and expenses for electric motors which fail after they have been terminated to a VFD during the warranty period.

Part 3 Execution

3.1 GENERAL

.1 The Contractor will provide the VFD manufacturer an as built of each motor application. Motor application data will include the following:

.1 Motor Manufacturer.

.2 Class.

.3 Motor Model Number.

.4 Motor Serial Number.

.5 Motor Frame.

.6 Motor H.P. (KW).

.7 Motor F.L.A.

.8 Motor Conductor Size.

.9 Ground Conductor.

.10 Length of Conductors from MCL to Motor.

.11 MCC Manufacturer.

.12 Motor MCP and Overload.

3.2 INSTALLATION

.1 Division 26 - Electrical shall extend analog input signal cable, analog speed indicating output cable, shutdown contact and drive fault contact from the drive to the MCC control terminal section. Analog cable shall be No. 16 shielded twisted pair cable.

.2 Division 23 - Mechanical shall be responsible for complete commissioning of each variable speed drive to satisfaction of Departmental Representative. Division 23 - Mechanical shall allow for factory representative to completely calibrate all drive circuits after installation on site.

END OF SECTION

Part 1 GENERAL

1.1 SUMMARY

.1 Section Includes.

.1 Methods and procedures for start-up, verification and commissioning, for building Energy Monitoring and Control System (EMCS) and includes:

.1 Start-up testing and verification of systems.

.2 Check out demonstration or proper operation of components.

.3 On-site operational tests.

.2 Related Sections.

.1 Section 25 05 01 - EMCS: General Requirements.

1.2 DEFINITIONS

.1 For additional acronyms and definitions refer to Section 25 05 01.

.2 AEL: ratio between total test period less any system downtime accumulated within that period and test period.

.3 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 Confirm with Departmental Representative that Design Criteria and Design Intents are still applicable.

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

1.4 SUBMITTALS

.1 Submittals in accordance with Section 01 33 00.

.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 in accordance with Section 01 78 00.

.5 Recommend additional changes and/or modifications deemed advisable in order to improve performance, environmental conditions or energy consumption.

1.5 CLOSEOUT SUBMITTALS

.1 Provide documentation, O&M Manuals, and training of O&M personnel for review of Departmental Representative before interim acceptance in accordance with Section 01 78 00.

1.6 COMMISSIONING

.1 Do commissioning in accordance with Section 01 91 00.

.2 Carry out commissioning under direction of Departmental Representative and in presence of Departmental Representative.

.3 Inform, and obtain approval from, Departmental Representative in writing at least 14 days prior to commissioning or each test. Indicate:

.1 Location and part of system to be tested or commissioned.

.2 Testing/commissioning procedures, anticipated results.

.3 Names of testing/commissioning personnel.

.4 Correct deficiencies, re-test in presence of Departmental Representative until satisfactory performance is obtained.

.5 Acceptance of tests will not relieve Contractor from responsibility for ensuring that complete systems meet every requirement of Contract.

.6 Load system with project software.

.7 Perform tests as required.

1.7 COMPLETION OF COMMISSIONING

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

1.8 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. Provide two-way radios.

.2 Instrumentation accuracy tolerances: 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, readily accessible and readable.

.5 Application: to conform to normal industry standards.

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 Departmental Representative.

.4 Debug system software.

.5 Optimize operation and performance of systems by fine-tuning PID values and modifying CDLs as required.

.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 Pre-Installation Testing.

.2 General: consists of field tests of equipment just prior to installation.

.3 Testing may be on site or at Contractor's premises as approved by Departmental Representative.

.4 Configure major components to be tested in same architecture as designed system. Include BECC equipment and 2 sets of Building Controller's including MCU's, LCU's, and TCU's.

.5 Equip each Building Controller with sensor and controlled device of each type (AI, AO, DI, DO).

.6 Additional instruments to include:

.1 DP transmitters.

.2 VAV supply duct SP transmitters.

.3 DP switches used for dirty filter indication and fan status.

.7 In addition to test equipment, provide inclined manometer, digital micro-manometer, milli-amp meter, source of air pressure infinitely adjustable between 0 and 500 Pa, to hold steady at any setting and with direct output to milli-amp meter at source.

.8 After setting, test zero and span in 10 % increments through entire range while both increasing and decreasing pressure.

.9 Departmental Representative to mark instruments tracking within 0.5% in both directions as "approved for installation".

.10 Transmitters above 0.5% error will be rejected.

.11 DP switches to open and close within 2% of setpoint.

.2 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 Verify each A-to-D convertor.

.3 Test and calibrate each AI using calibrated digital instruments.

.4 Test each DI to ensure proper settings and switching contacts.

.5 Test each DO to ensure proper operation and lag time.

.6 Test each AO to ensure proper operation of controlled devices. Verify tight closure and signals.

.7 Test operating software.

.8 Test application software and provide samples of logs and commands.

.9 Verify each CDL including energy optimization programs.

.10 Debug software.

.11 Blow out flow measuring and static pressure stations with high pressure air at 700 kPa.

.12 Provide point verification list in table format including point identifier, point identifier expansion, point type and address, low and high limits and engineering units. Include space on commissioning technician and Departmental Representative. 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 Two (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 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 24 hour 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.

.5 Departmental Representative to verify reported results.

3.3 ADJUSTING

.1 Final adjusting: 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 in accordance with Section 01 79 00.

END OF SECTION

Part 1 GENERAL

1.1 SUMMARY

.1 Section Includes.

.1 Requirements and procedures for training program, instructors and training materials, for building Energy Monitoring and Control System (EMCS) Work.

.2 Related Sections.

.1 Section 25 05 01 - EMCS: General Requirements.

1.2 DEFINITIONS

.1 CDL - Control Description Logic.

.2 For additional acronyms and definitions refer to Section 25 05 01.

1.3 SUBMITTALS

.1 Submittals in accordance with Section 01 33 00, supplemented and modified by requirements of this Section.

.2 Submit training proposal complete with hour-by-hour schedule including brief overview of content of each segment to Departmental Representative 30 days prior to anticipated date of beginning of training.

.1 List name of trainer, and type of visual and audio aids to be used.

.2 Show co-ordinated interface with other EMCS mechanical and electrical training programs.

.3 Submit reports within one week after completion of Phase 1 and Phase 2 training program that training has been satisfactorily completed.

1.4 QUALITY ASSURANCE

.1 Provide competent instructors thoroughly familiar with aspects of EMCS installed in facility.

.2 Departmental Representative reserves right to approve instructors.

1.5 INSTRUCTIONS

.1 Provide instruction to designated personnel in adjustment, operation, maintenance and pertinent safety requirements of EMCS installed.

.2 Training to be project-specific.

1.6 TIME FOR INSTRUCTION

.1 Number of days of instruction to be as specified in this section (1 day = 8 hours including two 15 minute breaks and excluding lunch time).

1.7 TRAINING MATERIALS

.1 Provide equipment, visual and audio aids, and materials for classroom training.

.2 Supply manual for each trainee, describing in detail data included in each training program.

.1 Review contents of manual in detail to explain aspects of operation and maintenance (O&M).

1.8 TRAINING PROGRAM

.1 To be in 2 phases over 6 month period.

.2 Phase 1: 2 day program to begin before 30 day test period at time mutually agreeable to Contractor, Departmental Representative.

.1 Train O&M personnel in functional operations and procedures to be employed for system operation.

.2 Supplement with on-the-job training during 30 day test period.

.3 Include overview of system architecture, communications, operation of computer and peripherals, report generation.

.4 Include detailed training on operator interface functions for control of mechanical systems, CDL's for each system, and elementary preventive maintenance.

.3 Phase 2: 3 day program to begin 8 weeks after acceptance for operators, equipment maintenance personnel and programmers.

.1 Provide multiple instructors on pre-arranged schedule. Include at least following:

.1 Operator training: provide operating personnel, maintenance personnel and programmers with condensed version of Phase 1 training.

.2 Equipment maintenance training: provide personnel with 1 days training within 1 day period in maintenance of EMCS equipment, including general equipment layout, trouble shooting and preventive maintenance of EMCS components, maintenance and calibration of sensors and controls.

.3 Programmers: provide personnel with 2 days training within 3 day period in following subjects in approximate percentages of total course shown:

.1 Software and Architecture: 10%

.2 Application Programs: 15%

.3 Controller Programming: 20%

.4 Troubleshooting and Debugging: 40%

.5 Colour Graphic Generation: 15%

1.9 ADDITIONAL TRAINING

.1 List courses offered by name, duration and approximate cost per person per week. Note courses recommended for training supervisory personnel.

1.10 MONITORING OF TRAINING

.1 Departmental Representative to monitor training program and may modify schedule and content.

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 SUMMARY

.1 Related Sections:

.1 Section 09 91 99 – Painting for Minor Works

.2 Section 25 05 02 - EMCS: Shop Drawings, Product Data and Review Process.

.3 Section 25 05 54 - EMCS: Identification.

.4 Section 25 30 01 – EMCS: Building Controllers

.5 Section 25 90 01 - EMCS: Site Requirements Applications and Systems Sequences of Operation.

1.2 REFERENCES

.1 American National Standards Institute (ANSI)/The Instrumentation, Systems and Automation Society (ISA).

.1 ANSI/ISA 5.5-1985, Graphic Symbols for Process Displays.

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

.1 ASHRAE STD 135-2012, BACnet - A Data Communication Protocol for Building Automation and Control Networks.

.3 Canadian Standards Association (CSA International).

.1 CAN/CSA-Z234.1-00(R2011), Metric Practice Guide. (Withdrawn)

.4 Consumer Electronics Association (CEA).

.1 CEA-709.1-C-2010 (ANSI), Control Network Protocol Specification.

.5 Department of Justice Canada (Jus).

.1 Canadian Environmental Assessment Act (CEAA), 1995, c. 37.

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

.6 Electrical and Electronic Manufacturers Association (EEMAC).

.1 EEMAC 2Y-1-1958, Light Gray Colour for Indoor Switch Gear.

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

.1 Material Safety Data Sheets (MSDS).

.8 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).

.9 Transport Canada (TC).

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

1.3 ACRONYMS AND ABBREVIATIONS

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

.41 USB - Universal Serial Bus.

.42 UPS - Uninterruptible Power Supply.

.43 VAV - Variable Air Volume.

1.4 DEFINITIONS

.1 Point: may be logical or physical.

.1 Logical points: values calculated by system such as setpoints, totals, counts, derived corrections and may include, but not limited to result of and statements in CDL's.

.2 Physical points: inputs or outputs which have hardware wired to controllers which are measuring physical properties, or providing status conditions of contacts or relays which provide interaction with related equipment (stop, start) and valve or damper actuators.

.2 Point Name: composed of two parts, point identifier and point expansion.

.1 Point identifier: comprised of three descriptors, "area" descriptor, "system" descriptor and "point" descriptor, for which database to provide 25 character field for each point identifier. "System" is system that point is located on.

.1 Area descriptor: building or part of building where point is located.

.2 System descriptor: system that point is located on.

.3 Point descriptor: physical or logical point description. For point identifier "area", "system" and "point" will be shortforms or acronyms. Database must provide 25 character field for each point identifier.

.2 Point expansion : comprised of three fields, one for each descriptor. Expanded form of shortform or acronym used in "area", "system" and "point" descriptors is placed into appropriate point expansion field. Database must provide 32 character field for each point expansion.

.3 Bilingual systems to include additional point identifier expansion fields of equal capacity for each point name for second language.

.1 System to support use of numbers and readable characters including blanks, periods or underscores to enhance user readability for each of the above strings.

.3 Point Object Type: points fall into following object types:

.1 AI (analog input).

.2 AO (analog output).

.3 DI (digital input).

.4 DO (digital output).

.5 Pulse inputs.

.4 Symbols and engineering unit abbreviations utilized in displays: to ANSI/ISA 5.5.

.1 Printouts: to ANSI/IEEE 260.1.

.2 Refer also to Section 25 05 54.

1.5 SYSTEM DESCRIPTION

.1 The existing controls system at the Grand Valley Institute for Women (GVI) is required to be upgraded and the newer control systems that have been installed since the original construction integrated into a new Building Automation System. Scope of work to be completed by Contractor is as follows:

.1 Install new controls for Public Entrance Building and renovations within Wing A of the main GVI Building.

.2 Replace existing Barber-Colman Network 8000 controllers as indicated on mechanical drawings within the GVI facility.

.3 Replace existing sensors as indicated on mechanical drawings.

.4 Integrate additional control points indicated within drawings and specifications within the GVI campus onto the new BAS.

.5 Provide new OWS (software and hardware). OWS to be based on the Niagara Framework platform by Tridium.

.6 Integrate existing Institutional Food Services and Stores Building (IFSS) BAS onto the new BAS.

.1 Existing controllers and devices are to be reused.

.2 Contractor is to map existing points to new OWS

.3 Sequences and programming of the existing IFFS controllers is to remain as existing.

.4 The existing IFSS system is a Johnson Controls FX Supervisory controller operating on the Tridium Niagara Software using the BACnet IP communication protocol.

.7 This Contractor is permitted to reuse existing controllers and devices if such devices are able to be integrated into the new BAS. If such devices cannot be reliably integrated they must be replaced as part of this contract. Contractor to confirm in writing to Departmental Representative within 2 weeks of award of contract how the existing devices are proposed to be used within the new BAS and how they will be integrated. Contractor is to include price for replacement of existing controllers that are permitted to be reused at the time of bid submission if they are required to be replaced as part of the contractors proposed BAS.

.8 Building and systems must remain fully functional during controls replacement. All new controllers are to operate under stand alone control until such a time they can be reliable integrated onto the new BAS without interfering with the operation of the existing BAS. Coordinate equipment shut-downs with Departmental Representative. All controllers to be installed, programmed, tested, and operated to minimize equipment downtime.

.2 Refer to mechanical floor plans, mechanical schematics and details, Section 25 90 01 and individual sections referenced within for overview of system and further detail on individual components.

.3 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.

.4 Design Requirements:

.1 This division will be responsible for conductors and cables, and grounding and bonding associated with the installation of the control system that are consistent with project requirements and listed regulatory requirements.

.2 This division will be responsible for the following scope of work. This list is not exhaustive and it is the responsibility of the Contractor to ensure that all work defined within the Contract Documents and coordinated.

.1 All 24V or other low voltage wiring, conduit, final connections, junction boxes, etc. required for any mechanical device and for controls system.

.2 All 120V wiring, conduit, final connections, junction boxes, etc. required for any mechanical controls and system. Coordinate required circuits from available circuit panels with Division 26.

.3 Provide and install any/all 120V to 24V step down controllers required for control of mechanical systems.

.4 Mounting and programming of VFD drives. Line side power wiring is by Division 26.

.5 Reviewing all mechanical shop drawings that contain controllers to ensure that they will be compatible with BACnet based BAS and wiring design.

.3 Supply sufficient programmable controllers of types to meet project requirements. Quantity and points contents as reviewed by Departmental Representative prior to installation.

.4 Existing control system is a Barber-Colman Network 8000 DDC BAS. All existing Barber-Colman controllers are to be replaced along with the existing operators work station (software and hardware). Contractor can re-use non-Barber-Colman controllers and gateways that have been added since the original construction at their own discretion. Contractor takes full responsibility for existing controllers if re-used and must provide a fully functioning system.

.5 Location of controllers as reviewed by Departmental Representative prior to installation.

.6 Provide utility power to EMCS as indicated. Coordinate with electrical contractor.

.7 Metric references: in accordance with CAN/CSA Z234.1 (withdrawn).

.5 Language Operating Requirements:

.1 Provide English operator selectable access codes.

.2 Use non-linguistic symbols for displays on graphic terminals. Other information to be in English.

.3 Operating system executive: provide primary hardware-to-software interface specified as part of hardware purchase with associated documentation to be in English.

.4 System manager software: include in English system definition point database, additions, deletions or modifications, control loop statements, use of high level programming languages, report generator utility and other OWS utilities used for maintaining optimal operating efficiency.

.5 Include, in English:

.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-definements).

.2 Graphic "display" functions, point commands to turn systems on or off, manually override automatic control of specified hardware points.

.3 Point name expansions in both languages.

.4 Reporting function such as trend log, trend graphics, alarm report logs, energy report logs, maintenance generated logs.

1.6 SUBMITTALS

.1 Make submittals in accordance with Section 01 33 00 and 25 05 02.

.2 Submit for review:

.1 Equipment list and systems manufacturers within 30 days after award of contract.

.3 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. 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 Have local office within 50 km of project staffed by trained personnel capable of providing instruction, routine maintenance and emergency service on systems,

.2 Provide record of successful previous installations submitting bid showing experience with similar installations utilizing computer-based systems.

.3 Have access to local supplies of essential parts and provide 7 year guarantee of availability of spare parts after obsolescence.

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

.5 Health and Safety:

.1 Do construction occupational health and safety in accordance with Section 01 35 36.

1.8 DELIVERY, STORAGE AND HANDLING

.1 Material Delivery Schedule: provide Departmental Representative with schedule within 4 weeks after award of Contract.

.2 Waste Management and Disposal:

.1 Separate waste materials for reuse and recycling in accordance with Section 01 74 20.

.2 Remove from site and dispose of packaging materials at appropriate recycling facilities.

.3 Collect and separate for disposal paper, plastic, polystyrene, corrugated cardboard, packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.

.4 Separate for reuse and recycling and place in designated containers Steel, Metal, Plastic waste in accordance with Waste Management Plan.

.5 Place materials defined as hazardous or toxic in designated containers.

.6 Handle and dispose of hazardous materials in accordance with CEPA, TDGA, Regional and Municipal regulations.

.7 Label location of salvaged material's storage areas and provide barriers and security devices.

.8 Ensure emptied containers are sealed and stored safely.

.9 Divert unused metal materials from landfill to metal recycling facility as approved by Departmental Representative.

.10 Fold up metal and plastic banding, flatten and place in designated area for recycling.

1.9 EXISTING CONDITIONS - CONTROL COMPONENTS

.1 Contractor is to utilize existing control wiring and piping if in good working order.

.2 Re-use field control devices that are usable in their original configuration.

.1 Do not modify original design of existing devices without written permission from Departmental Representative.

.2 Provide for new, properly designed device where re-usability of components is uncertain.

.3 Controls contractor is to re-use existing communication BUS' within Main GVI building for controls replacement.

.1 One BUS extends from ST-01 to the top floor of the Intensive Intervention Unit. This bus is a RS-485, shielded twisted wire (two wire) communication bus that is daisy chained from the GCM in ST-01 to all of the VAV box controllers and newer microzone controllers. Refer to mechanical drawings for system architecture schematic.

.2 A second BUS goes from ST-08, out to the Standard Living Environment (SLE), and back to ST-01 to connect to the GCM. This bus is a RS-485, shielded twisted wire (two wire) communication bus that is daisy chained to all of the local control modules LCM. Refer to mechanical drawings for system architecture schematic.

.4 Inspect and test existing devices and wiring (communication bus) intended for re-use within 30 days of award of contract, and prior to installation of new devices.

.1 Furnish test report within 40 days of award of contract listing each component to be re-used and indicating whether it is in good order or requires repair by Departmental Representative.

.2 Failure to produce test report will constitute acceptance of existing devices by contractor.

.5 Non-functioning items:

.1 Provide with report specification sheets or written functional requirements to support findings.

.2 Departmental Representative will repair or replace existing items judged defective yet deemed necessary for EMCS.

.6 Submit written request for permission to disconnect controls and to obtain equipment downtime before proceeding with Work.

.7 Assume responsibility for controls to be incorporated into EMCS after written receipt of approval from Departmental Representative.

.1 Be responsible for items repaired or replaced by Departmental Representative.

.2 Be responsible for repair costs due to negligence or abuse of equipment.

.3 Responsibility for existing devices terminates upon final acceptance of EMCS.

.8 Remove existing controls not re-used or not required. Place in approved storage for disposition as directed.

Part 2 PRODUCTS

2.1 EQUIPMENT

.1 Data Communication Protocol: to ASHRAE STD 135.

2.2 ADAPTORS

.1 Provide adaptors between metric and imperial components.

Part 3 EXECUTION

3.1 MANUFACTURER'S RECOMMENDATIONS

.1 Installation: to manufacturer's recommendations.

3.2 PAINTING

.1 Painting: in accordance with Section 09 91 99 , supplemented as follows:

.1 Clean and touch up marred or scratched surfaces of factory finished equipment to match original finish.

.2 Restore to new condition, finished surfaces too extensively damaged to be primed and touched up to make good.

.3 Clean and prime exposed hangers, racks, fastenings, and other support components.

.4 Paint unfinished equipment installed indoors to EEMAC 2Y-1.

END OF SECTION

Part 1 GENERAL

1.1 SUMMARY

.1 Section Includes.

.1 Methods and procedures for shop drawings submittals, preliminary and detailed review process including review meetings, for building Energy Monitoring and Control System (EMCS).

.2 Related Sections.

.1 Section 25 05 01 - EMCS: General Requirements.

.2 Section 25 01 11 - EMCS: Start-up, Verification and Commissioning.

1.2 DEFINITIONS

.1 Acronyms and definitions: refer to Section 25 05 01.

1.3 DESIGN REQUIREMENTS

.1 Preliminary Design Review: to contain following contractor and systems information.

.1 Location of local office.

.2 Description and location of installing and servicing technical staff.

.3 Location and qualifications of programming design and programming support staff.

.4 Names of contractors and site-specific key personnel.

.5 Sketch of site-specific system architecture.

.6 Specification sheets for each item including memory provided, programming language, speed, type of data transmission.

.7 Descriptive brochures.

.8 Sample CDL and graphics (systems schematics).

.9 Proof of demonstrated ability of system to communicate utilizing BACnet.

1.4 SUBMITTALS

.1 Submittals in accordance with Section 01 33 00 and coordinate with requirements in this Section.

.2 Submit preliminary design document within 30 working days after contract award, for review by Departmental Representative.

.3 Shop Drawings to consist of 3 hard copies and 1 soft copy of design documents, shop drawings, product data and software.

.4 Hard copy to be completely indexed and coordinated package to assure compliance with contract requirements and arranged in same sequence as specification and cross-referenced to specification section and paragraph number.

.5 Soft copy to be in Microsoft Word latest version format, structured using menu format for easy loading and retrieval on OWS.

1.5 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 Controller locations.
- .4 Auxiliary control cabinet locations.
- .5 Single line diagrams showing cable routings, conduit sizes, spare conduit capacity between control centre, field controllers and systems being controlled.
- .6 Valves: complete schedule listing including following information: designation, service, manufacturer, model, point ID, design flow rate, design pressure drop, required Cv, Valve size, actual Cv, spring range, pilot range, required torque, actual torque and close off pressure (required and actual).
- .7 Dampers: sketches showing module assembly, interconnecting hardware, operator locations, operator spring range, pilot range, required torque, actual torque.

1.6 DETAIL 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 Graphic system schematic displays of air and water systems with point identifiers and textual description of system, as specified.

.8 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.

.9 Listing and example of specified reports.

.10 Listing of time of day schedules.

.11 Mark up to-scale construction drawing to detail control room showing location of equipment and operator work space.

.12 Type and size of memory with statement of spare memory capacity.

.13 Full description of software programs provided.

.14 Sample of "Operating Instructions Manual" to be used for training purposes.

.15 Outline of proposed start-up and verification procedures. Refer to Section 25 01 11.

1.7 QUALITY ASSURANCE

.1 Preliminary Design Review Meeting: Convene meeting within 45 working days of award of contract to:

.1 Undertake functional review of preliminary design documents, resolve inconsistencies.

.2 Resolve conflicts between contract document requirements and actual items (e.g.: points list inconsistencies).

.3 Review interface requirements of materials supplied by others.

.4 Review "Sequence of Operations".

.2 Contractor's programmer to attend meeting.

.3 Departmental Representative retains right to revise sequence or subsequent CDL prior to software finalization without cost to Departmental Representative.

Part 2 PRODUCTS

2.1 NOT USED

.1 Not Used.

Part 3 EXECUTION

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 GENERAL

1.1 SUMMARY

.1 Section Includes.

.1 Requirements and procedures for final control diagrams and operation and maintenance (O&M) manual, for building Energy Monitoring and Control System (EMCS) Work.

.2 Related Sections.

.1 Section 25 05 01 - EMCS: General Requirements.

.2 Section 25 05 02 - EMCS: Submittals and Review Process.

.3 Section 25 01 11 - EMCS: Start-up, Verification and Commissioning.

1.2 DEFINITIONS

.1 BECC - Building Environmental Control Centre.

.2 OWS - Operator Work Station.

.3 For additional acronyms and definitions refer to Section 25 05 01.

1.3 SUBMITTALS

.1 Submittals in accordance with Section 01 78 00, supplemented and modified by requirements of this Section.

.2 Submit As-built drawings and Operation and Maintenance Manual to Departmental Representative in English.

.3 Provide soft copies and hard copies in hard-back, 50 mm 3 ring, D-ring binders.

.1 Binders to be 2/3 maximum full.

.2 Provide index to full volume in each binder.

.3 Identify contents of each manual on cover and spine.

.4 Provide Table of Contents in each manual.

.5 Assemble each manual to conform to Table of Contents with tab sheets placed before instructions covering subject.

1.4 AS-BUILTS

.1 Provide 1 copy of detailed shop drawings generated in Section 25 05 02 and include:

.1 Changes to contract documents as well as addenda and contract extras.

.2 Changes to interface wiring.

.3 Routing of conduit, wiring and control air lines associated with EMCS installation.

.4 Locations of obscure devices to be indicated on drawings.

.5 Listing of alarm messages.

.6 Panel/circuit breaker number for sources of normal/emergency power.

.7 Names, addresses, telephone numbers of each sub-contractor having installed equipment, local representative for each item of equipment, each system.

.8 Test procedures and reports: provide records of start-up procedures, test procedures, checkout tests and final commissioning reports as specified in Section 25 01 11.

.9 Basic system design and full documentation on system configuration.

.2 Submit for final review by Departmental Representative.

.3 Provide before acceptance 2 Hard and 1 soft copy incorporating changes made during final review.

1.5 O&M MANUALS

.1 Custom design O&M Manuals (both hard and soft copy) to contain material pertinent to this project only, and to provide full and complete coverage of subjects referred to in this Section.

.2 Provide 2 complete sets of hard and soft copies prior to system or equipment tests

.3 Include complete coverage in concise language, readily understood by operating personnel using common terminology of functional and operational requirements of system. Do not presume knowledge of computers, electronics or in-depth control theory.

.4 Functional description to include:

.1 Functional description of theory of operation.

.2 Design philosophy.

.3 Specific functions of design philosophy and system.

.4 Full details of data communications, including data types and formats, data processing and disposition data link components, interfaces and operator tests or self-test of data link integrity.

.5 Explicit description of hardware and software functions, interfaces and requirements for components in functions and operating modes.

.6 Description of person-machine interactions required to supplement system description, known or established constraints on system operation, operating procedures currently implemented for implementation in automatic mode.

.5 System operation to include:

.1 Complete step-by-step procedures for operation of system including required actions at each OWS.

.2 Operation of computer peripherals, input and output formats.

.3 Emergency, alarm and failure recovery.

.4 Step-by-step instructions for start-up, back-up equipment operation, execution of systems functions and operating modes, including key strokes for each command so that operator need only refer to these pages for keystroke entries required to call up display or to input command.

.6 Software to include:

.1 Documentation of theory, design, interface requirements, functions, including test and verification procedures.

.2 Detailed descriptions of program requirements and capabilities.

.3 Data necessary to permit modification, relocation, reprogramming and to permit new and existing software modules to respond to changing system functional requirements without disrupting normal operation.

.4 Software modules, fully annotated source code listings, error free object code files ready for loading via peripheral device

.5 Complete program cross reference plus linking requirements, data exchange requirements, necessary subroutine lists, data file requirements, other information necessary for proper loading, integration, interfacing, program execution.

.6 Software for each Controller and single section referencing Controller common parameters and functions.

.7 Maintenance: document maintenance procedures including inspection, periodic preventive maintenance, fault diagnosis, repair or replacement of defective components, including calibration, maintenance, repair of sensors, transmitters, transducers, controller and interface firmware's, plus diagnostics and repair/replacement of system hardware.

.8 System configuration document:

.1 Provisions and procedures for planning, implementing and recording hardware and software modifications required during operating lifetime of system.

.2 Information to ensure co-ordination of hardware and software changes, data link or message format/content changes, sensor or control changes in event that system modifications are required.

.9 Programmer control panel documentation: provide where panels are independently interfaced with BECC, including interfacing schematics, signal identification, timing diagrams, fully commented source listing of applicable driver/handler.

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 SUMMARY

.1 Section Includes.

.1 Requirements and procedures for identification of devices, sensors, wiring tubing, conduit and equipment, for building Energy Monitoring and Control System (EMCS) Work and nameplates materials, colours and lettering sizes.

.2 It is the intent of this section to have all new and existing devices, sensors, equipment, wiring and conduit that is associated with the EMCS, and is part of this work, to have the correct label and the label to be legible.

.2 Related Sections.

.1 Section 25 05 01 - EMCS: General Requirements.

1.2 REFERENCES

.1 Canadian Standards Association (CSA International).

.1 CSA C22.1-12, The Canadian Electrical Code, Part I (22nd Edition), Safety Standard for Electrical Installations.

1.3 DEFINITIONS

.1 For acronyms and definitions refer to Section 25 05 01.

1.4 SYSTEM DESCRIPTION

.1 Language Operating Requirements: provide identification for control items in English.

1.5 SUBMITTALS

.1 Submittals in accordance with Section 01 33 00 supplemented and modified by requirements of this Section.

.2 Submit to Departmental Representative for approval samples of nameplates, identification tags and list of proposed wording.

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 plastic tie.

.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 indicated on mechanical drawings, confirmed 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.

.2 Sign to read: "Caution: This equipment is under automatic remote control of EMCS" as reviewed by Departmental Representative.

2.5 WIRING

.1 Supply and install numbered tape markings on wiring at panels, junction boxes, splitters, cabinets and outlet boxes.

.2 Colour coding: to CSA C22.1. Use colour coded wiring in communications cables, matched throughout system.

.3 Power wiring: identify circuit breaker panel/circuit breaker number inside each EMCS panel.

2.6 CONDUIT

.1 Colour code EMCS conduit.

.2 Pre-paint box covers and conduit fittings.

.3 Coding: use fluorescent orange paint and confirm colour with Departmental Representative during "Preliminary Design Review".

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.

.2 Do not label nameplates within inmate areas.

3.2 EXISTING PANELS, DEVICES AND EQUIPMENT

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

.2 Existing equipment that retains its previous identifier but has an illegible nameplate or label shall be provided with a new nameplate and label so it can be easily identified in the field.

END OF SECTION

Part 1 GENERAL

1.1 SUMMARY

.1 Section Includes.

.1 Requirements and procedures for warranty and activities during warranty period, for building Energy Monitoring and Control System (EMCS).

.2 Related Sections.

.1 Section 25 05 01 - EMCS: General Requirements.

.3 References.

.1 Canada Labour Code (R.S. 1985, c. L-2)/Part I - Industrial Relations.

.2 Canadian Standards Association (CSA International).

.1 CSA Z204-94(R1999), Guidelines for Managing Indoor Air Quality in Office Buildings.

1.2 DEFINITIONS

.1 BC(s) - Building Controller(s).

.2 OWS - Operator Work Station.

.3 For additional acronyms and definitions refer to Section 25 05 01.

1.3 SUBMITTALS

.1 Submittals in accordance with Section 01 33 00.

.2 Submit detailed preventative maintenance schedule for system components to Departmental Representative.

.3 Submit detailed inspection reports to Departmental Representative.

.4 Submit dated, maintenance task lists to Departmental Representative and include the following sensor and output point detail, as proof of system verification:

.1 Point name and location.

.2 Device type and range.

.3 Measured value.

.4 System displayed value.

.5 Calibration detail

.6 Indication if adjustment required,

.7 Other action taken or recommended.

.5 Submit network analysis report showing results with detailed recommendations to correct problems found.

.6 Records and logs: in accordance with Section 01 78 00.

.1 Maintain records and logs of each maintenance task on site.

.2 Organize cumulative records for each major component and for entire EMCS chronologically.

.3 Submit records to Departmental Representative, after inspection indicating that planned and systematic maintenance have been accomplished.

.7 Revise and submit to Departmental Representative in accordance with Section 01 78 00 "As-built drawings" documentation and commissioning reports to reflect changes, adjustments and modifications to EMCS made during warranty period.

1.4 MAINTENANCE SERVICE DURING WARRANTY PERIOD

.1 Provide a 1 year warranty on parts, equipment and programming.

.2 Provide services, materials, and equipment to maintain EMCS for specified warranty period. Provide detailed preventative maintenance schedule for system components as described in Submittal article.

.3 Emergency Service Calls:

.1 Initiate service calls when EMCS is not functioning correctly.

.2 Qualified control personnel to be available during warranty period to provide service to "CRITICAL" components whenever required at no extra cost.

.3 Furnish Departmental Representative with telephone number where service personnel may be reached at any time.

.4 Service personnel to be on site ready to service EMCS within 6 hours after receiving request for service.

.5 Perform Work continuously until EMCS restored to reliable operating condition.

.4 Operation: foregoing and other servicing to provide proper sequencing of equipment and satisfactory operation of EMCS based on original design conditions and as recommended by manufacturer.

.5 Work requests: record each service call request, when received separately on approved form and include:

.1 Serial number identifying component involved.

.2 Location, date and time call received.

.3 Nature of trouble.

.4 Names of personnel assigned.

.5 Instructions of work to be done.

.6 Amount and nature of materials used.

.7 Time and date work started.

.8 Time and date of completion.

.6 Provide system modifications in writing.

.1 No system modification, including operating parameters and control settings, to be made without prior written approval of Departmental Representative.

Part 2 PRODUCTS

2.1 NOT USED

.1 Not Used.

Part 3 EXECUTION

3.1 FIELD QUALITY CONTROL

.1 Perform as minimum (3) three minor inspections and one major inspection (more often if required by manufacturer) per year. Provide detailed written report to Departmental Representative as described in Submittal article.

.2 Perform inspections during regular working hours, 0800 to 1630 h, Monday through Friday, excluding statutory holidays.

.3 Following inspections are minimum requirements and should not be interpreted to mean satisfactory performance:

- .1 Perform calibrations using test equipment having traceable, certifiable accuracy at minimum 50% greater than accuracy of system displaying or logging value.
- .2 Check each field input/output device in accordance with Canada Labour Code - Part I.
- .3 Provide dated, maintenance task lists, as described in Submittal article, as proof of execution of complete system verification.

.4 Minor inspections to include, but not limited to:

- .1 Perform visual, operational checks to BC's, peripheral equipment, interface equipment and other panels.
- .2 Check equipment cooling fans as required.
- .3 Visually check for mechanical faults, air leaks and proper pressure settings on pneumatic components.
- .4 Review system performance with Departmental Representative to discuss suggested or required changes.

.5 Major inspections to include, but not limited to:

- .1 Minor inspection.
- .2 Clean OWS(s) peripheral equipment, BC(s), interface and other panels, micro-processor interior and exterior surfaces.
- .3 Check signal, voltage and system isolation of BC(s), peripherals, interface and other panels.
- .4 Verify calibration/accuracy of each input and output device and recalibrate or replace as required.
- .5 Provide mechanical adjustments, and necessary maintenance on printers.
- .6 Run system software diagnostics as required.
- .7 Install software and firmware enhancements to ensure components are operating at most current revision for maximum capability and reliability.
  - .1 Perform network analysis and provide report as described in Submittal article.

.6 Rectify deficiencies revealed by maintenance inspections and environmental checks.

.7 Continue system debugging and optimization.

.8 Testing/verification of occupancy and seasonal-sensitive systems to take place during four (4) consecutive seasons, after facility has been accepted, taken over and fully occupied.

.1 Test weather-sensitive systems twice: first at near winter design conditions and secondly under near summer design conditions.

END OF SECTION

Part 1 GENERAL

1.1 SUMMARY

.1 Section Includes:

.1 System requirements for Local Area Network (LAN) for Building Energy Monitoring and Control System (EMCS).

.2 Related Sections:

.1 Section 25 05 01 - EMCS: General Requirements.

1.2 REFERENCES

.1 Canadian Standards Association (CSA International).

.1 CSA T568.1-05(R2010), Commercial Building Telecommunications Cabling Standard – Part 1: General Requirements.

.2 CSA T530-99, Commercial Building Standard for Telecommunications Pathways and Spaces (Adopted ANSI/TIA/EIA-569-A with modifications).

.2 Institute of Electrical and Electronics Engineers (IEEE)/Standard for Information technology - Telecommunications and information exchange between systems - Local and metropolitan area networks - Specific requirements.

.1 IEEE 802.3, Part 3: Carrier Sense Multiple Access with Collision Detection (CSMA/CD) Access Method and Physical Layer Specifications.

.3 Telecommunications Industries Association (TIA)/Electronic Industries Alliance (EIA)

.1 TIA/EIA-568-2009, Commercial Building Telecommunications Cabling Standards Set, Part 1 General Requirements Part 2 Balanced Twisted-Pair Cabling Components Part 3 Optical Fiber Cabling Components Standard.

.2 TIA/EIA-569-A-December 2001, Commercial Building Standard for Telecommunications Pathways and Spaces.

.4 Treasury Board Information Technology Standard (TBITS).

.1 TBITS 6.9-2000, Profile for the Telecommunications Wiring System in Government Owned and Leased Buildings - Technical Specifications.

1.3 DEFINITIONS

.1 Acronyms and definitions: refer to Section 25 05 01.

1.4 SYSTEM DESCRIPTION

.1 Data communication network to link Operator Workstations and Master Control Units (MCU) in accordance with CSA T529, TIA/EIA-568 and CSA T530, TIA/EIA-569-A and TBITS 6.9.

.1 Provide reliable and secure connectivity of adequate performance between different sections (segments) of network.

.2 Allow for future expansion of network, with selection of networking technology and communication protocols.

.2 Data communication network to include, but not limited to:

.1 EMCS-LAN.

.2 Network interface cards.

.3 Network management hardware and software.

.4 Network components necessary for complete network.

1.5 DESIGN REQUIREMENTS

.1 EMCS Local Area Network (EMCS-LAN).

.1 EMCS to utilize existing LAN within the buildings to connect to the new OWS. Coordinate with Departmental Representative for connection points to existing LAN and IP addresses.

.2 EMCS-LAN to: BACnet

.3 Support of combination of MCUs and OWSs directly connected to EMCS-LAN.

.4 High speed data transfer rates for alarm reporting, quick report generation from multiple controllers, upload/download information between network devices. Bit rate to be 10 Megabits per second minimum.

.5 Detection and accommodation of single or multiple failures of either OWSs, MCUs or network media. Operational equipment to continue to perform designated functions effectively in event of single or multiple failures.

.6 Commonly available, multiple sourced, networking components and protocols to allow system to co-exist with other networking applications including office automation.

.2 Dynamic Data Access.

.1 LAN to provide capabilities for OWSs, either network resident or connected remotely, to access point status and application report data or execute control functions for other devices via LAN.

.2 Access to data to be based upon logical identification of building equipment.

.3 Network Medium.

.1 Network medium: compatible with network protocol to be used within existing building.

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 SUMMARY

.1 Related Sections:

.1 Section 23 81 40 – Air and Water Source Unitary Heat Pumps

.2 Section 25 05 01 - EMCS: General Requirements.

.3 Section 25 05 02 - EMCS: Shop Drawings, Product Data and Review Process.

.4 Section 25 05 03 - EMCS: Project Record Documents.

.5 Section 25 30 02 - EMCS: Field Control Devices.

.6 Section 25 90 01 - EMCS: Site Requirements Applications and Systems Sequences of Operation.

1.2 REFERENCES

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

.1 ASHRAE 2011, Applications Handbook, SI Edition.

.2 ASHRAE STD 135-2012, BACnet - A Data Communication Protocol for Building Automation and Control Networks.

.2 Canadian Standards Association (CSA International).

.1 CSA C22.2 No.205-2012, Signal Equipment.

.3 Institute of Electrical and Electronics Engineers (IEEE).

.1 IEEE C37.90.1-2012, Standard for Surge Withstand Capabilities (SWC) Tests for Relays and Relay Systems Associated with Electric Power Apparatus.

.4 Public Works and Government Services Canada (PWGSC)/Real Property Branch/Architectural and Engineering Services.

.1 MD 250005-2009 Energy Monitoring and Control Systems (EMCS) Design Guidelines.

1.3 DEFINITIONS

.1 Acronyms and definitions: refer to Section 25 05 01.

1.4 SYSTEM DESCRIPTION

.1 Refer to Section 25 05 01 for overview of system and scope of work.

.2 General: Network of controllers comprising of MCU('s), LCU('s), ECU('s) or TCU('s) to be provided as indicated in System Architecture Diagram to support building systems and associated sequence(s) of operations as detailed in these specifications.

.1 Provide sufficient controllers to meet intents and requirements of this section.

.2 Controller quantity, and point contents to be approved by Departmental Representative at time of preliminary design review.

.3 This division will be responsible for conductors and cables, and grounding and bonding associated with the installation of the control system that are consistent with project requirements and listed regulatory requirements.

.4 This division will be responsible for the following scope of work. This list is not exhaustive and it is the responsibility of Contractor to ensure that all work defined within the Contract Documents and coordinated.

.1 All 24V or other low voltage wiring, conduit, final connections, junction boxes, etc. required for any mechanical device and for controls system.

.2 All 120V wiring, conduit, final connections, junction boxes, etc. required for any mechanical controls and system. Coordinate required circuits from available circuit panels with Division 26.

.3 Provide and install any/all 120V to 24V step down controllers required for control of mechanical systems.

.4 Mounting and programming of VFD drives. Line side power wiring is by Division 26.

.5 Reviewing all mechanical shop drawings that contain controllers to ensure that they will be compatible with BACnet based BAS and wiring design.

.5 Supply sufficient programmable controllers of types to meet project requirements. Quantity and points contents as reviewed by Departmental Representative prior to installation.

.6 Controllers: stand-alone intelligent Control Units.

.1 Incorporate programmable microprocessor, non-volatile program memory, RAM, power supplies, as required to perform specified functions.

.2 Incorporate communication interface ports for communication to LANs to exchange information with other Controllers.

.3 Capable of interfacing with operator interface device.

.4 Execute its logic and control using primary inputs and outputs connected directly to its onboard input/output field terminations or slave devices, and without need to interact with other controller. Secondary input used for reset such as outdoor air temperature may be located in other Controller(s).

.1 Secondary input used for reset such as outdoor air temperature may be located in other Controller(s).

.7 Contractor is to re-use existing communication BUS' within Main GVI building for controls replacement. Refer to Section 25 05 01 for testing requirements of existing communication bus.

.1 One BUS extends from ST-01 to the top floor of the Intensive Intervention Unit. This bus is a RS-485, shielded twisted wire (two wire) communication bus that is daisy chained from the GCM in ST-01 to all of the VAV box controllers and newer microzone controllers. Refer to mechanical drawings for system architecture.

.2 A second BUS goes from ST-08, out to the Standard Living Environment (SLE), and back to ST-01 to connect to the GCM. This bus is a RS-485, shielded twisted wire (two wire) communication bus that is daisy chained to all of the local control modules LCM. Refer to mechanical drawings for system architecture.

1.5 DESIGN REQUIREMENTS

.1 To include:

.1 Scanning of AI and DI connected inputs for detection of change of value and processing detection of alarm conditions.

.2 Perform On-Off digital control of connected points, including resulting required states generated through programmable logic output.

.3 Perform Analog control using programmable logic, (including PID) with adjustable dead bands and deviation alarms.

.4 Control of systems as described in sequence of operations.

.5 Execution of optimization routines as listed in this section.

.6 Web accessible control program.

.2 Field Termination and Interface Devices:

.1 To: CSA C22.2 No.205.

.2 Electronically interface sensors and control devices to processor unit.

.3 Include, but not be limited to, following:

.1 Programmed firmware or logic circuits to meet functional and technical requirements.

.2 Power supplies for operation of logics devices and associated field equipment.

.3 Lockable wall cabinet.

.4 Required communications equipment and wiring (if remote units).

.5 Leave controlled system in "fail-safe" mode in event of loss of communication with, or failure of, processor unit.

.6 Input Output interface to accept as minimum AI, AO, DI, DO functions as specified.

.7 Wiring terminations: use conveniently located screw type or spade lug terminals.

.4 AI interface equipment to:

.1 Convert analog signals to digital format with 10 bit analog-to-digital resolution.

.2 Provide for following input signal types and ranges:

.1 4 – 20 mA;

.2 0 – 10 V DC;

.3 100/1000 ohm RTD input;

.3 Meet IEEE C37.90.1 surge withstand capability.

.4 Have common mode signal rejection greater than 60 dB to 60 Hz.

.5 Where required, dropping resistors to be certified precision devices which complement accuracy of sensor and transmitter range specified.

.5 AO interface equipment:

.1 Convert digital data from controller processor to acceptable analog output signals using 8 bit digital-to-analog resolution.

.2 Provide for following output signal types and ranges:

.1 4 - 20mA.

.2 0 - 10 V DC.

.3 Meet IEEE C37.90.1 surge withstand capability.

.6 DI interface equipment:

.1 Able to reliably detect contact change of sensed field contact and transmit condition to controller.

.2 Meet IEEE C37.90.1 surge withstand capability.

.3 Accept pulsed inputs up to 2 kHz.

.7 DO interface equipment:

.1 Respond to controller processor output, switch respective outputs. Each DO hardware to be capable of switching up to 0.5 amps at 24 V AC.

.2 Switch up to 5 amps at 220 V AC using optional interface relay.

.3 Controllers and associated hardware and software: operate in conditions of 0 degrees C to 44 degrees C and 20 % to 90 % non-condensing RH.

.4 Controllers (MCU, LCU): mount in wall mounted cabinet with hinged, keyed-alike locked door for controllers in public areas. Controllers mounted within mechanical rooms, electrical/communication rooms, or return air plenums, may be wall mounted without cabinets.

.1 Provide for conduit entrance from top, bottom or sides of panel.

.2 ECUs and TCUs to be mounted in equipment enclosures or separate enclosures.

.3 Mounting details as approved by Departmental Representative for ceiling mounting.

.5 Cabinets to provide protection from water dripping from above, while allowing sufficient airflow to prevent internal overheating.

.6 Provide surge and low voltage protection for interconnecting wiring connections.

1.6 SUBMITTALS

.1 Make submittals in accordance with Section 01 33 00 and Section 25 05 02.

.1 Submit product data sheets for each product item proposed for this project.

1.7 OWNERSHIP OF PROPRIETARY MATERIAL

.1 All project developed hardware and software shall become the property of PWGSC, including but not limited to project graphic images, record drawings, project database, job-specific application programming code, and all documentation

.2 PWGSC shall be the named license holder of all software associate with any and all incremental work on the project. In addition, PWGSC shall receive ownership of all job specific configuration documentation, data files, and application-level software developed for the project.

.3 Any and all required ID’s and passwords for access to any component of software program shall be provided to the Departmental Representative.

.4 The Departmental Representative shall determine which organizations to be named in the System Installer (SI) organization ID (orgid) of all software licenses. The Departmental Representative shall be free to direct the modification of the "orgid" in any software license, regardless of supplier.

1.8 MAINTENANCE PROCEDURES

.1 Provide manufacturers recommended maintenance procedures for insertion in Section 25 05 03.

Part 2 PRODUCTS

2.1 OPEN, INTEROPERABLE, INTEGRATED ARCHITECTURES

.1 The intent of this specification it to provide a peer-to-peer networked, stand-alone, distributed control system with the capability to integrate ANSI/ASHRAE Standard 135-2012 BACnet communication protocol into an open interoperable system.

.2 The supplied computer software shall employ object-oriented technology for representation of all data and control devices within the system. All supplied devices must be BACnet Testing Laboratories listed. Physical connections of BACnet devices shall be via BACnet/IP and or BACnet MS/TP (RS-485) as specified.

.3 All components and controllers supplied under this division shall be true "peer-to-peer communicating devices. Components or controllers requiring "polling" by a host to pass data shall not be acceptable.

.4 The supplied system must incorporate the ability to access all data using standard Web browsers without requiring proprietary operator interface and configuration programs. Systems requiring proprietary database and user interface programs shall not be acceptable.

.5 A hierarchical topology is required to assure reasonable system response times and to manage the flow and sharing of data without unduly burdening the Owner's internal intranet network. Systems employing a "flat" single tiered architecture shall not be acceptable.

.1 Maximum acceptable response time from any alarm occurrence (at the point of origin) to the point of annunciation shall not exceed 5 seconds for local network connected user devices.

2.2 OWS HARDWARE

.1 PC system to include:

.1 Processor: micro-processor, operating at minimum clock speed of 4 Gigahertz, capable of supporting software necessary to perform functions specified in this section. System backplane bus (100 Megahertz) to support PCI and ISA boards.

.2 Internal clock.

.1 Uninterruptible clock: accuracy of plus or minus 5 seconds/month, capable of deriving year / month / day / hour / minute / second.

.2 Rechargeable batteries: to provide minimum 48 h clock operation in event of power failure.

.3 Asynchronous interfaces for connection to listed peripheral devices including LAN and remote devices.

.2 Power supply unit to accept 120 V, 60 Hz source and include line surge and low voltage protection for processor and its peripherals.

2.3 OWS PC COMPONENTS

.1 Primary OWS: PC compatible with following as minimum:

.1 IDE Disk drive controller to support 4 drives.

.1 1- 1 TB hard disk drive.

.2 1- 48X/24X/48X DVD-RW/CD-RW combo drive.

.2 512 MB RAM minimum.

.3 Keyboard.

.4 USB mouse.

.5 2 colour monitors: 21" minimum each. Flat panel display TFT, resolution 1280 X 1040, dot pitch 0.26 mm, colour support 24 bit,

.6 Video card with 128 MB video RAM, dual monitor native support.

.7 2-front USB and 4-rear USB connection slots.

.8 Include two 2 spare expansion slots in system for PWGSC's use.

.9 PCI Ethernet LAN Adapter to connect to local Ethernet LAN network.

.10 600 W minimum power supply.

2.4 OPERATING SYSTEM (OS) OR EXECUTIVE

.1 OS to support complement of hardware terminals and software programs specified.

.2 OS to be true multitasking operating environment.

.1 MS DOS or PC DOS based software platforms not permitted.

.3 OWS software to operate in "Windows" based operating environment.

2.5 OWS CONTROL SOFTWARE

.1 OWS is not to form part of real-time control functions either directly or indirectly or as part of communication link. Real-time control functions to reside in MCUs, LCUs, and TCUs with peer to peer communication occurring at MCU to MCU device level.

.2 The operators workstation shall be fitted with the Supervisor AX software from Tridium for central control and archiving.

.3 Time Synchronization Module.

.1 System to provide Time Synchronization of real-time clocks in controllers.

.2 System to perform this feature on regular scheduled basis and on operator request.

.4 User Display Interface Module.

.1 OWS software to support "Point Names" as defined in Section 25 05 01 - EMCS: General Requirements.

.2 Upon operator's request in either text, graphic or table mode, system to present condition of single point, system, area, or connected points on system to OWS. Display analog values digitally to 1 place of decimal with negative sign as required. Update displayed analog values and status when new values received. Flag points in alarm by blinking or different colour, to differentiate from points not in alarm. For systems supporting COSV, refresh rate of screen data not to exceed 5 seconds from time of field change and system is to execute supervisory background scan every 20 seconds to verify point data value. For other systems refresh rate not to exceed 5 seconds for points displayed. Initial display of new system graphic display (with up to 30 active points), including presentation of associated dynamic data not to exceed 8 seconds.

.5 General Event Log Module: to record system activities occurring at OWS or elsewhere in system including:

.1 Operator Log-in from user interface device.

.2 Communication messages: errors, failures and recovery.

.3 Event notifications and alarms by category.

.4 Record of operator initiated commands.

.6 General Event Log:

.1 Hold minimum of 4 months information and be readily accessible to operator.

.2 Able to be archived as necessary to prevent loss of information.

.7 Operator Control Software Module: to support entry of information into system from keyboard and mouse, disk, or from another network device. Display of information to user; dynamic displays, textual displays, and graphic displays to display logging and trending of system information and following tasks:

.1 Automatic logging of digital alarms and change of status messages.

.2 Automatic logging of analog alarms.

.3 System changes: alarm limits, set-points, alarm lockouts.

.4 Display specific point values, states as selected.

.5 Provide reports as requested and on scheduled basis when required.

.6 Display graphics as requested, and on alarm receptions (user's option).

.7 Display list of points within system.

.8 Display list of systems within building.

.9 Direct output of information to selected peripheral device.

.10 On-line changes:

.1 Alarm limits.

.2 Setpoints.

.3 Deadbands.

.4 Control and change of state changes.

.5 Time, day, month, year.

.6 Control loop configuration changes for controller-based CDLs.

.7 Control loop tuning changes.

.8 Schedule changes.

.9 Changes, additions, or deletions, of points, graphics, for installed and future systems.

.11 According to assigned user privileges (password definition) following functions are to be supported:

.1 Permit operator to terminate automatic (logic based) control and set value of field point to operator selected value. These values or settings to remain in effect until returned to automatic (logic based) control by operator.

.2 Requests for status, analog values, graphic displays, logs and controls to be through user interface screens.

.12 Software and tools utilized to generate, modify and configure building controllers to be installed and operational on the OWS.

.8 Message Handling Module - and Error Messages: to provide message handling for following conditions:

.1 Message and alarm buffering to prevent loss of information.

.2 Error detection correction and retransmission to guarantee data integrity.

.3 Informative messages to operator for data error occurrences, errors in keyboard entry, failure of equipment to respond to requests or commands and failure of communications between EMCS devices.

.4 Default device definition to be implemented to ensure alarms are reported as quickly as possible in event of faulty designated OWS.

.9 Access ControlModule.

.1 Minimum 5 levels of password access protection to limit control, display, or data base manipulation capabilities. Following is preferred format of progression of password levels:

.1 Guest: no password data access and display only.

.2 Operator Level: full operational commands including automatic override.

.3 Technician: data base modifications.

.4 Programmer: data base generation.

.5 Highest Level : system administration - password assignment addition, modification.

.2 User-definable, automatic log-off timers from 1 to 60 min. to prevent operators leaving devices on-line inadvertently. Default setting = 30 minutes.

.10 Trend Data Module: includes historical data collection utility, trend data utility, control loop plot utility. Each utility to permit operator to add trend point, delete trend point, set scan rate.

.1 Historical data collection utility: collect concurrently operator selected real or calculated point values at operator selectable rate 30-480 minutes. Samples to include for each time interval (time-stamped), minimum present value, maximum present value, and average present value for point selected. Rate to be individually selectable for each point. Data collection to be continuous operation, stored in temporary storage until removed from historical data list by operator. Temporary storage to have at least 1 month capacity on local controller and backed up on OWS for a period of 2 years.

.2 Trend data utility: continuously collect point object data variables for variables from building controllers as selected by operator, including at minimum; present value of following point object types - DI, DO, AI, AO set points value, calculated values. Trend data utility to have capacity to trend concurrently points at operator-selectable rate of 600 seconds to 3600 seconds, individually selectable for selected value, or use of COSV detection. Collected trend data to be stored on minimum 96 h basis in temporary storage until removed from trend data list by operator. Option to archive data before overwriting to be available.

.3 Control loop plot utility: for AO Points provide for concurrent plotting of Measured value input - present value, present value of output, and AO setpoint. Operator selectable sampling interval to be selectable between 1 second to 20 seconds. Plotting utility to scroll to left as plot reaches right side of display window. Systems not supporting control loop plot as separate function must provide predefined groups of values. Each group to include values for one control loop display.

.4 Trend data Module to include display of historical or trend data to OWS screen in X Y plot presentation. Plot utility to display minimum of 6 historical points or 6 trend points concurrently or 1 Control Loop Plot. For display output of real time trend data, display to automatically index to left when window becomes full. Provide plotting capabilities to display collected data based on range of selected value for (Y) component against time/date stamp of collected data for (X) component.

.5 Provide separate reports for each trend utility. Provide operator feature to specify report type, by point name and for output device. Reports to include time, day, month, year, report title, and operator's initials. Implement reports using report module. Ensure trend data is exportable to third party spreadsheet or database applications for PCs.

.11 Report Module: reports for energy management programs, function totalization, analog/pulse totalization and event totalization features available at MCU level.

.1 Reports to include time, day, month, year, report title, operator's initials.

.2 Software to provide capability to:

.1 Generate and format reports for graphical and numerical display from real time and stored data.

.2 Print and store reports as selected by operator.

.3 Select and assign points used in such reports.

.4 Sort output by area, system, as minimum.

.3 Periodic/automatic report:

.1 Generate specified report(s) automatically including options of start time and date, interval between reports (hourly, daily, weekly, monthly), output device. Software to permit modifying periodic/automatic reporting profile at any time.

.2 Reports to include:

.1 Power demand and duty cycle summary: see application program for same.

.2 Disabled "Locked-out" point summary: include point name, whether disabled by system or by operator.

.3 Run time summary: summary of accumulated running time of selected equipment. Include point name, run time to date, alarm limit setting. Run time to accumulate until reset individually by operator.

.4 Summary of run time alarms: include point name, run time to date, alarm limit.

.5 Summary of start/stop schedules: include start/stop times and days, point name.

.6 Motor status summary.

.4 Report types:

.1 Dynamic reports: system to printout or display of point object data value requested by operator. System to indicate status at time of request, when displayed, updated at operator selected time interval. Provide option for operator selection of report type, by point name, and/or output device. Ensure reports are available for following point value combinations:

.2 Points in accessible from this OWS (total connected for this location), multiple "areas".

.3 Area (points and systems in Area).

.4 Area, system (points in system).

.5 System (points by system type).

.6 System point (points by system and point object type).

.7 Area point (points by system and point object type).

.8 Point (points by point object type).

.5 Summary report: printout or display of point objet data value selected by operator. Report header to indicate status at time of request. Ensure reports are available on same basis as dynamic reports. Provide option as to report type, point name, output device.

.6 Include preformatted reports as listed in Event/Alarm Module.

.12 Graphics Display Module: graphics software utility to permit user to create, modify, delete, file, and recall graphics required by Section 25 90 01.

.1 Provide capacity for 100% expansion of system graphics. Graphic interface to provide user with multiple layered diagrams for site, building in plan view, floor furniture plan view and building systems, overlayed with dynamic data appropriately placed and permitting direct operator interaction. Graphic interface to permit operator to start and stop equipment, change set points, modify alarm limits, override system functions and points from graphic system displays by use of mouse or similar pointing device.

.2 Display specific system graphics: provide for manual and/or automatic activation (on occurrence of an alarm). Include capability to call up and cancel display of graphic picture.

.3 Library of pre-engineered screens and symbols depicting standard air handling components (fans, coils, filters, dampers, VAV), complete mechanical system components (chillers, boilers, pumps), electrical symbols.

.4 Graphic development, creation, modification package to use mouse and drawing utility to permit user to:

.1 Modify portion of graphic picture/schematic background.

.2 Delete graphic picture.

.3 Call up and cancel display of graphic picture.

.4 Define symbols.

.5 Position and size symbols.

.6 Define background screens.

.7 Define connecting lines, curves.

.8 Locate, orient, size descriptive text.

.9 Define, display colours of elements.

.10 Establish co-relation between symbols or text and associated system points or other graphic displays.

.5 User to be able to build graphic displays showing on-line point data from multiple MCU panels. Graphic displays to represent logical grouping of system points or calculated data based upon building function, mechanical system, building layout, other logical grouping of points which aids operator in analysis of facility operation. Data to be refreshed on screen as "changed data" without redrawing of entire screen or row on screen.

.6 Dynamic data (temperature, humidity, flow, status) to be shown in actual schematic locations, to be automatically updated to show current values without operator intervention.

.7 Windowing environment to allow user to view several graphics simultaneously to permit analysis of building operation, system performance, display of graphic associated with alarm to be viewed without interrupting work in progress.

.8 Utilize graphics package to generate system schematic diagrams as required in Section 25 90 01 - EMCS: Site Requirements, Applications and System Sequences of Operation, and as directed by Departmental Representative. In addition provide graphics for schematic depicted on mechanical plan flow diagrams, point lists and system graphics. Provide graphic for floor depicting room sensors and control devices located in their actual location. For floor graphic include secondary diagram to show TCU-VAV box actuator and , flow sensor. Diagram to be single line schematic of ductwork as well as associated heating coil or radiation valve. Departmental Representative to provide CAD floor layouts. Provide display of TCU -VAV's in table form, include following values as minimum; space temp, setpoint, mode, actual flow, min flow setpoint, max flow setpoint, cooling signal value, and heating signal value. Organize table by rooms and floor groupings.

.9 Provide complete directory of system graphics, including other pertinent system information. Utilize mouse or pointing device to "point and click” to activate selected graphic.

.10 Provide unique sequence of operation graphic or pop-up window for each graphic that is depicted on OWS. Provide access to sequence of operation graphic by link button on each system graphic. Provide translation of sequence of operation, a concise explanation of systems operation, from control descriptive logic into plain English language.

.13 Event/Alarm Module : displays in window alarms as received and stored in General Event Log.

.1 Classify alarms as "critical", "cautionary", "maintenance". Alarms and alarm classifications to be designated by personnel requiring password level.

.2 Presentation of alarms to include features identified under applicable report definitions of Report Module paragraph.

.3 Alarm reports.

.1 Summary of points in critical, cautionary or maintenance alarm. Include at least point name, alarm type, current value, limit exceeded.

.2 Analog alarm limit summary: include point name, alarm limits, deviation limits.

.3 Summary of alarm messages: include associated point name, alarm description.

.4 Software to notify operator of each occurrence of alarm conditions. Each point to have its own secondary alarm message.

.5 EMCS to notify operator of occurrence of alarms originating at field device within following time periods of detection:

.1 Critical – 5 seconds.

.2 Cautionary - 10 seconds.

.3 Maintenance – 10 seconds.

.6 Display alarm messages in English.

.7 Primary alarm message to include as minimum: point identifier, alarm classification, time of occurrence, type of alarm. Provide for initial message to be automatically presented to operator whenever associated alarm is reported. Assignment of secondary messages to point to be operator-editable function. Provide secondary messages giving further information (telephone lists, maintenance functions) on per point basis.

.8 System reaction to alarms: provide alarm annunciation by dedicated window (activated to foreground on receipt of new alarm or event) of OWS with visual and audible hardware indication. Acknowledgement of alarm to change visual indicator from flashing to steady state and to silence audible device. Acknowledgment of alarm to be time, date and operator stamped and stored in General Event Log. Steady state visual indicator to remain until alarm condition is corrected but must not impede reporting of new alarm conditions. Notification of alarm not to impede notification of subsequent alarms or function of Controller's/CDL. Do not allow random occurrence of alarms to cause loss of alarm or over-burden system. Do not allow acknowledgment of one alarm as acknowledgement of other alarms.

.9 Controller network alarms: system supervision of controllers and communications lines to provide following alarms as minimum:

.1 Controller not responding - where possible delineate between controller and communication line failure.

.2 Controller responding - return to normal.

.3 Controller communications bad - high error rate or loss of communication.

.4 Controller communications normal - return to normal.

.10 Digital alarm status to be interrogated every 2 seconds as minimum or be direct interrupting non-polling type (COV). Annunciate each non-expected status with alarm message.

.14 Archiving and Restoration Module.

.1 Primary OWS to include services to store back-up copies of controller databases. Perform complete backup of OWS software and data files at time of system installation and at time of final acceptance. Provide backup copies before and after Controller's revisions or major modifications.

.2 Provide continuous integrity supervision of controller data bases. When controller encounters database integrity problems with its data base, system to notify operator of need to download copy data base to restore proper operation.

.3 Ensure data base back-up and downloading occurs over LAN without specialized operator technical knowledge. Provide operator with ability to manually download entire controller data base, or parts thereof as required.

.15 CDL Generator and Modifier Module.

.1 CDL Generator module to permit generation and modification of CDLs.

.2 Provide standard reference modules for text based systems module that will permit modification to suit site specific applications. Module to include cut, paste, search and compare utilities to permit easy CDL modification and verification.

.3 Provide full library of symbols used by manufacturer for system product installed accessible to operators for systems using graphical environment for creation of CDLs Module to include graphic tools required to generate and create new object code for downloading to building controllers.

.4 Module to permit testing of code before downloading to building controllers.

2.6 WEB BROWSER CLIENTS

.1 The system shall be capable of supporting an unlimited number of clients using a standard Web browser. Systems requiring additional software (to enable a standard Web browser) to be resident on the client machine, or manufacture-specific browsers shall not be acceptable.

.2 The Web browser software shall run on any operating system and system configuration that is supported by the Web browser. Systems that require specific machine requirements in terms of processor speed, memory, etc., in order to allow the Web browser to function with the EMCS, shall not be acceptable.

.3 The Web browser shall provide the same view of the system, in terms of graphics, schedules, calendars, logs, etc., and provide the same interface methodology as is provided by the Graphical User Interface. Systems that require different views or that require different means of interacting with objects such as schedules, or logs, shall not be permitted.

.4 The Web browser client shall support at a minimum, the following functions:

.1 User log-on identification and password shall be required. If an unauthorized user attempts access, a blank web page shall be displayed. Security using Java authentication and encryption techniques to prevent unauthorized access shall be implemented.

.2 Graphical screens developed for the GUI shall be the same screens used for the Web browser client. Any animated graphical objects supported by the GUI shall be supported by the Web browser interface.

.3 HTML programming shall not be required to display system graphics or data on a Web page. HTML editing of the Web page shall be allowed if the user desires a specific look or format.

.4 Storage of the graphical screens shall be in the MCU, without requiring any graphics to be stored on the client machine. Systems that require graphics storage on each client are not acceptable.

.5 Real-time values displayed on a Web page shall update automatically without requiring a manual “refresh” of the Web page.

.6 Users shall have administrator-defined access privileges. Depending on the access privileges assigned, the user shall be able to perform the following:

.1 Modify common application objects, such as schedules, calendars, and set points in a graphical manner.

.2 Schedule times will be adjusted using a graphical slider, without requiring any keyboard entry from the operator.

.3 Holidays shall be set by using a graphical calendar, without requiring any keyboard entry from the operator.

.4 Commands to start and stop binary objects shall be done by right-clicking the selected object and selecting the appropriate command from the pop-up menu. No entry of text shall be required.

.5 View logs and charts

.6 View and acknowledge alarms

.7 Setup and execute SQL queries on log and archive information

.5 The system shall provide the capability to specify a user’s (as determined by the log-on user identification) home page. Provide the ability to limit a specific user to just their defined home page. From the home page, links to other views, or pages in the system shall be possible, if allowed by the system administrator

2.7 MASTER CONTROL UNIT (MCU)

.1 General: primary function of MCU is to provide co-ordination and supervision of subordinate devices in execution of optimization routines such as demand limiting or enthalpy control.

.2 MCU must be C-UL listed to CSA and shall be BACnet Testing Laboratory listed.

.3 Include high speed communication LAN Port for Peer to Peer communications with OWS(s) and other MCU level devices.

.1 MCU must communicate in BACnet / IP.

.4 Master Control unit to be web-accessible and embedded with Niagara Frameworks by Tridium.

.5 MCU local I/O capacity as follows:

.1 MCU I/O points as allocated in I/O Summary Table referenced in Section 25 90 01.

.2 LCUs may be added to support system functions.

.6 Central Processing Unit (CPU).

.1 Processor to consist of minimum 16 bit microprocessor capable of supporting software to meet specified requirements.

.2 CPU idle time to be more than 30% when system configured to maximum input and output with worst case program use.

.3 Minimum addressable memory to be at manufacturer's discretion but to support at least performance and technical specifications to include but not limited to:

.1 Non-volatile EEPROM to contain operating system, executive, application, sub-routine, other configurations definition software. Tape media not acceptable.

.2 Battery backed (72 hour minimum capacity) RAM (to reduce the need to reload operating data in event of power failure) to contain CDLs, application parameters, operating data or software that is required to be modifiable from operational standpoint such as schedules, setpoints, alarm limits, PID constants and CDL and hence modifiable on-line through operator panel or remote operator's interface. RAM to be downline loadable from OWS.

.4 Include uninterruptible clock accurate to plus or minus 5 secs/month, capable of deriving year/month/day/hour/minute/second, with rechargeable batteries for minimum 72 hour operation in event of power failure.

2.8 LOCAL CONTROL UNIT (LCU)

.1 Provide multiple control functions for typical built-up and package HVAC systems, hydronic systems and electrical systems.

.2 Minimum of 16 I/O points of which minimum be 4 AOs, 4 AIs, 4 DIs, 4 DOs.

.3 Points integral to one Building System to be resident on only one controller.

.4 Microprocessor capable of supporting necessary software and hardware to meet specified requirements as listed in previous MCU article with following additions:

.1 Include minimum 2 interface ports for connection of local computer terminal.

.2 Design so that shorts, opens or grounds on input or output will not interfere with other input or output signals.

.3 Physically separate line voltage (70V and over) circuits from DC logic circuits to permit maintenance on either circuit with minimum hazards to technician and equipment.

.4 Include power supplies for operation of LCU and associated field equipment.

.5 In event of loss of communications with, or failure of, MCU, LCU to continue to perform control. Controllers that use defaults or fail to open or close positions not acceptable.

.6 Provide conveniently located screw type or spade lug terminals for field wiring.

2.9 TERMINAL/EQUIPMENT CONTROL UNIT (TCU/ECU)

.1 Microprocessor capable of supporting necessary software and hardware to meet TCU/ECU functional specifications.

.2 Controller to communicate directly with EMCS through EMCS LAN and provide access from EMCS OWS for setting occupied and unoccupied space temperature setpoints, flow setpoints, and associated alarm values, permit reading of sensor values, field control values (% open) and transmit alarm conditions to EMCS OWS.

.3 Controls contractor to provide TCU/ECU controller and actuators to terminal equipment manufacturer for factory mounting.

.4 Constant Volume Bypass Terminal and Variable Volume Terminal Controllers.

.1 Microprocessor based controller with integral flow transducer, including software routines to execute PID algorithms, calculate airflow for integral flow transducer, control modulating two-way heating valve, and measure temperatures as per I/O Summary required inputs. Air flow control to be pressure independent.

.2 Controller to support point definition; in accordance with Section 25 05 01.

.3 Controller to operate independent of network in case of communication failure.

.4 Controller to include damper actuator and terminations for input and output sensors and devices. Actuator to be 24V reversible type. Factory mount actuator direct to the damper shaft. Actuator to have an adjustable end-stop.

.5 Sequence of operation as indicated in Section 25 90 01.

2.10 LEVELS OF ADDRESS

.1 Upon operator's request, EMCS to present status of any single 'point', 'system' or point group, entire 'area', or entire network on printer or OWS as selected by operator.

.1 Display analog values digitally to 1place of decimals with negative sign as required.

.2 Update displayed analog values and status when new values received.

.3 Flag points in alarm by blinking, reverse video, different colour, bracketed or other means to differentiate from points not in alarm.

.4 Updates to be change-of-value (COV)-driven or if polled not exceeding 2 second intervals.

2.11 POINT NAME SUPPORT

.1 Controllers (MCU, LCU) to support PWGSC point naming convention as defined in Section 25 05 01.

Part 3 EXECUTION

3.1 LOCATION

.1 Refer to mechanical drawings for location of existing controllers. Replacement controllers shall be in the same location as the controllers they are replacing. Any new controllers added to integrate new equipment shall be installed in a location similar to the controllers serving similar equipment within the system. Final mounting locations of new controllers to be approved by Departmental Representative.

.2 Location of controllers for the Public Entrance Building to be within Mechanical Room A202. Final mounting locations within room to be approved by Departmental Representative.

3.2 INSTALLATION

.1 Install Controllers in secure locking enclosures.

.2 Provide necessary power from local 120 V branch circuit panel for equipment including conduit, junction boxes, labour, and accessories. Coordinate exact power requirements with Division 26.

.3 Install tamper locks on breakers of circuit breaker panel.

.4 Provide for the installation and mapping of points from manufacturer's supplied gateway(s) for VRF system as specified in Section 23 81 40. Gateway to be accessible from OWS.

END OF SECTION

Part 1 GENERAL

1.1 SUMMARY

.1 Related Sections:

.1 Section 25 01 11 - EMCS: Start-Up, Verification and Commissioning.

.2 Section 25 05 01 - EMCS: General Requirements.

.3 Section 25 05 02 - EMCS: Shop Drawings, Product Data and Review Process.

.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 - Electrical.

.7 Section 26 27 26 - Wiring Devices.

1.2 REFERENCES

.1 American National Standards Institute (ANSI).

.1 ANSI C12.7-2005, Requirements for Watthour Meter Sockets.

.2 ANSI/IEEE C57.13-08, Standard Requirements for Instrument Transformers.

.2 American Society for Testing and Materials International, (ASTM).

.1 ASTM B148-97(R2009), Standard Specification for Aluminum-Bronze Sand Castings.

.3 National Electrical Manufacturer's Association (NEMA).

.1 NEMA 250-2008, Enclosures for Electrical Equipment (1000 Volts Maximum).

.4 Air Movement and Control Association, Inc. (AMCA).

.1 AMCA Standard 500-D-2012, Laboratory Method of Testing Dampers For Rating.

.5 Canadian Standards Association (CSA International).

.1 CAN/CSA-C22.1-12, Canadian Electrical Code, Part 1 (22nd Edition), Safety Standard for Electrical Installations.

1.3 DEFINITIONS

.1 Acronyms and Definitions: refer to Section 25 05 01.

1.4 SUBMITTALS

.1 Submit shop drawings and manufacturer's installation instructions in accordance with Section 25 05 02.

.2 Pre-Installation Tests.

.1 Submit samples at random from equipment shipped, as requested by Departmental Representative, for testing before installation. Replace devices not meeting specified performance and accuracy.

.3 Manufacturer's Instructions:

.1 Submit manufacturer's installation instructions for specified equipment and devices.

1.5 EXISTING CONDITIONS

.1 Cutting and Patching: in accordance with Section 01 73 00 supplemented as specified herein.

.2 Repair surfaces damaged during execution of Work.

.3 Turn over to Departmental Representative existing materials removed from Work not identified for re-use.

Part 2 PRODUCTS

2.1 GENERAL

.1 Control devices of each category to be of same type and manufacturer.

.2 External trim materials to be corrosion resistant. Internal parts to be assembled in watertight, vibration-proof assembly.

.3 Operating conditions: 0 - 32°C with 10 - 90% RH (non-condensing) unless otherwise specified.

.4 Terminations: use standard conduit box with slot screwdriver compression connector block unless otherwise specified.

.5 Transmitters and sensors to be unaffected by external transmitters including walkie talkies.

.6 Account for hysteresis, relaxation time, maximum and minimum limits in applications of sensors and controls.

.7 Outdoor installations: use weatherproof construction in NEMA 4 enclosures.

.8 Devices installed in user occupied space not exceed Noise Criteria (NC) of 35. Noise generated by any device must not be detectable above space ambient conditions.

.9 Range: including temperature, humidity, pressure, as indicated in I/O summary in Section 25 90 01.

2.2 CONTROL PANELS

.1 Provide control panel of unitized cabinet type construction. Mount relays, switches and controllers with control point adjustment in cabinet and pressure gauges, pilot lights, push buttons and switches flush on cabinet panel face.

.2 Fabricate panels from 3 mm rolled sheet metal sheet with baked enamel finish, flush fitting, gasketted doors hung on piano type hinges and three point latches and locking handles. CSA approved for line voltage applications.

.3 Mount panels on vibration free walls or free standing angle iron supports. Provide engraved plastic nameplates for instruments and controls inside cabinet and on cabinet face.

.4 Provide pans and rails for mounting terminal blocks, relays, wiring and other necessary devices.

.5 Provide an individual switch for disconnection and a fuse for isolation of all panel mounted instruments requiring a 120 volt supply.

.6 Make all wiring connections in the shop from the equipment mounted on the panel to numbered terminal blocks conveniently located in the panel, including the power supply for all instruments.

.7 Identify all wiring by means of stamped markings on heat shrinkable tubing. Install all wiring neatly and laced or bunched into cable form using plastic wire clips, where practical, contained in plastic wiring channels with covers. Maximum 25 conductors to each wire bundle.

.8 Provide terminal blocks, tabular clamp, 300 V, complete with track. Each terminal shall be clearly indelibly marked with the wire number connection to it. Each field connecting conductor shall be served by one terminal. Provide 20% spare unit terminals, with a minimum of two spare terminals. Provide all necessary terminal block accessories such as manufacturer jumpers and marking tape.

.9 Install "Hand-Off-Auto" selector switches such that safety controls and electrical over current protection are not overridden when selector switch is in the "Hand" position. "Hand-Off-Auto" selector switches shall be provided for all ventilation fans and sump pumps.

.10 Control Power for control panel shall be 120 Volts A.C. from panel circuits provided by Division 16.

.11 Install bonding conductor between main control and auxiliary panels complete with grounding lugs, in addition to CSA grounding requirements.

2.3 WIRE

.1 Control wiring for digital functions shall be 1 mm minimum with 300 Volt insulation.

.2 Control wiring for analog functions shall be 1 mm minimum with 300 Volts insulation, twisted and shielded, 2 or 3 wire to match analog function hardware.

.3 Sensor wiring shall be 1 mm minimum twisted and shielded, 2 or 3 wire to match analog function hardware or 1.3 mm as required by code.

.4 Transformer current wiring shall be 1.3 mm minimum.

2.4 CONDUITS AND CABLES

.1 Install wiring in conduit or trays. Conform to Division 26 requirements for conduit and trays specifications.

.2 Seal conduit where such conduit leaves heated areas and enters unheated area.

.3 In the field panel, run low level signal lines in separate conduit from high level signal and power transmission lines.

.4 Identify each cable and wire at every termination point.

.5 Provide instrumentation complete with standard electrical conduit box for termination unless otherwise noted.

.6 Where applicable, mount field interface equipment (i.e. relays, transducers, etc.) in local device cabinets adjacent to field interface panels.

.7 Separate conduits shall be provided for pneumatic tubing and electrical wiring runs.

.8 Color code all conductors and conduits by permanently applied color bands. Color code shall follow base building schedule.

2.5 TEMPERATURE SENSORS AND THERMOSTATS

.1 General: To be resistance or thermocouple type to following requirements:

.1 Thermocouples: limit to temperature range of 200 degrees C and over.

.2 RTD's: 100 or 1000 ohm at 0 degrees C (plus or minus 0.2 ohms) platinum element with strain minimizing construction, 3 integral anchored leadwires. Coefficient of resistivity: 0.00385 ohms/ohm °C.

.3 Sensing element: hermetically sealed.

.4 Stem and tip construction: copper or type 304 stainless steel.

.5 Time constant response: less than 3 seconds to temperature change of 10°C.

.6 Immersion wells: NPS 3/4, stainless steel spring loaded construction, with heat transfer compound compatible with sensor. Insertion length to be half of pipe diameter.

.7 Temperature sensors provided in inmate accessible areas to be provided with protective wire guard cover.

.2 Room temperature sensors and display wall modules.

.1 Temperature sensing and wall module.

.1 Jack connection for plugging in laptop personal computer for access to field adjustments of damper ranges, user adjustable set-point range, unoccupied set-points, as well as PI tuning variables.

.2 Integral thermistor sensing element 10,000 ohm at 24 degrees.

.3 Accuracy 0.2°C over range of 0 to 70°C.

.4 Stability 0.02°C drift per year.

.5 Separate mounting base for ease of installation.

.2 Room temperature sensors.

.1 Wall mounting, in slotted type covers having brushed aluminum finish.

.2 Element 10-50 mm long RTD with ceramic tube or equivalent protection or thermistor, 10,000 ohm, accuracy of plus or minus 0.2°C.

.3 VRF equipment thermostats

.1 Wall mounted thermostats for controlling VRF indoor units to be provided by VRF equipment manufacturer and installed by Division 25.

.4 VRF equipment temperature sensors.

.1 Wall mounted temperature sensors for controlling VRF indoor units to be provided by VRF equipment manufacturer and installed by Division 25.

.3 Duct temperature sensors:

.1 General purpose duct type: suitable for insertion into ducts at various orientations, insertion length as required to measure temperature from centre of duct.

.2 Averaging duct type: incorporates numerous sensors inside assembly which are averaged to provide one reading. Minimum insertion length 600 mm. Bend probe at field installation time to 100 mm radius at point along probe without degradation of performance.

.4 Outdoor air temperature sensors:

.1 Outside air type: complete with probe length 100 - 150 mm long, non-corroding shield to minimize solar and wind effects, threaded fitting for mating to 13 mm conduit, weatherproof construction in NEMA 4 enclosure.

.5 Remote Bulb Thermostat:

.1 Line Voltage remote bulb type thermostat with:

.1 30A rating at 120V

.2 Copper capillary tube, length to suit site installation.

.3 Cast weather tight box.

2.6 CARBON DIOXIDE SENSOR

.1 Requirements:

.1 Used for CO2 based ventilation control.

.2 Non-Dispersion-Infrared (NDIR) technology used to measure carbon dioxide gas.

.3 Device provides voltage or current output based on CO2 levels.

.4 Automatic Background Calibration (ABC) algorithm based on long-term evaluation reduces required typical zero-drift check maintenance

.5 Power supply: 24 V DC into load of 575 ohms.

2.7 TEMPERATURE TRANSMITTERS

.1 Requirements:

.1 Input circuit: to accept 3-lead, 100 or 1000 ohm at 0 degrees C, platinum resistance detector type sensors.

.2 Power supply: 24 V DC into load of 575 ohms. Power supply effect less than 0.01°C per volt change.

.3 Output signal: 4 - 20 mA into 500 ohm maximum load.

.4 Input and output short circuit and open circuit protection.

.5 Output variation: less than 0.2% of full scale for supply voltage variation of plus or minus 10%.

.6 Combined non-linearity, repeatability, hysteresis effects: not to exceed plus or minus 0.5% of full scale output.

.7 Maximum current to 100 or 1000 ohm RTD sensor: not to exceed 25 mA.

.8 Integral zero and span adjustments.

.9 Temperature effects: not to exceed plus or minus 1.0% of full scale/ 50°C.

.10 Long term output drift: not to exceed 0.25% of full scale/ 6 months.

.11 Transmitter ranges: select narrowest range to suit application from following:

.1 Minus 50 degrees C to plus 50°C, plus or minus 0.5°C.

.2 0 to 100°C, plus or minus 0.5°C.

.3 0 to 50°C, plus or minus 0.25°C.

.4 0 to 25°C, plus or minus 0.1°C.

.5 10 to 35°C, plus or minus 0.25 °C.

2.8 HUMIDITY SENSORS

.1 Duct Requirements:

.1 Range: 5 - 90% RH minimum.

.2 Operating temperature range: 0 - 60 degrees C.

.3 Absolute accuracy:

.1 Duct sensors: plus or minus 3%.

.4 Sheath: stainless steel with integral shroud for specified operation in air streams of up to 10 m/s.

.5 Maximum sensor non-linearity: plus or minus 2% RH with defined curves.

.6 Duct mounted sensors: locate so that sensing element is in air flow in duct, 3m downstream of steam dispersion device.

.2 Outdoor Humidity Requirements:

.1 Range: 0 - 100% RH minimum.

.2 Operating temperature range: -40°C.

.3 Absolute accuracy: plus or minus 2%.

.4 Temperature coefficient: plus or minus 0.03%RH/ degrees C over 0 to 50 degrees C.

.5 Must be unaffected by condensation or 100% saturation.

.6 No routine maintenance or calibration is required.

2.9 HUMIDITY TRANSMITTERS

.1 Requirements:

.1 Input signal: from RH sensor.

.2 Output signal: 4 - 20 mA onto 500 ohm maximum load.

.3 Input and output short circuit and open circuit protection.

.4 Output variations: not to exceed 0.2% of full scale output for supply voltage variations of plus or minus 10%.

.5 Output linearity error: plus or minus 1.0% maximum of full scale output.

.6 Integral zero and span adjustment.

.7 Temperature effect: plus or minus 1.0% full scale/ 6 months.

.8 Long term output drift: not to exceed 0.25% of full scale output/ 6 months.

2.10 PRESSURE TRANSDUCERS

.1 Requirements:

.1 Combined sensor and transmitter measuring pressure.

.1 Internal materials: suitable for continuous contact with industrial standard instrument air, compressed air, water, steam, as applicable.

.2 Output signal: 4 - 20 mA into 500 ohm maximum load.

.3 Output variations: less than 0.2% full scale for supply voltage variations of plus or minus 10%.

.4 Combined non-linearity, repeatability, and hysteresis effects: not to exceed plus or minus 0.5% of full scale output over entire range.

.5 Temperature effects: not to exceed plus or minus 1.5% full scale/ 50°C.

.6 Over-pressure input protection to at least twice rated input pressure.

.7 Output short circuit and open circuit protection.

.8 Accuracy: plus or minus 1% of Full Scale.

2.11 DIFFERENTIAL PRESSURE TRANSMITTERS

.1 Requirements:

.1 Internal materials: suitable for continuous contact with industrial standard instrument air, compressed air, water, steam, as applicable.

.2 Output signal: 4 - 20 mA into 500 ohm maximum load.

.3 Output variations: less than 0.2% full scale for supply voltage variations of plus or minus 10%.

.4 Combined non-linearity, repeatability, and hysteresis effects: not to exceed plus or minus 0.5% of full scale output over entire range.

.5 Integral zero and span adjustment.

.6 Temperature effects: not to exceed plus or minus 1.5% full scale/50°C.

.7 Over-pressure input protection to at least twice rated input pressure.

.8 Output short circuit and open circuit protection.

.9 Unit to have 12.5 mm N.P.T. conduit connection. Enclosure to be integral part of unit.

2.12 STATIC PRESSURE SENSORS

.1 Requirements:

.1 Multipoint element with self-averaging manifold.

.1 Maximum pressure loss: 160 Pa at 10 m/s. (Air stream manifold).

.2 Accuracy: plus or minus 1% of actual duct static pressure.

2.13 STATIC PRESSURE TRANSMITTERS

.1 Requirements:

.1 Output signal: 4 - 20 mA linear into 500 ohm maximum load.

.2 Calibrated span: not to exceed 150% of duct static pressure at maximum flow.

.3 Accuracy: 0.4% of span.

.4 Repeatability: within 0.5% of output.

.5 Linearity: within 1.5% of span.

.6 Deadband or hysteresis: 0.1% of span.

.7 External exposed zero and span adjustment.

.8 Unit to have 12.5 mm N.P.T. conduit connection. Enclosure to be integral part of unit

2.14 PRESSURE AND DIFFERENTIAL PRESSURE SWITCHES

.1 Requirements:

.1 Internal materials: suitable for continuous contact with compressed air, water, steam, etc., as applicable.

.2 Adjustable setpoint and differential.

.3 Switch: snap action type, rated at 120V, 15 amps AC or 24 V DC.

.4 Switch assembly: to operate automatically and reset automatically when conditions return to normal. Over-pressure input protection to at least twice rated input pressure.

.5 Accuracy: within 2% repetitive switching.

.6 Provide switches with isolation valve and snubber, where code allows, between sensor and pressure source.

.7 Switches on high temperature hot water service: provide pigtail syphon.

2.15 TEMPERATURE SWITCHES

.1 Requirements:

.1 Operate automatically. Reset automatically, except as follows:

.1 Low temperature detection: manual reset.

.2 Adjustable setpoint and differential.

.3 Accuracy: plus or minus 1 degrees C.

.4 Snap action rating: 120V, 15 amps as required. Switch to be DPST for hardwire and EMCS connections.

.5 Type as follows:

.1 Duct, general purpose: insertion length = 460 mm.

.2 Thermowell: stainless steel, with compression fitting for NPS 3/4 thermowell. Immersion length: 100 mm.

.3 Low temperature detection: continuous element with 6000 mm insertion length, duct mounting, to detect coldest temperature in any 30 mm length.

.4 Strap-on: with helical screw stainless steel clamp.

2.16 SUMP LEVEL SWITCHES

.1 Requirements:

.1 Liquid level activated switch sealed in waterproof and shockproof enclosure.

.2 Complete with float, flexible cord, weight. Instrument casing to be suitable for immersion in measured liquid.

.3 N.O./N.C. Contacts rated at 15 amps at 120V AC. CSA approval for up to 250 volt 10 amps AC.

2.17 AIR PRESSURE GAUGES

.1 Diameter: 38 mm minimum.

.2 Range: zero to two times operating pressure of measured pressure media or nearest standard range.

2.18 ELECTROMECHANICAL RELAYS

.1 Requirements:

.1 Double voltage, DPDT, plug-in type with termination base.

.2 Coils: rated for 120V AC or 24V DC. Other voltage: provide transformer.

.3 Contacts: rated at 5 amps at 120V AC.

.4 Relay to have visual status indication

2.19 SOLID STATE RELAYS

.1 General:

.1 Relays to be socket or rail mounted.

.2 Relays to have LED Indicator.

.3 Input and output Barrier Strips to accept 14 to 28 AWG wire.

.4 Operating temperature range to be -20°C to 70°C.

.5 Relays to be CSA Certified.

.6 Input/output Isolation Voltage to be 4000 VAC at 25°C for 1 second maximum duration.

.7 Operational frequency range, 45 to 65 HZ.

.2 Input:

.1 Control voltage, 3 to 32 VDC.

.2 Drop out voltage, 1.2 VDC.

.3 Maximum input current to match AO (Analog Output) board.

.3 Output.

.1 AC or DC Output Model to suit application.

2.20 CURRENT TRANSDUCERS

.1 Requirements:

.1 Purpose: combined sensor/transducer, to measure line current and produce proportional signal in one of following ranges:

.1 4-20 mA DC.

.2 0-1 volt DC.

.3 0-10 volts DC.

.4 0-20 volts DC.

.2 Frequency insensitive from 10 - 80 hz.

.3 Accuracy to 0.5% full scale.

.4 Zero and span adjustments. Field adjustable range to suit motor applications.

.5 Adjustable mounting bracket to allow for secure/safe mounting inside MCC.

2.21 CURRENT SENSING RELAYS

.1 Requirements:

.1 Suitable to detect belt loss or motor failure.

.2 Trip point adjustment, output status LED.

.3 Split core for easy mounting.

.4 Induced sensor power.

.5 Relay contacts: capable of handling 0.5 amps at 30 VAC / DC. Output to be NO solid state.

.6 Suitable for single or 3 phase monitoring. For 3-Phase applications: provide for discrimination between phases.

.7 Adjustable latch level.

2.22 CONTROL DAMPERS

.1 Construction: blades, 152 mm wide, 1219 mm long, maximum. Modular maximum size, 1219 mm wide x 1219 mm high. Three or more sections to be operated by jack shafts.

.2 Materials:

.1 Frame: 2.03 mm minimum thickness extruded aluminum. For outdoor air and exhaust air applications, frames to be insulated.

.2 Blades: extruded aluminum. For outdoor air/exhaust air applications, blades to be internally insulated.

.3 Bearings: maintenance free, synthetic type of material.

.4 Linkage and shafts: aluminum, zinc and nickel plated steel.

.5 Seals: synthetic type, mechanically locked into blade edges.

.1 Frame seals: synthetic type, mechanically locked into frame sides.

.3 Performance: minimum damper leakage meet or exceed AMCA Standard 500-D ratings.

.1 Size/Capacity: refer to damper schedule

.2 25 L/s/m² maximum allowable leakage against 1000 Pa static pressure for outdoor air and exhaust air applications.

.3 Temperature range: minus 30°C to plus 40°C.

.4 Arrangements: dampers mixing warm and cold air to be parallel blade, mounted at right angles to each other, with blades opening to mix air stream.

.5 Jack shafts:

.1 25 mm diameter solid shaft, constructed of corrosion resistant metal complete with required number of pillow block bearings to support jack shaft and operate dampers throughout their range.

.2 Include corrosion resistant connecting hardware to accommodate connection to damper actuating device.

.3 Install using manufacturers installation guidelines.

.4 Use same manufacturer as damper sections.

2.23 ELECTRONIC CONTROL DAMPER ACTUATORS

.1 Requirements:

- .1 Direct mount proportional type as indicated.
- .2 Spring return for "fail-safe" in Normally Open or Normally Closed position as indicated.
- .3 Operator: size to control dampers against maximum pressure and dynamic closing/opening pressure, whichever is greater.
- .4 Power requirements: 5 VA maximum at 24 V AC.
- .5 Operating range: 0 - 10 V DC or 4 - 20 mA DC.
- .6 For VAV box applications floating control type actuators may be used.
- .7 Damper actuator to drive damper from full open to full closed in less than 120 seconds.

2.24 CONTROL VALVES

.1 Body: globe style.

- .1 Flow characteristic to suit coil application.
- .2 Flow factor (KV) as indicated on control valve schedule: CV in imperial units.
- .3 Normally open
- .4 Two port, as indicated.
- .5 Leakage rate ANSI class IV, 0.01% of full open valve capacity.
- .6 Packing easily replaceable.
- .7 Stem, stainless steel.
- .8 Plug and seat, stainless steel, brass
- .9 Disc, replaceable, material to suit application.
- .10 NPS 2 and under:
  - .1 Screwed National Pipe Thread (NPT) tapered female connections.
  - .2 Valves to ANSI Class 250, valves to bear ANSI mark.
  - .3 Rangeability 50:1 minimum.
- .11 NPS 2½ and larger:
  - .1 Flanged connections.
  - .2 Valves to ANSI Class 150, valves to bear ANSI mark.
  - .3 Rangeability 100:1 minimum.

.2 Butterfly Valves NPS 2 and larger:

- .1 Body: ANSI Class 150 cast iron installed in locations as indicated.
- .2 End connections to suit flanges that are ANSI Class 150.
- .3 Extended stem neck to provide adequate clearance for flanges and insulation.
- .4 Pressure limit: bubble tight sealing to 170 kilopascals.
- .5 Disc/vane: 316 stainless steel.
- .6 Seat: PTFE (polytetrafluoroethylene)
- .7 Stem: 316 stainless steel.

.8 Flow factor (KV) as indicated on control valve schedule: CV in imperial units.

.9 Flow characteristic linear.

.10 Maximum flow requirement as indicated on control valve schedule.

.11 Maximum pressure drop as indicated on control valve schedule: pressure drop not to exceed one half of inlet pressure.

.12 Normally open, as indicated.

.13 Valves are to be provided complete with mounting plate for installation of actuators.

2.25 ELECTRONIC / ELECTRIC VALVE ACTUATORS

.1 Requirements:

.1 Construction: steel, cast iron, aluminum.

.2 Control signal: 0-10V DC or 4-20 mA DC.

.3 Positioning time: to suit application. 90 sec maximum.

.4 Fail to normal position as indicated.

.5 Scale or dial indication of actual control valve position.

.6 Size actuator to meet requirements and performance of control valve specifications.

.7 For interior and perimeter terminal heating and cooling applications floating control actuators are acceptable.

.8 Minimum shut-off pressure: refer to control valve schedule.

2.26 PANELS

.1 Wall mounted enamelled steel cabinets with hinged and key-locked front door.

.2 Multiple panels as required to handle requirements with additional space to accommodate 25% additional capacity as required by Departmental Representative without adding additional cabinets.

.3 Panels to be lockable with same key.

2.27 WIRING

.1 In accordance with Section 26 27 26.

.2 For wiring under 70 volts use FT6 rated wiring where wiring is not run in conduit. Other cases use FT4 wiring.

.3 Wiring must be continuous without joints.

.4 Sizes:

.1 Field wiring to digital device: #18AWG.

.2 Analog input and output: shielded #18 minimum solid copper.

Part 3 EXECUTION

3.1 INSTALLATION

.1 Install equipment, components so that manufacturer's and CSA labels are visible and legible after commissioning is complete.

.2 Install field control devices in accordance with manufacturers recommended methods, procedures and instructions.

.3 Temperature transmitters, humidity transmitters, current-to-pneumatic transducers, solenoid air valves, controllers, relays: install in NEMA I enclosure or as required for specific applications. Provide for electrolytic isolation in cases when dissimilar metals make contact.

.4 Support field-mounted panels, transmitters and sensors on pipe stands or channel brackets.

.5 Fire stopping: provide space for fire stopping in accordance with Section 07 84 00. Maintain fire rating integrity.

.6 Electrical:

.1 Complete installation in accordance with Section 26 05 00.

.2 Modify existing starters to provide for EMCS as indicated in I/O Summaries and as indicated.

.3 Terminate wires with screw terminal type connectors suitable for wire size, and number of terminations.

.4 Install communication wiring in conduit.

.1 Provide complete conduit system to link Building Controllers, field panels and OWS(s).

.2 Conduit sizes to suit wiring requirements and to allow for future expansion capabilities specified for systems.

.3 Maximum conduit fill not to exceed 40%.

.4 Design drawings do not show conduit layout.

.5 Do not run exposed conduits in normally occupied spaces unless otherwise indicated or unless impossible to do otherwise. Departmental Representative to review before starting Work. Wiring in mechanical rooms, wiring in service rooms and exposed wiring must be in conduit.

.7 Mechanical: supply and install in accordance with Section 23 05 05.

.1 Pipe Taps.

.2 Wells and Control Valves.

.3 Air flow stations, dampers, and other devices.

.8 VAV Terminal Units: supply, install and adjust as required.

.1 Air probe, actuator and associated VAV controls.

.2 Tubing from air probe to DP sensor as well as installation and adjustment of air flow sensors and actuators.

.3 Co-ordinate air flow adjustments with balancing trade.

3.2 TEMPERATURE AND HUMIDITY SENSORS

.1 Stabilize to ensure minimum field adjustments or calibrations.

.2 Readily accessible and adaptable to each type of application to allow for quick easy replacement and servicing without special tools or skills.

.3 Outdoor installation:

.1 Protect from solar radiation and wind effects by non-corroding shields.

.2 Install in NEMA 4 enclosures.

.4 Duct installations:

.1 Do not mount in dead air space.

.2 Locate within sensor vibration and velocity limits.

.3 Securely mount extended surface sensor used to sense average temperature.

.4 Thermally isolate elements from brackets and supports to respond to air temperature only.

.5 Support sensor element separately from coils, filter racks.

.5 Averaging duct type temperature sensors.

.1 Install averaging element horizontally across the ductwork starting 300 mm from top of ductwork. Each additional horizontal run to be no more than 300 mm from one above it. Continue until complete cross sectional area of ductwork is covered. Use multiple sensors where single sensor does not meet required coverage.

.2 Wire multiple sensors in series for low temperature protection applications.

.3 Wire multiple sensors separately for temperature measurement.

.4 Use software averaging algorithm to derive overall average for control purposes.

.6 Thermowells: install for piping installations.

.1 Locate well in elbow where pipe diameter is less than well insertion length.

.2 Thermowell to restrict flow by less than 30%.

.3 Use thermal conducting paste inside wells.

3.3 PANELS

.1 Arrange for conduit and tubing entry from top, bottom or either side.

.2 Wiring and tubing within panels: locate in trays or individually clipped to back of panel.

.3 Identify wiring and conduit clearly.

3.4 PRESSURE AND DIFFERENTIAL PRESSURE SWITCHES AND SENSORS

.1 Install isolation valve and snubber on sensors between sensor and pressure source where code allows.

.2 Protect sensing elements on steam and high temperature hot water service with pigtail syphon between valve and sensor.

3.5 I/P TRANSDUCERS

.1 Install air pressure gauge on outlet.

3.6 AIR PRESSURE GAUGES

.1 Install pressure gauges on pneumatic devices, I/P, pilot positioners, motor operators, switches, relays, valves, damper operators, valve actuators.

.2 Install pressure gauge on output of auxiliary cabinet pneumatic devices.

3.7 IDENTIFICATION

.1 Identify field devices in accordance with Section 25 05 54.

3.8 AIR FLOW MEASURING STATIONS

.1 Protect air flow measuring assembly until cleaning of ducts is completed.

3.9 TESTING AND COMMISSIONING

.1 Calibrate and test field devices for accuracy and performance in accordance with Section 25 01 11.

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 (23rd Edition), Safety Standard for Electrical Installations.

.2 CAN3-C235-83(R2015), Preferred Voltage Levels for AC Systems, 0 to 50,000 V.

.2 Institute of Electrical and Electronics (IEEE)/National Electrical Safety Code Product Line (NESC)

.1 IEEE SP1122-2000, The Authoritative Dictionary of IEEE Standards Terms, 7th Edition.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00.

.2 Product Data:

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

.3 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 Submit drawings and product data to inspection authorities.

.5 If changes are required, notify Departmental Representative of these changes before they are made.

.4 Certificates:

.1 Provide CSA certified equipment and material.

.2 Where CSA certified equipment and material is not available, submit such equipment and material to authority having jurisdiction inspection authorities 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.

.5 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, as described in PART 3 - FIELD QUALITY CONTROL.

1.3 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00.

.2 Operation and Maintenance Data: submit operation and maintenance data 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.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 and with manufacturer's written instructions.

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

.3 Storage and Handling Requirements:

.1 Store materials indoors 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 Develop Construction Waste Management Plan and Waste Reduction Workplan related to Work of this Section and in accordance with Section 01 74 20.

.5 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding and packaging materials as specified in Construction Waste Management Plan and Waste Reduction Workplan in accordance with Section 01 74 20.

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 Provide material and equipment in accordance with Section 01 61 00.

.2 Material and equipment to be CSA certified. Where CSA certified material and equipment are not available, obtain special approval from authority having jurisdiction before delivery to site and submit such approval as described in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS.

.3 Factory assemble control panels and component assemblies.

2.3 ELECTRIC MOTORS, EQUIPMENT AND CONTROLS

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

.2 Control wiring and conduit: in accordance with 26 05 34 except for conduit, wiring and connections below 50 V which are related to control systems specified in mechanical sections and as indicated on mechanical drawings.

2.4 WARNING SIGNS

.1 Warning Signs: in accordance with requirements of authority having jurisdiction, inspection authorities 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: lamicoid, matt white finish face, black core, lettering accurately aligned and engraved into core mechanically attached with self tapping screws.

.2 Nameplates for Critical Power Panels: same as above, except with blue lamicoid

.3 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 and label.

.5 Nameplates for terminal cabinets and junction boxes to indicate system and/or voltage characteristics.

.6 Identify equipment with Size 3 labels engraved "ASSET INVENTORY NO. [_____]" 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 250 V	Yellow	
up to 600 V	Yellow	Green
up to 5 kV	Yellow	Blue
Telephone	Green	
Other Communication Systems	Green	Blue
Fire Alarm	Red	
Emergency Voice	Red	Blue
Other Security Systems	Red	Yellow

2.9 FINISHES

.1 Shop finish metal enclosure surfaces by application of rust resistant primer inside and outside, and at least two coats of finish enamel.

.1 Paint outdoor electrical equipment "equipment green" finish.

.2 Paint indoor switchgear and distribution enclosures light gray.

2.10 SERVICE INTERRUPTIONS

.1 Coordinate all service interruptions in advance with the Departmental Representative, in accordance with 01 14 00 Work Restrictions and provide:

.1 List of all scheduled interruptions

.2 Areas and equipment affected by each interruption

.3 Duration of each interruption

Part 3 EXECUTION

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Departmental Representative.

.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 INSTALLATION

.1 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 Install conduit and sleeves prior to pouring of concrete.

.1 Sleeves through concrete: schedule 40 steel pipe, sized for free passage of conduit, and protruding 50 mm.

.2 Install cables, conduits and fittings embedded or plastered over, close to building structure so furring can be kept to minimum.

3.5 LOCATION OF OUTLETS

.1 Locate outlets in accordance with Section 26 05 32.

.2 Do not install outlets back-to-back in wall; allow minimum 150 mm horizontal clearance between boxes.

.3 Change location of outlets at no extra cost or credit, providing distance does not exceed 3000 mm, and information is given before installation.

.4 Locate light switches on latch side of doors.

.1 Locate disconnect devices in mechanical and elevator machine rooms on latch side of floor.

3.6 MOUNTING HEIGHTS

.1 Mounting height of equipment is from finished floor to centreline of equipment unless specified or indicated otherwise.

.2 If mounting height of equipment is not specified or indicated, verify before proceeding with installation.

.3 Install electrical equipment at following heights unless indicated otherwise.

.1 Local switches: 1150 mm.

.2 Wall receptacles:

.1 General: 400 mm.

.2 Above top of continuous baseboard heater: 200 mm.

.3 Above top of counters or counter splash backs: 175 mm.

.4 In mechanical rooms: 1150 mm.

.5 TV height: 1600mm.

.3 Panelboards: as required by Code or as indicated.

.4 Telephone and interphone outlets: 400 mm.

.5 Wall mounted telephone and interphone outlets: 1150 mm.

.6 Fire alarm stations: 1150 mm.

.7 Fire alarm bells: 2100 mm.

.8 Television outlets: 400 mm.

.9 Wall mounted speakers: 2100 mm.

.10 Clocks: 2100 mm.

.11 Door bell pushbuttons: 1150 mm.

3.7 CO-ORDINATION OF PROTECTIVE DEVICES

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

3.8 FIELD QUALITY CONTROL

.1 Load Balance:

.1 Measure phase current 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 2% of rated voltage of equipment.

.3 Provide upon completion of work, load balance report as directed in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS, phase and neutral currents on 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 in accordance with Section 01 45 00.

.1 Circuits originating from branch distribution panels.

.2 Lighting and its control.

.3 Motors, heaters and associated control equipment including sequenced operation of systems where applicable.

.4 Systems: fire alarm, 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 and operating personnel in operation, care and maintenance of systems, system equipment and components.

.2 Arrange and pay for services of manufacturer's factory service engineer to supervise start-up of installation, check, adjust, balance and calibrate components and instruct operating personnel.

.3 Provide these services for such period, and for as many visits as necessary to put equipment in operation, and ensure that operating personnel are conversant with aspects of its care and operation.

3.10 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11.

.3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 20.

.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

1 General

1.1 SUMMARY

1.1.1 Provide complete electrical power connections for mechanical equipment.

1.2 RELATED REQUIREMENTS

1.2.1 Section 21 13 13 – Wet Pipe Sprinkler Systems

1.2.2 Section 22 10 10 – Plumbing Pumps

1.2.3 Section 22 30 05 – Domestic Water Heaters

1.2.4 Section 23 34 00 – HVAC Fans

1.2.5 Section 23 36 00 – Air Terminal Units

1.2.6 Section 23 52 00 – Heating Boilers

1.2.7 Section 23 73 11 – Air Handling Unit Packaged

1.2.8 Section 23 83 00 – Radiant Heating Units

1.2.9 Section 23 92 49 – Variable Frequency Drives

1.2.10 Section 26 05 10 – Common Work Results for Electrical

1.2.11 Section 26 05 28 – Conduits, Outlet Boxes and Fittings for Electrical Systems

1.2.12 Section 26 05 19 – Electrical Power Conductors and Cables

1.2.13 Section 16130 – Outlet Boxes and Fittings

2 Products

2.1 MATERIALS

2.1.1 Include disconnects, conduits, wire fittings, interlocks, outlet boxes, junction boxes, and all associated equipment required to provide power wiring for mechanical equipment.

2.2 EXTERIOR EQUIPMENT

2.2.1 All equipment mounted on the exterior of the building shall be weatherproof.

3 Execution

3.1 POWER WIRING

3.1.1 Install motor feeders, starters disconnects and associated equipment and make connections to all motors.

3.1.2 Install 120VAC branch circuit wiring for control circuits as shown and as required by controls contractor.

3.1.3 Install wiring to starters furnished with equipment and from starters to motors and equipment.

3.2 CONTROLS

3.2.1 Wire and connect 120VAC line voltage thermostats for force flows and unit heaters. Thermostats provided by Division 20. Coordinate this work with mechanical contractor.

3.2.2 Wire and connect 120VAC float switches for sump pumps. Float switches provided by Division 20.

3.3 SPRINKLER SYSTEM

3.3.1 Wire and connect flow and tamper switches to fire alarm control panel.

3.4 HEATING CABLES

3.4.1 Supply and install thermostats and wiring, coordinate with Section 26 05 19.16.

3.5 VARIABLE FREQUENCY DRIVES

3.5.1 All variable frequency drives (VFD's) shall be supplied and installed by the mechanical trade. Line and load side power wiring shall be completed by the electrical trade. All installation shall be in accordance with VFD cable manufacturers installation requirements.

3.6 STARTERS

3.6.1 All loose motor starters shall be supplied and installed by the mechanical trade. All line side and load side power wiring shall be completed by the electrical trade.

3.7 VARIABLE AIR VOLUME (VAV) BOXES

3.7.1 Provide 120VAC power supply for VAV boxes.

3.7.2 Power circuits shall be dedicated to the VAV boxes. Do not share circuits with other equipment or devices.

3.7.3 Provide one (1) 15A circuit for every 6 VAV boxes.

3.7.4 Refer to mechanical drawings and specifications for VAV box locations.

3.7.5 Include disconnects, conduits, wire, fittings, interlocks, outlet boxes, junction boxes, and all associated equipment required to provide 120VAC power wiring for VAV boxes.

3.7.6 For additional circuits, utilize the nearest suitable 120VAC or 600VAC panelboard(s) in close proximity. Coordinate exact panelboard with Departmental Representative. Provide additional breakers as required.

3.7.7 Coordinate all work with VAV installer/supplier.

3.8 BMS/BAS/DDC CONTROL PANELS

3.8.1 Provide 120VAC power supply for BMS/BAS/DDC panels.

3.8.2 Power circuits shall be dedicated to the BMS/BAS/DDC panels. Do not share circuits with other equipment or devices.

3.8.3 Provide a minimum one (1) 15A circuit for each BMS/BAS/DDC panel. Provide additional circuits as requested by the controls contractor once detailed design of the control system becomes available.

3.8.4 Refer to mechanical drawings and specifications for BMS/BAS/DDC panel locations.

3.8.5 Include disconnects, conduits, wire, fittings, interlocks, outlet boxes, junction boxes, and all associated equipment required to provide 120VAC power wiring for BMS/BAS/DDC panels.

3.8.6 Utilize the nearest suitable 120VAC panelboard designated for mechanical equipment and systems. Coordinate exact panelboard with Departmental Representative. Provide additional breakers as required.

3.8.7 Coordinate all work with BMS/BAS/DDC installer/supplier.

3.9 MOTORIZED DAMPERS

3.9.1 Provide 120VAC power supply for mechanical motorized dampers.

3.9.2 Power circuits shall be dedicated to the mechanical motorized dampers. Do not share circuits with other equipment or devices.

3.9.3 Provide one (1) 15A circuit for every 2 motorized dampers.

3.9.4 Refer to mechanical drawings and specifications for motorized damper locations.

3.9.5 Include disconnects, conduits, wire, fittings, interlocks, outlet boxes, junction boxes, and all associated equipment required to provide 120VAC power wiring for motorized dampers.

3.9.6 Utilize the nearest suitable 120VAC panelboard designated for mechanical equipment and systems. Coordinate exact panelboard with Departmental Representative. Provide additional breakers as required.

3.9.7 Coordinate all work with motorized damper installer/supplier.

3.10 CONTROL TRANSFORMERS

3.10.1 Provide 120VAC power supply for mechanical control transformers.

3.10.2 Power circuits shall be dedicated to the mechanical control transformers. Do not share circuits with other equipment or devices.

3.10.3 Provide one (1) 15A circuit for every 1000VA of control transformers.

3.10.4 Refer to mechanical drawings and specifications control transformer locations.

3.10.5 Include circuit breakers, disconnects, conduits, wire, fittings, outlet boxes, junction boxes, and all associated equipment required to provide 120VAC power wiring for control transformers.

3.10.6 Utilize the nearest suitable 120VAC panelboard designated for mechanical equipment and systems. Coordinate exact panelboard with Departmental Representative. Provide additional breakers as required.

3.10.7 Coordinate all work with the control transformer installer/supplier.

END OF SECTION

1 General

1.1 RELATED REQUIREMENTS

1.1.1 Section 14 24 23 – Hydraulic Passenger Elevators

1.1.2 Section 26 05 20 – Wires and Cables (0-1000V)

1.2 COORDINATION

1.2.1 Coordinate all work with the elevator manufacturer and verify responsibilities relating to Work required by Division 26 – Electrical and Division 27 – Communications.

1.2.2 Coordinate location of lights, machines and equipment installed in elevator pits and machine rooms with elevator installer on site.

1.2.3 Coordinate electrical service requirements for elevators including, but not limited to, fused disconnect switches at machine room door.

1.2.4 Coordinate voice and data communications cabling requirements for telephone service in elevator cabs and data connections in elevator machine rooms.

2 Products

2.1 ELEVATOR POWER DISTRIBUTION

2.1.1 Provide fused disconnect switches including auxiliary contact and HRC fuses as indicated on Drawings.

2.1.2 Provide all necessary power cabling for installation of elevator and elevator equipment.

2.1.3 Provide all necessary communications wiring between the elevator room and the main telephone terminal board.

3 Execution

3.1 EQUIPMENT WIRING

3.1.1 Install elevator machine room light switch, elevator power disconnect devices and cab light power disconnect devices on lock side of machine room door within elevator machine room.

3.1.2 Connect power service connections, communication service connections, and fire alarm signals for elevator car homing relays, fused switches and associated conduit and wire for elevator cab lighting, ventilation and power to elevator sequence controller.

3.1.3 Fused disconnect switch for elevator main drive shall have an auxiliary contact for interlocking with elevator controller where elevators have emergency return unit for loss of power.

3.1.4 Where elevators have an emergency return unit for loss of power operation, the fused disconnect switch for the elevator main drive shall have auxiliary contacts for interlocking with the elevator controller.

3.1.5 Connect fused disconnect switch and related power wiring for cathodic protection.

END OF SECTION

Part 1 GENERAL

1.1 RELATED REQUIREMENTS

.1 Section 26 05 00.

1.2 REFERENCES

.1 CSA International

.1 CSA C22.2 No.18.1-13, Metallic outlet boxes (Tri-national standard, with UL 514A and ANCE NMX- J-023/1).

.2 CAN/CSA-C22.2 No.18.2-06(R2011), Nonmetallic Outlet Boxes.

.3 CSA C22.2 No.18.3-12, Conduit, tubing, and cable fittings (Tri-national standard, with ANCE NMX-J-017 and UL 514B).

.4 CAN/CSA-C22.2 No.18.4-15, Hardware for the Support of Conduit, Tubing, and Cable (Bi-National standard, with UL 2239).

.5 CSA C22.2 No. 18.5-13, Positioning devices (Bi-national standard, with UL 1565).

.6 CSA C22.2 NO. 65-13, Wire connectors (Tri- national standard, with UL 486A-486B and NMX-J-543-ANCE).

.2 National Electrical Manufacturers Association (NEMA).

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for wire and box connectors and include product characteristics, performance criteria, physical size, finish and limitations.

1.4 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00.

.2 Operation and Maintenance Data: submit operation and maintenance data for wire and box connectors for incorporation into manual.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 and with manufacturer's written instructions.

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

.3 Storage and Handling Requirements:

.1 Store materials indoors 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 Develop Construction Waste Management Plan and Waste Reduction Workplan related to Work of this Section and in accordance with Section 01 74 20.

.5 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding and packaging materials as specified in Construction Waste Management Plan and Waste Reduction Workplan in accordance with Section 01 74 20.

Part 2 PRODUCTS

2.1 MATERIALS

.1 Pressure type wire connectors to: CSA C22.2 No.65, with current carrying parts of copper sized to fit copper conductors as required.

.2 Fixture type splicing connectors to: 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 EEMAC 1Y-2 or NEMA to consist of:

.1 Connector body and stud clamp for stranded, round copper conductors.

.2 Clamp for stranded, round copper conductors.

.3 Stud clamp bolts.

.4 Bolts for copper conductors.

.5 Sized for conductors as indicated.

.4 Clamps or connectors for armoured cable, TECK cable, aluminum sheathed cable, flexible conduit, as required to: CAN/CSA-C22.2 No.18.4.

Part 3 EXECUTION

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for wire and box connectors installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Departmental Representative.

.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 INSTALLATION

.1 Remove insulation carefully from ends of conductors and cables and:

.1 Apply coat of zinc joint compound on aluminum conductors prior to installation of connectors.

.2 Install mechanical pressure type connectors and tighten screws with appropriate compression tool recommended by manufacturer. Installation shall meet secureness tests in accordance with CSA C22.2 No.65.

.3 Install fixture type connectors and tighten to CSA C22.2 No.65. Replace insulating cap.

.4 Install bushing stud connectors in accordance with NEMA.

3.3 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11.

.3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 20.

.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

Part 1 GENERAL

1.1 PRODUCT DATA

.1 Provide product data in accordance with Section 01 33 00.

1.2 DELIVERY, STORAGE AND HANDLING

.1 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, paddling, and packaging materials in accordance with Section 01 74 20.

Part 2 PRODUCTS

2.1 BUILDING WIRES

.1 Conductors: stranded for 10 AWG and larger. Minimum size: 12 AWG.

.2 Copper conductors: size as indicated, with 600 V insulation of cross-linked thermosetting polyethylene material rated RW90 XLPE.

.3 Conductors:

.1 Grounding conductor: copper.

.2 Circuit conductors: copper, size as indicated.

.4 Insulation:

.1 Cross-linked polyethylene XLPE.

.2 Rating: , 600 V.

.5 Inner jacket: polyvinyl chloride material.

.6 Overall covering: thermoplastic polyvinyl chloride, compliant to applicable Building Code classification for this project.

2.2 ARMOURED CABLES

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

.2 Type: AC90 - lead sheath over cable assembly and under armour.

.3 Armour: interlocking type fabricated from aluminum strip.

.4 Type: PVC jacket over thermoplastic armour and compliant to applicable Building Code classification for this project.

.5 Connectors: anti short connectors.

2.3 VARIABLE FREQUENCY DRIVE CABLES

.1 Variable Frequency (Speed) Drive Cables: Provide variable frequency drive cables meeting the requirements of CSA C22.2 No. 123 and CSA C22.2 No. 174 from all VFD's to each designated motor load, comprised as follows:

.1 Sectored ground design consisting of 3 bare bonding conductors

.2 1000 volt rated cross linked polyethylene insulated phase conductors

.3 FT4 rated PVC outer jacket

.4 Sized to suit project requirements

Part 3 EXECUTION

3.1 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 00.

.2 Perform tests using method appropriate to site conditions and to approval of Departmental Representative and local authority having jurisdiction over installation.

.3 Perform tests before energizing electrical system.

3.2 GENERAL CABLE INSTALLATION

.1 Terminate cables in accordance with Section 26 05 20.

.2 Cable Colour Coding: to Section 26 05 00.

.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.

.2 In surface and lighting fixture raceways in accordance with Section 26 05 33-01

3.4 INSTALLATION OF TECK90 CABLE (0 -1000 V)

.1 Group cables wherever possible on channels.

.2 Install cable securely supported by hangers.

3.5 INSTALLATION OF ARMOURED CABLES

.1 Group cables wherever possible on channels.

3.6 INSTALLATION OF VARIABLE FREQUENCY DRIVES

.1 Install and connect to all variable frequency drives (VFD's) supplied with mechanical equipment, and in accordance with VFD cable manufacturers installation requirements.

.2 Provide input power supply to VFD's; provide VFD cable from VFD to designated motor.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 This Section covers the identification of various electrical equipment, wire and conduit using:

.1 Conduit and Wire Markers
.2 Voltage Markers
.3 Stencils
.4 Equipment Tags and Nameplates
.5 Chart and Directory Frames
.6 Custom and Standard Applied Labels

.2 Paint identification of systems, conduit and equipment will be completed by painting contractor responsible for work specified in Section 09 91 00.

.3 Application of identification labels and stencils to systems, equipment and wires will be completed by trade contractor responsible for scope of work specified in this section.

.4 This section will identify and label the systems, conduit and equipment to the painting contractor that require painting in the specified color schemes.

1.2 RELATED REQUIREMENTS

.1 Section 09 91 00 – Painting: Site painting of electrical work.

.2 Section 20 05 43 – Mechanical Systems Identification

1.3 REFERENCE STANDARDS

.1 Canadian Standards Association (CSA):

.1 Ontario Electrical Safety Code (latest edition)

1.4 DESIGN CRITERIA

.1 Wording on nameplates, tags and labels shall be submitted for review and accepted by the Departmental Representative before manufacture.

.2 Nameplates for terminal cabinets and junction boxes to indicate system and voltage characteristics.

1.5 SUBMITTALS

.1 Provide the following submittals in accordance with Section 01 30 00 – Administrative Requirements:

.1 Submit schedule of nameplates, size of each nameplate, wording and corresponding size of letters for approval.
.2 Submit a complete schedule of all equipment to have identification complete with symbol and description engraved on lamacoid plates.
.3 Submit manufacturers catalogue literature for each product specified, identifying use for interior or exterior installations.
.4 Submit two labels, indicating type and quality of installed products.
.5 Submit manufacturer's installation instructions indicating special procedures, and installation methods.

1.6 PROJECT CLOSEOUT SUBMISSIONS

.1 Provide copies of directories and legends for inclusion in the operating and maintenance data manuals in accordance with Section 01 92 00 – Facility Operation.

1.7 SCHEDULING AND COORDINATION

.1 Coordinate painted color coding of piping and equipment with work specified in Section 09 91 00.

.2 Provide lengths of conduit, quantities of equipment, hangers and supports, and additional information required by Section 09 91 00 in sufficient time to allow accurate pricing.

1.8 PRE-CONSTRUCTION MEETING

.1 Arrange a pre-construction meeting in accordance with Section 01 30 00 – Administrative Requirements and as follows:

.1 Attendees shall include, but not be limited to the Contractor's personnel, the Departmental Representative including mechanical and electrical engineers, the electrical contractor and painting trade contractor.

.2 Items that will be discussed in this meeting include, but are not limited to: mechanical and electrical painting, special surface effects, coordination of work with other trades, protection of finishes, acceptability of substrates and quality of materials being used for the project.

Part 2 Products

2.1 MATERIALS

.1 Select identification materials to suit surfaces to which they are being applied including but not limited to:

.1 Exterior Weather Exposed Surfaces
.2 Interior Building Surfaces
.3 Surfaces Exposed to High Temperature or Cryogenic Conditions
.4 Surfaces Exposed to High Humidity Conditions
.5 Surfaces Subject to Wear or Abrasion

2.2 TAGS AND LABELS

.1 Laminated Plastic Nameplate (lamacoid): Self-adhesive, composite laminated plastic nameplates, 3 mm thick x minimum 100 mm long with one smooth black surface for electrical systems; red for fire alarm systems; with core of white plastic, bevelled edge, designed to leave white lettering on a black or red background when engraved, mechanically attached with self tapping screws fabricated as follows:

Size	Nameplate Height	Letter Height	Lines of Text
1	13 mm	5 mm	1
2	16 mm	8 mm	1

Size	Nameplate Height	Letter Height	Lines of Text
3	19 mm	5 mm	2
4	25 mm	19 mm	1
5	32 mm	8 mm	2
6	38 mm	13 mm	2
7	50 mm	8 mm	3

.2 Colour Banding Tape: Adhesive backed plastic tape, integrally coloured, minimum 25 mm wide for primary colour and 19 mm wide for auxiliary colour.

.3 Wire Identification Materials: Use one of the following:

.1 Heat shrink sleeves, blank.
.2 Clear plastic tape wrap-on strips with white writing section.
.3 Wrap-on strips, pre-numbered.
.4 Slip-on identification bead markers or sleeves, blank or pre-numbered.
.5 Colour Banding Tape: Adhesive backed plastic tape, integrally coloured.

.4 Conduit, Power Supply and Voltage Markers: Pre-printed, adhesive backed plasticized labels indicating line voltage, colours as listed in 3.3.3 below, as scheduled for installations.

.5 Snap Around Cable Markers: Pre-formed snap around fibre optic or circuit cable marker, 175 mm x 6 mm Ø.

.6 Site Printed Identification Labels: Site-printed, machine-printed, adhesive backed plasticized minimum 13 mm high strip labels colours as indicated in 3.3.3 below.

.7 Stencils: Factory-cut stencils ready for paint applied 50 mm high lettering and flow arrows, colour of letters and directional arrows as scheduled.

2.3 DIRECTORIES

.1 Provide a typewritten directory for each system identified, minimum size 216 mm x 279 mm, or larger as required to accommodate information requirements.

.2 Mount each directory in an individual metal frame and protect with clear, unbreakable acrylic sheet, permanently mounted.

.3 Provide additional copies for inclusion in each Operating and Maintenance Manual.

Part 3 Execution

3.1 PREPARATION, PROTECTION AND CLEAN-UP

.1 Degrease and clean surfaces to receive identification materials.

.2 Prepare surfaces in accordance with Section 09 91 00 for stencil painting.

.3 Ensure that new and existing equipment and surfaces are carefully covered with tarping, or heavy-duty plastic.

.4 Ensure that spills and splatter on finishes and equipment are cleaned up totally and promptly.

3.2 CONDUIT AND CABLE IDENTIFICATION

.1 Colour code conduit and metallic sheathed cables in accordance with colour code specified in 3.3.3 below.

.2 Propose lettering and numbering for conduit and cable identification based on room number, system number, outlet type, and address labelling system and sub-system and submit for review as required by 1.4 and 1.5 above before installation.

.3 Install identification markers in accordance with accepted shop drawings and manufacturer's instructions.

.4 Install primary and auxiliary in colours using plastic tape or paint installed on conduit at the following locations:

.1 At each branch or riser take off.
.2 At each passage through walls, floors or ceilings, both sides.
.3 On all straight runs evenly spaced to a maximum of 15 metres O/C.
.4 Identify on both sides of obscuring items where partially obscured by other conduits, pipes, ducts or equipment.
.5 Identify at points of entry and leaving, and at each access opening where conduit is concealed in pipe chase or other confined space.
.6 Identify at starting and end points of runs and at each piece of equipment.
.7 Identify all junction boxes in every system, both inside and outside the junction box.

3.3 EQUIPMENT IDENTIFICATION

.1 Colour code equipment in accordance with colour code specified in 3.3.3 below.

.2 Propose lettering and numbering for conduit based on room number, system number, outlet type, and address labelling system and sub-system and submit as required by 1.4 and 1.5 above including, but not limited to, the following:

.1 Panels, pull boxes, disconnect switches, starters, switchgear, and transformers shall be prefinished in accordance with colour code specified.
.2 Electrical rooms, components and equipment with nameplates, sized to correspond to the size of the equipment to be identified including, but not limited to, the following:

.1 Panels:

.1 Identify power panels, isolated power panels, distribution panels and branch circuit panels as indicated on drawings.
.2 Indicate main voltages and current ratings.
.3 Provide typed panel directories.

.2 Transformers: Indicate capacity, primary and secondary voltages.

.3 Disconnect switches, starters, contactors, and motor control centres: Indicate equipment being controlled and voltage.
.4 Terminal cabinets and pull boxes: Indicate system and voltage.
.5 On/Off switches: Indicate areas being served.
.6 Distribution centres: Identify distribution centres as indicated on drawings and indicate main voltages.
.7 Motor control centres and starters.
.8 All miscellaneous electrical equipment.
.9 Circuit number on each receptacle throughout, where there is only one receptacle on one circuit, identify as DED.CCT #...

.3 Colour Code for Junction Box Cover Plates on Various Systems

System		Colour	Written Code
120/208V	-Normal Lighting and Power	White	
	-Emergency power	White/Red	
	-UPS	White/Blue	
240/416V	-Normal lighting and Power	Pink	
	-Emergency Power	Pink/Red	
	-UPS	Pink/Blue	
346/600V	-Normal lighting and Power	Yellow	
	-Emergency power	Yellow/Red	
	-UPS	Yellow/Blue	
Fire Alarm		Red	
Telephone		Orange	
Cable TV		Purple	
Data		Brown	
Control	-HVAC	Green	
	-L.V. Lighting Control	Green/Black	
Security		Grey	
Surveillance, CCTV		Grey/Black	
Public Address		Dark Green	“PA”
Audio Visual		Yellow	“AV”
Paging			“PG”
Intercom			“ICOM”

3.4 SINGLE LINE ELECTRICAL DIAGRAMS

.1 Provide single line electrical diagrams under acrylic sheet as follows:

.1 Electrical distribution system: locate in main electrical room.
.2 Electrical power generation and distribution systems: locate in generator room.

.2 Drawings: 610 mm x 915 mm minimum size.

3.5 NAMEPLATE IDENTIFICATION OF EQUIPMENT

.1 Identify equipment with lamacoid nameplates, as indicated in Equipment Identification Schedule.

3.6 PANEL BOARD DIRECTORIES

.1 Identify loads controlled by each over current protective device in each panel board, by means of a typewritten panel board directory.

3.7 COMMUNICATIONS CABLE AND EQUIPMENT LABELLING

.1 Label communication outlets, panels and ports with lamacoid nameplates as specified in Equipment Identification Schedule.

.2 Label each of cables with other ends address using Wire Identification Materials.

.3 Label outlets with labels vertically aligned in each row.

.4 Position panel labels in the same position on each panel.

3.8 IDENTIFICATION OF PULL AND JUNCTION BOXES

.1 Identify pull and junction boxes over 100 mm size as follows:

.1 Use boxes that are prefinished in coded colours, or spray paint inside and outside of boxes before installation, in coded colours designating voltage or system.
.2 Apply lamacoid nameplate to cover of each box.
.3 Identify system name, except where sequence identification is required, then identify system name and number.

.2 Identify pull and junction boxes 100 mm or less in size as follows:

.1 Spray paint inside of boxes in coded colours designating voltage or system.
.2 Apply permanent identifying markings directly to box covers designating voltage or system using indelible black ink.
.3 Mark in black on the colour coded cover plates the year when this colour code was applied. Use 4-digit numbers to represent the year.

3.9 COLOUR IDENTIFICATION OF WIRING

.1 Identify No. 4/0 AWG wiring and smaller by continuous insulation colour.

.2 Identify wiring larger than No. 4/0 AWG by continuous insulation colour or by colour banding tape applied at each end and at splices.

.3 Colour coding shall be in accordance with Canadian Electrical Code, and as follows:

Voltage	Colour

120/208 V, 3 phase	Red, black and blue.
120/208 V emergency	Red, black and blue with yellow tracer.
347/600 V 3 phase	Orange, brown and yellow.
347/600 V emergency	Orange, brown and yellow with red tracer.

.4 Where multi-conductor cables are used, use same colour coding system for identification of wiring throughout each system.

.5 Maintain phase sequence and colour coding throughout each system.

3.10 NAME/NUMBER IDENTIFICATION OF WIRING

.1 Identify No. 8 AWG wiring and smaller using one of the wire identification materials specified in 2.2.3, 2.2.5 or 2.2.6 above.

.2 Type or print on blank wire identification materials using indelible black ink.

.3 Identify wiring at all pull boxes, junction boxes, and outlet boxes for all systems.

.4 Identify each conductor as to panel and circuit, terminal, terminal numbers, system number scheme, and polarization, as applicable.

.5 Wiring terminations, lugs, terminals, and screws used for termination of wiring shall be suitable for either copper or aluminum conductors.

3.11 IDENTIFICATION OF RECEPTACLES AND FIRE ALARM END-OF-LINE RESISTORS AND DUCT DETECTORS

.1 Standard duplex receptacles: provide lamacoid name tag with 6 mm high white lettering on black background (red background for emergency receptacles) indicating circuit and panel designation and locate on wall above receptacle.

.2 On all other receptacles, provide lamacoid nametag indicating voltage, phase, amps, circuit and panel designations.

.3 Fire alarm end-of line resistors and duct detectors: identify zone number with 6 mm high white lettering on red background on lamacoid name tag located on wall above device.

.4 Identify remote LED indicators for duct detectors.

3.12 MANUFACTURERS AND CSA LABELS

.1 Visible and legible after equipment is installed.

3.13 WARNING SIGNS

.1 Porcelain enamel signs, minimum size 175 mm x 250 mm.

3.14 EQUIPMENT IDENTIFICATION SCHEDULE

Equipment	Colour	Nameplate Identification	Lamacoid Nameplate Size
Main Distribution	Voltage	Building name, consulting engineer, date installed, amperage, voltage	7

Equipment	Colour	Nameplate Identification	Lamacoid Nameplate Size
Centre	Colour	Main breaker, Metering cabinet	4
		Instrument transformer enclosure	6
		Loads controlled by each over current protective device	1
		Metering devices	1
Distribution Centres	Voltage Colour	Distribution centre designation, amperage, and voltage	5
		Loads controlled by each over current protective device	1
Panelboards	Voltage Colour	Panelboard designation, where fed from configuration (e.g 100A 120/208V, 3P 4W	2
Motor Control Centres	Voltage Colour	MCC designation, amperage and voltage	3
		Motors or loads controlled by each unit and mnemonics	1
		Relay terminal and transformer compartments	1
Manual Motor Starters	N/A	Load controlled and mnemonics	1
Ground Bus	N/A	System Ground	1
On/Off Switches	N/A	Load controlled	1
Disconnect Switches, Magnetic Motor Starters and Contactors	Voltage Colour	Voltage and equipment controlled and mnemonics	2
Transformers	Voltage Colour	Transformer designation, capacity, secondary and primary voltages	2
Emergency Power Equipment	Voltage Colour	Designation and voltage	2
Wireways	N/A	Voltage and system designation	2
Line Voltage Cabinets and Enclosures	Voltage Colour	Designation and voltage	2
Low Voltage Cabinets and Enclosures	System Colour	System name; system name and number if more than one cabinet or enclosure	2
		Major components within cabinets and enclosures	1
Communication Outlet and Outlet Assemblies	N/A	Outlet Designation	1

Equipment	Colour	Nameplate Identification	Lamacoid Nameplate Size
Communication Panels	N/A	Panel Designation	1
Communication Ports	N/A	Port Designation	1

END OF SECTION

Part 1 GENERAL

1.1 RELATED REQUIREMENTS

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

1.2 REFERENCES

.1 American National Standards Institute /Institute of Electrical and Electronics Engineers (ANSI/IEEE)

.1 ANSI/IEEE 837-02, IEEE Standard for Qualifying Permanent Connections Used in Substation Grounding.

.2 Operations and Maintenance 2009.

.2 CSA International

.1 CSA Z32-09, Electrical Safety and Essential Electrical Systems in Health Care Facilities.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00.

.2 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.

1.4 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00.

.2 Operation and Maintenance Data: submit operation and maintenance data for grounding equipment for incorporation into manual.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 and with manufacturer's written instructions.

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

.3 Storage and Handling Requirements:

.1 Store materials indoors 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.

Part 2 PRODUCTS

2.1 EQUIPMENT

.1 Grounding conductors: bare stranded copper, soft annealed, sized per Code or as indicated.

.2 Insulated grounding conductors: green, copper conductors, sized per Code or as indicated.

.3 Ground bus: copper, size size 6 mm x 50 mm x 0.6 m long, complete with insulated supports, fastenings, connectors.

.4 Non-corroding accessories necessary for grounding system shall be mechanical type made of silicon bronze, 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 Where EMT is used, run ground wire in conduit.

.2 Install connectors in accordance with manufacturer's instructions.

.3 Protect exposed grounding conductors from mechanical injury.

.4 Use mechanical connectors for grounding connections to equipment provided with lugs.

.5 Soldered joints not permitted.

.6 Install bonding wire for flexible conduit, connected at both ends to grounding bushing, solderless lug, clamp or cup washer and screw. Bonding conductor shall be installed within the conduit.

.7 Make grounding connections in radial configuration only, with connections terminating at single grounding point. Avoid loop connections.

.8 Bond single conductor, metallic armoured cables to ground at supply end, and provide non metallic entry plate at load end and run separate ground conductor.

.9 Ground all low tension conduits that terminate in telecom rooms/closets/panels and at cable trays, using grounding clamps or grounding bushings.

.10 Equipment Grounding: Install grounding connections from the equipment ground bus to typical equipment included in, but not necessarily limited to the following list. Service equipment, transformers, switch gear, panels, duct systems, frame of motors, motor control centres, starters, control panels, building steel work, generators, elevators and escalators, distribution panels, outdoor lighting.

.11 Communications Grounding: Extend existing grounding system to provide grounding and bonding system for all communication systems.

.12 Ground items of electrical equipment in electrical room and IT equipment in communication equipment room to ground bus with individual bare stranded copper connections size 2/0 AWG.

END OF SECTION

Part 1 GENERAL

1.1 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 74 20.

.2 Remove from site and dispose of all packaging materials at appropriate recycling facilities.

.3 Collect and separate for disposal paper, plastic, polystyrene, corrugated cardboard, packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.

.4 Divert unused metal materials from landfill to metal recycling facility as approved by Departmental Representative.

.5 Fold up metal banding, flatten and place in designated area for recycling.

Part 2 PRODUCTS

2.1 SUPPORT CHANNELS

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

Part 3 EXECUTION

3.1 INSTALLATION

.1 Secure equipment to hollow and solid masonry, tile and plaster surfaces with lead anchors or nylon shields.

.2 Secure equipment to poured concrete with expandable inserts.

.3 Secure equipment to hollow masonry walls or suspended ceilings with toggle bolts.

.4 Secure surface mounted equipment with twist clip fasteners to inverted T bar ceilings. Ensure that T bars are adequately supported to carry weight of equipment specified before installation.

.5 Support equipment, conduit or cables using clips, spring loaded bolts, cable clamps designed as accessories to basic channel members.

.6 Fasten exposed conduit or cables to building construction or support system using straps.

.1 One-hole steel straps to secure surface conduits and cables 50 mm and smaller.

.2 Two-hole steel straps for conduits and cables larger than 50 mm.

.3 Beam clamps to secure conduit to exposed steel work.

.7 Suspended support systems.

.1 Support individual cable or conduit runs with 6 mm dia threaded rods and spring clips.

.2 Support 2 or more cables or conduits on channels supported by 6 mm dia threaded rod hangers where direct fastening to building construction is impractical.

.8 For surface mounting of two or more conduits use channels at 3 m on centre spacing.

.9 Provide metal brackets, frames, hangers, clamps and related types of support structures where indicated or as required to support conduit and cable runs.

.10 Ensure adequate support for raceways and cables dropped vertically to equipment where there is no wall support.

.11 Do not use wire lashing or perforated strap to support or secure raceways or cables.

.12 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.

.13 Install fastenings and supports as required for each type of equipment cables and conduits, and in accordance with manufacturer's installation recommendations.

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 SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00.

.2 Product Data:

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

.3 Provide shop drawings: in accordance with Section 01 33 00.

.1 Provide drawings stamped and signed by professional engineer registered or licensed in Province of Ontario, Canada.

1.3 DELIVERY, STORAGE AND HANDLING

.1 Waste Management and Disposal:

.1 Separate waste materials for reuse and recycling in accordance with Section 01 74 20.

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 sized less than 400 A.

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 flat covers.

2.3 CABINETS

.1 Construction: welded sheet steel as indicated hinged door, handle, latch, lock with 2 keys and catch

.2 Type E Empty: surface return flange mounting.

.3 Type T Terminal: surface return flange containing 19 mm fire retardant treated plywood backboard.

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 indicated 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.

.2 Identification Labels: size 2 indicating system name, voltage and phase or as indicated.

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 SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00.

1.3 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00.

.2 Waste Management and Disposal:

.1 Separate waste materials for reuse and recycling in accordance with Section 01 74 20.

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.

.6 Shallow depth boxes where required for flush mounting, coordinate with architectural drawings

2.2 GALVANIZED STEEL OUTLET BOXES

.1 One-piece electro-galvanized construction.

.2 Single and multi-gang flush device boxes for flush installation, minimum size 76 x 50 x 38 mm or as indicated. 102 mm square outlet boxes when more than one conduit enters one side with extension and plaster rings as required.

.3 Utility boxes for outlets connected to surface-mounted EMT conduit, minimum size 102 x 54 x 48 mm.

.4 102 mm square or octagonal outlet boxes for lighting fixture outlets.

.5 Extension and plaster rings for flush mounting devices in finished plaster or tile walls.

2.3 MASONRY BOXES

.1 Electro-galvanized steel masonry single and multi-gang boxes for devices flush mounted in exposed block walls.

2.4 CONCRETE BOXES

.1 Electro-galvanized sheet steel concrete type boxes for flush mount in concrete with matching extension and plaster rings as required.

2.5 CONDUIT BOXES

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

2.6 OUTLET BOXES FOR NON-METALLIC SHEATHED CABLE

.1 Electro-galvanized, sectional, screw ganging steel boxes, minimum size 76 x 50 x 63 mm with two double clamps to take non-metallic sheathed cables.

2.7 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.

2.8 SERVICE FITTINGS

.1 'High tension' receptacle fitting made of 2 piece stainless steel or die-cast aluminum with brushed aluminum housing finish for 1 single, 1 duplex and two duplex receptacles. Bottom plate with two knockouts for centered or offset installation. 12 x 102 mm extension piece as indicated or as required.

.2 Pedestal type 'low tension' fitting made of 2 piece stainless steel or die cast aluminum with brushed aluminum housing finish to accommodate one and two amphenol jack connectors.

Part 3 EXECUTION

3.1 INSTALLATION

.1 Support boxes independently of connecting conduits.

.2 Fill boxes with paper, sponges or foam or similar approved material to prevent entry of debris during construction. Remove upon completion of work.

.3 For flush installations mount outlets flush with finished wall using plaster rings to permit wall finish to come within 6 mm of opening.

.4 Provide correct size of openings in boxes for conduit, mineral insulated and armoured cable connections. Do not install reducing washers.

.5 Vacuum clean interior of outlet boxes before installation of wiring devices.

.6 Identify systems for outlet boxes as required.

END OF SECTION

Part 1 GENERAL

1.1 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CAN/CSA-C22.2 No. 62-93(R2013), Surface Raceway Systems.

1.2 SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00.

.2 Product Data:

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

.3 Quality assurance submittals: provide following in accordance with Section 01 45 00.

.1 Manufacturer's Instructions: provide manufacturer's installation instructions and special handling criteria, installation sequence and cleaning procedures.

.4 Indicate types of raceways with terminology similar to that used in this Section.

1.3 DELIVERY, STORAGE AND HANDLING

.1 Waste Management and Disposal:

.1 Separate waste materials for reuse and recycling in accordance with Section 01 74 20.

Part 2 PRODUCTS

2.1 SURFACE RACEWAY SYSTEM

.1 One piece aluminum, free of sharp edges to CAN/CSA-C22.2 No. 62.

.2 The raceway and all system components must be cUL Listed in full compliance with their standard for surface metal raceways and fittings. All extrusions are to be 6063-T5 aluminum alloy, with nominal wall thickness of 2.03mm throughout.

.3 The surface finish is to be satin, anodized #204 Type clear, Class R1 Mil-Spec with minimum anodized finish of 0.10mm.

.4 Multi-channel to accommodate normal power, emergency power, and communications cabling.

.5 Corners, pull boxes, elbows, tees, two piece assembly to facilitate site wiring.

.6 Switch, receptacle, extension boxes, adapters and fittings required for complete installation.

Part 3 EXECUTION

3.1 INSTALLATION

.1 Install raceway to coordinate with casework where shown. Coordinate exact location, mounting height and all other installation details with furniture/casework/millwork supplier/installer and prepare coordination drawings and submit for Departmental Representative's approval prior to commencing installation.

.2 Install raceway systems as indicated and in accordance with manufacturer's instructions.

.3 Install supports, elbows, tees, connectors, fittings, bushings, adaptors as required.

.4 Keep number of elbows, offsets and connections to minimum.

.5 Use wiring with mechanical protection in channel raceways.

.6 Install barriers in raceways for different services where required by code.

.7 Install wiring after installation of raceway system is complete.

END OF SECTION

Part 1 GENERAL

1.1 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CSA C22.2 NO. 18.1-13, Metallic Outlet Boxes.

.2 CAN/CSA-C22.2 NO. 18.2-06(R2011), Nonmetallic Outlet Boxes.

.3 CSA C22.2 No. 18.3-12, Conduit, Tubing, and Cable Fittings (Tri-National standard, with ANCE NMX-J-017 and UL 514B).

.4 CAN/CSA-C22.2 No. 18.4-04(R2013), Hardware for the Support of Conduit, Tubing, and Cable.

.5 CSA C22.2 No. 45.1-07(R2012), Electrical Rigid Metal Conduit - Steel (Tri-National standard, with UL 6 and NMX-J-534-ANCE-2007).

.6 CSA C22.2 No. 56-13, Flexible Metal Conduit and Liquid-Tight Flexible Metal Conduit

.7 CSA C22.2 No. 83-M1985(R2013), Electrical Metallic Tubing.

.8 CSA C22.2 No. 211.2-06(R2011), Rigid PVC (Unplasticized) Conduit.

.9 CAN/CSA-C22.2 No. 227.3-05(R2010), Nonmetallic Mechanical Protection Tubing (NMPT), A National Standard of Canada (February 2006).

1.2 SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00.

.2 Product data: submit manufacturer's printed product literature, specifications and datasheets.

.1 Submit cable manufacturing data.

.3 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 in accordance with Section 01 74 20.

.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 CONDUITS

.1 Rigid metal conduit: to CSA C22.2 No. 45, galvanized steel threaded.

.2 Epoxy coated conduit: to CSA C22.2 No. 45, with zinc coating and corrosion resistant epoxy finish inside and outside.

.3 Electrical metallic tubing (EMT): to CSA C22.2 No. 83, with couplings with expanded ends.

.4 Rigid pvc conduit: to CSA C22.2 No. 211.2.

.5 Flexible metal conduit: to CSA C22.2 No. 56, liquid-tight flexible metal.

.6 Flexible pvc conduit: to CAN/CSA-C22.2 No. 227.3.

2.2 CONDUIT FASTENINGS

.1 One hole steel straps to secure surface conduits NPS 2 50 mm and smaller.

.1 Two hole steel straps for conduits larger than NPS 2 50 mm.

.2 Beam clamps to secure conduits to exposed steel work.

.3 Channel type supports for two or more conduits at 3 m on centre.

.4 Threaded rods, 6 mm diameter, to support suspended channels.

2.3 CONDUIT FITTINGS

.1 Fittings: to CSA C22.2 No. 18.3 and CAN/CSA- C22.2 No. 18.4, manufactured for use with conduit specified. Coating: same as conduit.

.2 Ensure factory "ells" where 90 degrees bends for NPS 1 25 mm and larger conduits.

.3 Watertight connectors and couplings for EMT.

.1 Set-screws are not acceptable.

2.4 EXPANSION FITTINGS FOR RIGID CONDUIT

.1 Weatherproof expansion fittings with internal bonding assembly suitable for 100 mm linear expansion.

.2 Watertight expansion fittings with integral bonding jumper suitable for linear expansion and 19 mm deflection.

.3 Weatherproof expansion fittings for linear expansion at entry to panel.

2.5 FISH CORD

.1 Polypropylene.

Part 3 EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION

.1 Install conduits to conserve headroom in exposed locations and cause minimum interference in spaces through which they pass.

.2 Conceal conduits except in mechanical and electrical service rooms and in other unfinished areas.

.3 Surface mount conduits except as indicated.

.4 Use rigid galvanized steel threaded conduit except where specified otherwise.

.5 Use epoxy coated conduit in corrosive areas, including acid room.

.6 Use electrical metallic tubing (EMT) except in cast concrete and above 2.4 m not subject to mechanical injury.

.7 Use flexible metal conduit for connection to motors in dry areas, connection to surface or recessed fluorescent fixtures and work in movable metal partitions.

.8 Use liquid tight flexible metal conduit for connection to motors or vibrating equipment in damp, wet or corrosive locations.

.9 Use explosion proof flexible connection for connection to explosion proof motors.

.10 Install conduit sealing fittings in hazardous areas.

.1 Fill with compound.

.11 Minimum conduit size for lighting and power circuits: NPS ¾ 19 mm.

.12 Bend conduit cold:

.1 Replace conduit if kinked or flattened more than 1/10th of its original diameter.

.13 Mechanically bend steel conduit over 19 mm diameter.

.14 Field threads on rigid conduit must be of sufficient length to draw conduits up tight.

.15 Install fish cord in empty conduits.

.16 Run 2-NPS 1 25 mm spare conduits up to ceiling space and 2-NPS 1 25 mm spare conduits down to ceiling space from each flush panel.

.1 Terminate these conduits in 152 x 152 x 102 mm junction boxes in ceiling space or in case of an exposed concrete slab, terminate each conduit in surface type box.

.17 Remove and replace blocked conduit sections.

.1 Do not use liquids to clean out conduits.

.18 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 or surface channels.

.5 Do not pass conduits through structural members except as indicated.

.6 Do not locate conduits less than 75 mm parallel to steam or hot water lines with minimum of 25 mm at crossovers.

3.4 CONCEALED CONDUITS

.1 Run parallel or perpendicular to building lines.

.2 Do not install horizontal runs in masonry walls.

.3 Do not install conduits in terrazzo or concrete toppings.

3.5 CONDUITS UNDERGROUND

.1 Slope conduits to provide drainage.

.2 Waterproof joints (pvc excepted) with heavy coat of bituminous paint.

3.6 CLEANING

.1 Proceed in accordance with Section 01 74 11.

.2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 GENERAL

1.1 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CAN/CSA-C22.2 No.126 1-09, Cable Tray Systems.

.2 National Electrical Manufacturers Association (NEMA) standards

.1 NEMA VE 1-2002, Metal Cable Tray Systems.

1.2 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data in accordance with section 01 33 00.

.2 Identify types of cabletroughs used.

.3 Show actual cabletrough installation details and suspension system.

1.3 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 74 20.

.2 Remove from site and dispose of all packaging materials at appropriate recycling facilities.

.3 Collect and separate for disposal paper, plastic, polystyrene, corrugated cardboard, packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.

.4 Divert unused metal and wiring materials from landfill to metal recycling facility as approved by Departmental Representative.

.5 Fold up metal banding, flatten and place in designated area for recycling.

Part 2 PRODUCTS

2.1 CABLETROUGH

.1 Cabletroughs and fittings: to NEMA VE 1.

.2 Ventilated type, Class C1 to CAN/CSA C22.2 No.126.

.3 Trays: aluminum, 300 mm wide with depth of 100 mm.

.4 Fittings: horizontal elbows, end plates, drop outs, vertical risers and drops, tees, wyes, expansion joints and reducers where required, manufactured accessories for cabletrough supplied.

.1 Radii on fittings: 600 mm minimum.

.5 Barriers where different voltage systems are in same cabletrough.

2.2 SUPPORTS

.1 Provide supports as required.

Part 3 EXECUTION

3.1 INSTALLATION

.1 Install complete cabletrough system.

.2 Support cabletrough on both sides.

.3 Remove sharp burrs or projections to prevent damage to cables or injury to personnel.

3.2 CABLES IN CABLETROUGH

.1 Install cables individually.

.2 Lay cables into cabletrough. Use rollers when necessary to pull cables.

.3 Secure cables in cabletrough at 6 m centres, with nylon ties.

.4 Identify cables every 30 m with size 2 nameplates in accordance with Section 26 05 00.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 This Section includes requirements for supply and installation of lighting control equipment including:

.1 Factory assembled dimming control

.2 Interfaces and modules

.3 Low voltage wall stations

.4 Control interfaces

.5 Sensors

1.2 RELATED REQUIREMENTS

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

1.3 SUBMITTALS

.1 Provide required information in accordance with Section 01.

.2 Action Submittals: Provide the following submittals before starting any Work of this Section:

.1 Product Data: Submit Product data for lighting control system and all components specified indicating features, characteristics, capacities, limitations and ratings of controllers, interfaces and other components.

.2 Shop Drawings: Submit Shop Drawings clearly indicating minimum clearances, installation details, fastenings, component identification and as follows:

.1 Single line diagram including wiring for power, signal and control systems; differentiate between manufacturer installed and site installed wiring.

.2 Indicate zoning of controls and fixtures being controlled.

1.4 PROJECT CLOSEOUT SUBMISSIONS

.1 Operation and Maintenance Data: Submit manufacturer's written instructions for operations and maintenance procedures, include name of original installer and contact information in accordance with Section 01 92 00 – Facility Operation and as follows:

.1 System Start-up Information

.2 Installation Guide

.3 Set-up and Programming Guide

1.5 SITE CONDITIONS

.1 Ambient Conditions: Do not install equipment until following conditions can be maintained in spaces to receive equipment:

.1 Ambient temperature: 0°C to 40°C

.2 Relative humidity: Maximum 90%, non-condensing.

.3 Protect lighting control system from dust during installation.

1.6 QUALITY ASSURANCE

.1 Qualifications: Provide proof of qualifications during the course of the Work of this Section:

.1 Manufacturer: Obtain lighting controls system through one source from a single manufacturer or using materials from a secondary source that are acceptable to the manufacturer.

.2 Installer: Install using personnel experienced in installation of lighting control systems of similar design and complexity as required for this Project and whose work has resulted in construction with a record of successful in-service performance.

1.7 WARRANTY

.1 Provide warranty information in accordance with Section 01. Warranties specified in this Section are independent from, and run concurrently with, any other warranties for the Contract; submit warranty in the name of the Owner.

.2 Manufacturer Warranty: Provide manufacturer's written warranty in the name of the Owner certifying that the specified Products conform to the performance and physical properties listed in this Section, and will remain free of defects in material or manufacture, for a period of two (2) years from date of Substantial Performance of the Work including the following:

.1 Replacement Parts for Manufacturer Lighting System Components: 100% coverage.

.2 Manufacturer Labor Coverage to Troubleshoot and Diagnose a Lighting Issue: 100% coverage.

.3 First–Available Onsite or Remote Response Time

.4 24 Hours per Day, 7 Days per Week Telephone Technical Support, excluding Manufacturer Holidays

.5 Remote Diagnostics for Applicable System

Part 2 Products

2.1 LIGHTING MANAGEMENT HUBS

.1 Provided in a pre-assembled NEMA listed enclosure with terminal blocks listed for field wiring.

.2 Connects to controls and power panels via RS485.

.3 Enables light management software to control and monitor compatible dimming ballasts and ballast modules, power panels, power modules, and window treatments.

.1 Utilizes Ethernet connectivity to light management computer utilizing one of the following methods:

.2 Dedicated network.

.3 Dedicated VLAN.

.4 Shared network with Building Management System (BMS).

.5 Corporate network where managed switches are configured to allow multicasting and use of IGMP.

.4 Integrates control station devices, power panels, shades, preset lighting controls, and external inputs into a single customizable lighting control system with:

.1 Multiple Failsafe Mechanisms:

.1 Power failure detection via emergency lighting interface.

.2 Protection: Lights go to full on if ballast wires are shorted.

.3 Distributed architecture provides fault containment. Single hub failure or loss of power does not compromise lights and shades connected to other lighting management hubs.

.2 Manual overrides.

.3 Automatic control.

.4 Central computer control and monitoring.

.5 Furnished with astronomical time clock.

.6 Furnished with solar clock to track the position of the sun to control the shades to limit penetration of direct sunlight.

.7 Maintains a backup of the programming in a non-volatile memory capable of lasting more than ten years without power.

2.2 LIGHTING MANAGEMENT SYSTEM SOFTWARE

.1 Provide system software license and hardware that is designed, tested, manufactured, and warranted by a single manufacturer.

.2 Configuration Setup Software:

.1 Suitable to make system programming and configuration changes.

.2 Windows-based, capable of running on either central server or a remote client over TCP/IP connection.

.3 Allows manufacturer (either remotely or with on-site service call); end-user (with training); to:

.1 Capture system design:

.1 Geographical layout.

.2 Load schedule zoning.

.3 Shade grouping.

.4 Equipment schedule.

.5 Equipment assignment to lighting management hubs.

.6 Daylighting design.

.2 Define the configuration for the following in each area:

.1 Lighting scenes.

.2 Shade group presets.

.3 Control station devices.

.4 Interface and integration equipment.

.5 Occupancy/after hours.

.6 Partitioning.

.7 Daylighting.

.8 Emergency lighting.

.9 Night lights.

.3 Startup:

.1 Addressing.

.2 Daylighting.

.3 Provide customized conditional programming.

.3 Control and Monitor Software:

.1 Accessibility and Platform Support:

.1 Web-based; runs on most HTML5 compatible browsers (including Internet Explorer, Chrome, and Safari).

.2 Supports multiple platforms and devices; runs from a tablet, desktop, laptop, or smartphone; optimized for displays of 1024 by 768 pixels or higher.

.3 User interface supports multi-touch gestures such as pinch to zoom, drag to pan, etc.

.4 Utilizes HTTPS (industry-standard certificate-based encryption and authentication for security).

.2 Desktop Application:

.1 Client installation for Windows-based operating systems.

.2 Performed using basic system tree view.

.2 System Navigation and Status Reporting:

.1 Performed using graphical floor plan view or a generic system layout.

.1 Graphical Floor Plan View: Utilizes customized CAD based drawing of the building. Pan and zoom feature allows for easy navigation; dynamically adjusts the details presented based on zoom level.

.2 Area, scene, and zone names can be changed in real time.

.3 Control of Lights:

.1 Area lights can be monitored for on/off status.

.2 All lights in an area can be turned on/off or sent to a specific level.

.3 For areas that have been zoned, these areas may be sent to a predefined lighting scene, and individual zones may be controlled.

.4 Area lighting scenes can be renamed and modified in real-time, changing the levels that zones go to when a scene is activated.

.5 High and low end of area lighting can be tuned/trimmed.

.6 Control and monitor area partition status.

.4 Occupancy:

.1 Area occupancy can be monitored.

.2 Area occupancy can be disabled to override occupancy control or in case of occupancy sensor problems.

.3 Area occupancy settings including level that lights turn on to when area is occupied, and level that lights turn off to when area is unoccupied can be changed in real-time.

.4 Monitor energy savings due to occupancy down to an individual area.

.5 Daylighting:

.1 Daylighting can be enabled/disabled. Can be used to override the control currently taking place in the space.

.2 The following is particularly useful when new departments move into a space.

.3 Daylight calibration can be adjusted for each daylit area.

.4 Daylight status can be monitored.

.5 Monitor energy savings due to daylight harvesting down to an individual area.

.6 Load Shedding; Allows the building manager to monitor whole building lighting power usage and apply a customized load shed reduction to selected areas, thereby reducing a building's power usage; load shedding triggered via lighting control software, BACnet, or OpenADR.

.7 Scheduling: Schedule time of day and astronomic time clock events to automate functions.

.1 Adjust or disable a single occurrence of a repeating scheduled event.

.2 Easily monitor and adjust scheduled events using a weekly calendar view.

.8 Reporting: Provide reporting capability that allows the building manager to gather real-time and historical information about the system as follows:

.1 Energy Reports: Show a comparison of cumulative energy used over a period of time for one or more areas or meter groups.

.2 Power Reports: Show power usage trend over a period of time for one or more areas or meter groups.

.3 Energy Density Report: Show energy usage in W/sq ft.

.4 Energy Savings By Strategy Report: Show energy savings for any area broken down by strategy (tuning, occupancy, daylighting, scheduled events, personal control, and load shedding).

.5 Activity Report: Show what activity has taken place over a period of time for one or more areas. Activity includes occupant activities (e.g. wall controls being pressed), building manager operation (e.g. controlling/changing areas using the control and monitor tool), and device failures (e.g. keypads or ballasts that are not responding).

.6 Lamp Failure Report: Shows which areas are currently reporting lamp failures.

.7 Sensor Level Report: Shows the light level in footcandles of any photosensor in the system.

.8 Alert Activity Report: Capable of generating historical reports of all alert activity within the system.

.9 Diagnostics: Allows the building manager to check on the status of all equipment in the lighting control system. Devices to be listed with a reporting status of OK, missing, or unknown.

.10 Alerts and Alarms: Monitors the system for designated events/triggers and automatically generates alerts according to configured response criteria.

.1 Capable of monitoring for the following events/triggers:

.1 A failed piece of equipment (e.g., control, sensor, etc.); alert cleared when equipment is replaced.

.2 Low battery conditions in battery-operated sensors and controls; alert cleared when battery is replaced.

.3 Luminaires with lamp operating hours in excess of designated time.

.4 A load shed event; alert generated for beginning and end of trigger.

.5 Energy usage higher than designated threshold target.

.6 Potential light level condition discrepancies (daylight sensors not agreeing with expected lighting status).

.2 View alerts on a customized graphical floor plan.

.3 Capable of generating alerts through visible changes in software or through email messages.

.4 Capable of customizing the frequency of alerts and providing notifications immediately or through daily, weekly, or monthly summaries.

.5 Capable of sending different alerts to different system users.

.6 Capable of generating historical reports of all alert activity within the system.

.11 Administration:

.1 Users: Allows new user accounts to be created and existing user accounts to be edited.

.2 Supports Active Directory (LDAP) tying user accounts to network accounts.

.3 Area and feature access can be restricted based on login credentials with three levels of access rights (Admin, Programmer, Controller) and customized access levels available.

.4 Publish Graphical Floor Plan: Allows admin user to publish new graphical floor plan files, allowing users to monitor the status of lights, occupancy of areas, and daylighting status.

.5 The control and monitor tool can be used to adjust some of these settings, and thus it is important to back up the project database prior to changing settings in the design and setup tool.

.6 Back-Up Project Database: Allows admin user to back up the project database that holds all the configuration information for the system, including keypad programming, areas scenes, daylighting, occupancy programming, emergency levels, night lights, and time clock.

.7 Publish Project Database: Allows admin user to send a new project database to the server and download the new configuration to the system. The project database holds all the configuration information for the system, including keypad programming, area scenes, daylighting, occupancy programming, emergency levels, night lights, and time clock.

.12 Favorite Buttons: Provide global scene control or modes of operation across the entire system.

.13 Provides control/monitoring of partition status to automatically reconfigure how the space operates based on the partition's open/closed status.

.4 Web Services Integration License:

.1 Provide ability to communicate by means of XML web services

.2 Web services integrator can monitor:

.1 Area instantaneous power usage.

.2 Area instantaneous power savings.

.3 Area energy savings.

.4 Area energy usage.

.5 Area maximum power usage.

.3 Initiate load shed event using OpenADR protocol in an auto-Demand-Response event without additional interfaces or gateways.

.4 Supports both push and pull for integration with third party systems and energy dashboards.

.5 Mobile Control and Programming Software License:

.1 Allows mobile control and programming of lighting control system via an Apple iPad.

.2 Provides users the ability to:

.1 Control and monitor area lighting scenes, zones, and shade presets.

.2 Easily identify zones and shade groups.

.3 Edit area lighting scenes, shade presets, scene fade rates, and scene delay rates.

.4 Restrict user access by area.

.5 Restrict users from ability to make changes.

.6 Historical logging of who made changes available in control and monitor software.

.3 Connects to lighting control system via Wi-Fi.

.4 Can connect directly to processor or through computer (server) in the system.

.6 Provide control stations with configuration as indicated or as required to control the loads as indicated.

.7 Wired Control Stations:

.1 General Requirements:

.1 Class 2 (low voltage).

.2 UL listed.

.3 Control stations can be replaced without reprogramming.

.8 Control Modules:

.1 Products:

.1 Control module with wired inputs

.2 Provides inputs for:

.1 Four (4) Occupancy sensors

.2 Four (4) daylight sensors

.3 Four (4) IR receiver for personal control

.4 Four (4) IEC PELV / NEC® Class 2 dry contact switches

.5 Control link for sensor module integration

.3 Provide automated control of lighting in 4 zones

.9 Sensor Modules:

.1 Products:

.1 Sensor module with wireless inputs

.2 Provide wireless communication inputs for:

1) Occupancy sensors.
2) Daylight sensors.
3) Wireless controller.

.3 RF Range: 30 feet (9 m) between sensor and compatible RF receiving devices.

.4 RF Frequency: 434 MHz; operates in FCC governed frequency spectrum for periodic operation; continuous transmission spectrum is not permitted.

.2 Communicate sensor information to wired low-voltage digital link for use by compatible devices.

2.3 SOURCE QUALITY CONTROL

.1 Factory Testing;

.1 Perform full-function factory testing on all completed assemblies. Statistical sampling is not acceptable.

.2 Perform full-function factory testing on 100 percent of all ballasts and LED drivers.

.3 Perform factory audit burn-in of all dimming assemblies and panels at 104 degrees F (40 degrees C) at full load for two hours.

.4 Perform factory burn-in of 100 percent of all ballasts at 104 degrees F (40 degrees C).

Part 3 EXECUTION

3.1 EXAMINATION

.1 Verify that field measurements are as shown on the drawings.

.2 Verify that ratings and configurations of system components are consistent with the indicated requirements.

.3 Verify that mounting surfaces are ready to receive system components.

.4 Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

.1 Perform work in a neat and workmanlike manner

.2 Install products in accordance with manufacturer's instructions.

.3 Provide dedicated network between lighting management system computer and lighting management hubs.

.4 Define each dimmer/relay load type, assign each load to a zone, and set control functions.

.5 Mount exterior daylight sensors to point due north with constant view of daylight.

.6 Ensure that daylight sensor placement minimizes sensor view of electric light sources. Locate ceiling-mounted and luminaire-mounted daylight sensors to avoid direct view of luminaires.

.7 LED Light Engine/Array Lead Length: Do not exceed 100 feet (31 m).

3.3 FIELD QUALITY CONTROL

.1 Include centralized PC control systems.

.2 standard startup services include multiple site visits to ensure proper operation. The first site visit ensures that the contractor is trained to install the system correctly. The second visit starts up the system and ensures that the system is operating as specified, and trains the owner on system operation and functionality.

.3 Manufacturer's Startup Services:

.1 Manufacturer's authorized Service Representative to conduct minimum of two site visits to ensure proper system installation and operation.

.2 Conduct Pre-Installation visit to review requirements with installer as specified in Part 1 under "Administrative Requirements".

.3 Conduct second site visit upon completion of lighting control system to perform system startup and verify proper operation:

.1 Verify connection of power wiring and load circuits.

.2 Verify connection and location of controls.

.3 Energize lighting management hubs and download system data program.

.4 Address devices.

.5 Verify proper connection of panel links (low voltage/data) and address panel.

.6 Download system panel data to dimming/switching panels.

.7 Check dimming panel load types and currents and supervise removal of by-pass jumpers.

.8 Verify system operation control by control.

.9 Verify proper operation of manufacturer's interfacing equipment.

.10 Verify proper operation of manufacturer's supplied PC and installed programs.

.11 Configure initial groupings of ballast for wall controls, daylight sensors and occupancy sensors.

.12 Train Owner's representative on system capabilities, operation, and maintenance, as specified in Part 3 under "Closeout Activities".

.13 Obtain sign-off on system functions.

.4 Correct defective work, adjust for proper operation, and retest until entire system complies with contract documents.

3.4 ADJUSTING

.1 On-Site Scene and Level Tuning;: Include as part of the base bid for Lighting Control Manufacturer to visit site to conduct meeting with Engineer; Owner's representative; Lighting Designer; or engineer to make required lighting adjustments to the system for conformance with original design intent.

.2 Sensor Fine-Tuning: Lighting Control Manufacturer to provide up to two additional post-startup on-site service visits for fine-tuning of sensor calibration.

3.5 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11.

.3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 20 and 01 35 21.

.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.6 CLOSEOUT ACTIVITIES

.1 Training:

.1 Include services of manufacturer's authorized Service Representative to perform on-site training of Owner's personnel on operation, adjustment, and maintenance of lighting control system as part of standard system start-up services.

.1 Include training on software to be provided:

.1 Configuration software used to make system programming and configuration changes.

.2 Control and monitor.

.3 Energy savings display software.

.4 Personal web-based control software.

.2 Customer-Site Solution Training Visit: Include as part of the base bid; for Lighting Control Manufacturer to provide one; day(s) of additional on-site system training.

3.7 PROTECTION

.1 Protect installed products from subsequent construction operations.

.2 Protect installed products and components from damage during construction.

.3 Repair damage to adjacent materials caused by network lighting controls installation.

3.8 MAINTENANCE

.1 System Optimization Visit;: Include as part of the base bid; for Lighting Control System Manufacturer to visit site six months after system start-up to evaluate system usage and discuss opportunities to make efficiency improvements that will fit with the current use of the facility.

END OF SECTION

Part 1 GENERAL

1.1 WORK INCLUDED

.1 Provide all wall mounted equipment in sprinklered areas with accessories to prevent the entry of water into the enclosures in the event that the sprinkler system is activated.

Part 2 PRODUCTS

2.1 MATERIALS

.1 Gaskets on lighting, receptacle and distribution panelboards.

.2 Gaskets on doors and drip shields on fire alarm and communication systems panels and enclosures.

.3 Louvres facing outward and downward where openings are required for heat dissipation. Expanded metal screening is not acceptable.

.4 CSA certified sealing rings for rigid steel galvanized conduit and CSA certified raintight connectors for steel galvanized electrical metallic tubing (EMT).

Part 3 EXECUTION

3.1 INSTALLATION

.1 Install sealing rings and raintight connectors on all conduit terminations entering the top or side of all panel enclosures and for all conduit terminations for pull boxes, junction boxes, splitter troughs, wireways, auxiliary gutters, cable troughs and disconnect switches installed below the level of the sprinkler heads.

END OF SECTION

Part 1 GENERAL

1.1 RELATED REQUIREMENTS

.1 Section 26 05 29 Hangers And Supports For Electrical Systems

.2 26 05 34 Conduits, Conduit Fastenings And Conduit Fittings

1.2 REFERENCES

.1 CSA International

.1 CSA C22.2 No.29-11, Panelboards and Enclosed Panelboards.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00.

.2 Product Data:

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

.3 Shop Drawings:

.1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Ontario, Canada.

.2 Include on drawings:

.1 Electrical detail of panel, branch breaker type, quantity, ampacity and enclosure dimension.

.4 Sustainable Design Submittals:

.1 Construction Waste Management:

.1 Submit project Waste Reduction Workplan highlighting recycling and salvage requirements.

.2 Submit calculations on end-of-project recycling rates, salvage rates, and landfill rates demonstrating that 75% of construction wastes were recycled or salvaged.

1.4 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00.

.2 Operation and Maintenance Data: submit operation and maintenance data for panelboards for incorporation into manual.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 and with manufacturer's written instructions.

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

.3 Storage and Handling Requirements:

.1 Store materials indoors 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 Develop Waste Reduction Workplan related to Work of this Section and in accordance with Section 01 35 21.

.5 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding and packaging materials as specified Waste Reduction Workplan in accordance with Section 01 74 20.

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.

.2 120/208V panelboards: bus and breakers rated for 18kA (symmetrical) interrupting capacity or as indicated.

.3 600V panelboards: bus and breakers rated for 18kA (symmetrical) interrupting capacity or as indicated.

.4 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.

.5 Panelboards: mains, number of circuits, and number and size of branch circuit breakers as indicated.

.6 Enclosure: sprinkler proof hood

.7 All 120/208V branch circuit panelboards shall be single tub design.

.8 Minimum of 2 flush locks for each panel board.

.9 Two keys for each panelboard and key panelboards alike.

.10 Copper bus with neutral of same ampere rating of mains.

.11 Mains: suitable for bolt-on breakers.

.12 Trim with concealed front bolts and hinges.

.13 Trim and door finish: baked enamel.

.14 Include grounding busbar terminals for bonding conductor equal to breaker capacity of the panel board.

2.2 BREAKERS

.1 Breakers: to Section 26 28 16.02.

.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.

.4 Lock-on devices for 10% of 15 to 30 A breakers installed as indicated. Turn over unused lock-on devices to Departmental Representative.

.5 Lock-on devices for fire alarm, exit and night light circuits.

.6 Two and 3 pole breakers shall have common simultaneous trip.

2.3 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 00.

.2 All panelboard tags indicated on drawings are for design coordination only. All panelboards to be tagged according to local distribution nomenclature. Obtain Departmental Representative approval for all proposed panelboard tags.

.3 Nameplate for each panelboard size 4 engraved.

.4 Nameplate for each circuit in distribution panelboards size 2 engraved.

.5 Complete circuit directory with typewritten legend showing location and load of each circuit, mounted in plastic envelope at inside of panel door.

Part 3 EXECUTION

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for panelboards installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate 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 INSTALLATION

.1 Locate panelboards as indicated and mount securely, plumb, true and square, to adjoining surfaces.

.2 Mount panelboards to height specified in Section 26 05 00 or as indicated.

.3 Connect loads to circuits.

.4 Connect neutral conductors to common neutral bus.

.5 Balance connected loads within 5% by adjusting branch circuit locations.

.6 Provide all mounting brackets, busbar drillings and filler pieces for spaces.

3.3 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11.

.3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 20

.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 panelboards installation.

END OF SECTION

Part 1 GENERAL

1.1 REFERENCES

1.1 RELATED REQUIREMENTS

1.1.1 Section 26 05 00 – Common Work Results for Electrical

1.1.2 Section 26 05 28 – Conduits, Outlet Boxes and Fittings for Electrical Systems

.1 CSA International

.1 CSA C22.2 No.42-10, General Use Receptacles, Attachment Plugs and Similar Devices.

.2 CAN/CSA-C22.2 No.42.1-00(R2009), Cover Plates for Flush-Mounted Wiring Devices (Bi-national standard, with UL 514D).

.3 CSA C22.2 No.55-M1986(R2008), Special Use Switches.

.4 CSA C22.2 No.111-10, General-Use Snap Switches (Bi-national standard, with UL 20).

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for wiring devices and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:

.1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Ontario, Canada.

.4 Sustainable Design Submittals:

.1 Construction Waste Management:

.1 Submit project Waste Management Plan and Waste Reduction Workplan highlighting recycling and salvage requirements.

.2 Submit calculations on end-of-project recycling rates, salvage rates, and landfill rates demonstrating that 75% of construction wastes were recycled or salvaged.

1.3 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00.

.2 Operation and Maintenance Data: submit operation and maintenance data for wiring devices for incorporation into manual.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 and with manufacturer's written instructions.

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

.3 Storage and Handling Requirements:

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

.2 Store and protect wiring devices from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

.4 Packaging Waste Management: remove for reuse of pallets, crates, padding and packaging materials as specified in Construction Waste Management Plan and Waste Reduction Workplan in accordance with Section 01 74 20 and Section 01 35 21.

Part 2 PRODUCTS

2.1 SWITCHES

.1 15 A, 120 V, single pole, three-way switches to: CSA C22.2 No.55 and CSA C22.2 No.111.

.2 Manually-operated general purpose AC switches with following features:

.1 Terminal holes approved for No. 10 AWG wire.

.2 Silver alloy contacts.

.3 Urea or melamine moulding for parts subject to carbon tracking.

.4 Suitable for back and side wiring.

.5 Ivory toggle.

.3 Toggle operated fully rated for tungsten filament and fluorescent lamps, and up to 80% of rated capacity of motor loads heating loads.

.4 Switches of one manufacturer throughout project.

2.2 RECEPTACLES

.1 Duplex receptacles, CSA type 5-15 R, 125 V, 15 A, U ground, to: CSA C22.2 No.42 with following features:

.1 Ivory urea moulded housing.

.2 Suitable for No. 10 AWG for back and side wiring.

.3 Break-off links for use as split receptacles.

.4 Eight back wired entrances, four side wiring screws.

.5 Triple wipe contacts and riveted grounding contacts.

.2 Single receptacles CSA type 5-15 R, 125 V, 15 A, U ground with following features:

.1 Ivory urea moulded housing.

.2 Suitable for No. 10 AWG for back and side wiring.

.3 Four back wired entrances, 2 side wiring screws.

.3 Other receptacles with ampacity and voltage as indicated.

.4 Receptacles of one manufacturer throughout project.

2.3 SPECIAL WIRING DEVICES

.1 Special wiring devices:

.1 Clock hanger outlets, 15 A, 125 V, 3 wire, grounding type, suitable for No. 10 AWG for installation in flush outlet box.

.2 Electric shaver outlets, 15 A, 125 V, AC with 20 VA isolating transformer with stainless steel cover plate marked RAZOR ONLY.

.3 Pilot lights as indicated, with neon type 0.04 W, 125 V lamp and red plastic lens flush type.

2.4 COVER PLATES

.1 Cover plates for wiring devices to: CSA C22.2 No.42.1.

.2 Sheet steel utility box cover for wiring devices installed in surface-mounted utility boxes.

.3 Stainless steel 1 mm thick cover plates for wiring devices mounted in flush-mounted outlet box.

.4 Cast cover plates for wiring devices mounted in surface-mounted FS or FD type conduit boxes.

.5 Weatherproof double lift spring-loaded cast aluminum cover plates, complete with gaskets for duplex receptacles as indicated.

.6 Weatherproof spring-loaded cover plates complete with gaskets for single receptacles or switches.

2.5 SOURCE QUALITY CONTROL

.1 Cover plates from one manufacturer throughout project.

Part 3 EXECUTION

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for wiring devices installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Departmental Representative.

.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 INSTALLATION

.1 Switches:

.1 Install single throw switches with handle in "UP" position when switch closed.

.2 Install switches in gang type outlet box when more than one switch is required in one location.

.3 Mount toggle switches at height in accordance with Section 26 05 00.

.2 Receptacles:

.1 Install receptacles in gang type outlet box when more than one receptacle is required in one location.

.2 Mount receptacles at height in accordance with Section 26 05 00.

.3 Where split receptacle has one portion switched, mount vertically and switch upper portion.

.4 Install GFI type receptacles as indicated.

.3 Cover plates:

.1 Install suitable common cover plates where wiring devices are grouped.

.2 Do not use cover plates meant for flush outlet boxes on surface-mounted boxes.

3.3 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11.

.3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 20 and 01 35 21.

.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.4 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Protect stainless steel cover plate finish with paper or plastic film until painting and other work is finished.

.3 Repair damage to adjacent materials caused by wiring device installation.

END OF SECTION

Part 1 GENERAL

1.1 REFERENCES

.1 CSA International (CSA)

.1 CSA C22.2 No. 5-09, Molded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures (Tri-national standard with UL 489, and NMX-J-266-ANCE-2010).

1.2 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 with ampacity of 100 A and over or with interrupting capacity of 22,000 A symmetrical (rms) and over at system voltage.

.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 Section 01 61 00 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 circuit breakers 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 by manufacturer of pallets, crates, padding and packaging materials as specified in Construction Waste Management Plan and Waste Reduction Workplan in accordance with Section 01 74 20.

Part 2 PRODUCTS

2.1 BREAKERS GENERAL

.1 Moulded-case circuit breakers and ground-fault circuit-interrupters: to CSA C22.2 No. 5

.2 Bolt-on moulded case circuit breaker: quick- make, quick-break type, for manual and automatic operation with temperature compensation for 40 degrees C ambient.

.3 Plug-in moulded case circuit breakers: quick- make, quick-break type, for manual and automatic operation with temperature compensation for 40°C ambient.

.4 Common-trip breakers: with single handle for multi-pole applications.

.5 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.

.6 Circuit breakers with interchangeable trips as indicated.

.7 Circuit breakers to have minimum 18kA symmetrical rms interrupting capacity rating.

2.2 THERMAL MAGNETIC BREAKERS DESIGN A

.1 Moulded case circuit breaker to operate automatically by means of thermal and magnetic tripping devices to provide inverse time current tripping and instantaneous tripping for short circuit protection.

2.3 MAGNETIC BREAKERS DESIGN B

.1 Moulded case circuit breaker to operate automatically by means of magnetic tripping devices to provide instantaneous tripping for short circuit protection.

2.4 CURRENT LIMITING AND SERIES RATED THERMAL MAGNETIC BREAKERS DESIGN C

.1 Thermal magnetic breakers with current limiters.

.1 Time current limiting characteristics of fuses limiters coordinated with time current tripping characteristics of circuit breaker.

.2 Co-ordination to result in interruption by breaker of fault-level currents up to interrupting capacity of breaker.

.2 Series rated breakers to be manufacturer tested and listed. Breakers to be applied following manufacturer's guidelines and accepted best practice.

.1 Breakers applied following manufacturer's guidelines and accepted best practice.

2.5 SOLID STATE TRIP BREAKERS DESIGN D

.1 Moulded case circuit breaker to operate by means of solid-state trip unit with associated current monitors and self-powered shunt trip to provide inverse time current trip under overload condition, and long time, short time, instantaneous, tripping for phase, ground fault short circuit protection.

2.6 OPTIONAL FEATURES

.1 Include:

.1 Shunt trip.

.2 Auxiliary switch.

.3 Motor-operated mechanism c/w time delay unit.

.4 Under-voltage release.

.5 On-off locking device.

.6 Handle mechanism.

2.7 ENCLOSURE

.1 NEMA 2.

Part 3 EXECUTION

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Departmental Representative.

.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 INSTALLATION

.1 Install circuit breakers as indicated.

3.3 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11.

.3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 20.

.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

Part 1 GENERAL

1.1 PRODUCT DATA

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

1.2 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 74 20.

Part 2 PRODUCTS

2.1 DISCONNECT SWITCHES

.1 Fusible, non-fusible, horsepower rated disconnect switch in CSA Enclosure, size as indicated.

.2 Provision for padlocking in on-off switch position by three locks.

.3 Mechanically interlocked door to prevent opening when handle in ON position.

.4 Fuses: size as indicated.

.5 Fuseholders: relocatable and suitable without adaptors, for type and size of fuse indicated.

.6 Quick-make, quick-break action.

.7 ON-OFF switch position indication on switch enclosure cover.

.8 Weatherproof enclosure where installed outdoors

2.2 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 00.

.2 Indicate name of load controlled on size 4 nameplate.

Part 3 EXECUTION

3.1 INSTALLATION

.1 Install disconnect switches complete with fuses if applicable.

END OF SECTION

Part 1 GENERAL

1.1 REFERENCES

.1 International Electrotechnical Commission (IEC)

.1 IEC 60947-4-1-2009, Low-voltage switchgear and control gear - Part 4-1: Contactors and motor-starters - Electromechanical contactors and motor-starters.

1.2 ACTION

.1 All starters shall be supplied and installed by Mechanical contractor.

1.3 CLOSEOUT SUBMITTALS

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

1.4 DELIVERY, STORAGE AND HANDLING

.1 Take possession, store and handle in accordance with Section 01 61 00.

.2 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, paddling, and packaging materials in accordance with Section 01 74 20.

Part 2 PRODUCTS

2.1 MOTOR STARTERS

.1 Shall be supplied and installed by Mechanical contractor.

2.2 CONTROL TRANSFORMER

.1 Shall be supplied and installed by Mechanical contractor utilizing line voltage power supply provided by Electrical contractor. Provide line voltage where required. Coordinate this work on site.

2.3 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 00.

Part 3 EXECUTION

3.1 INSTALLATION

.1 All line voltage wiring on line side and load side of starter and/or VFD by electrical contractor.

.2 Wire starters and line voltage controls as indicated.

.3 Ensure correct fuses installed.

.4 Confirm motor nameplate and adjust overload device to suit.

3.2 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 00 and manufacturer's instructions.

.2 Operate switches and contactors to verify correct functioning.

.3 Perform starting and stopping sequences of contactors and relays.

.4 Check that sequence controls, interlocking with other separate related starters, equipment, control devices, operate as indicated.

3.3 CLEANING

.1 Clean in accordance with Section 01 74 11.

.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 74 20.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Supply, install, test and commission electronic sub-metering system as specified herein and shown on the Drawings.

.2 The DMS is to include real-time sub-metering data collection and communications software which can interface to the Building Automation System via BACnet IP or BACnet MSTP.

.3 The DMS is to be capable of handling a minimum of 2000 electricity, gas, water, BTU and steam submetering points.

.4 The Digital Sub-Metering will be completed with all necessary:

- .1 Electronic Field Panels
- .2 Energy Monitoring Pods (EMP)
- .3 Current Transformers (CTs)
- .4 Potential Transformers (PTs)
- .5 Wiring
- .6 Accessories

.5 All electrical meters shall be equipped with dry contact pulse outputs for connection to Building Automation System.

.6 Digital Sub-Metering System shall be capable of receiving measurement inputs from BAS system.

.7 The digital sub-metering electrical installation is to be completed by the Electrical Contractor for the project, including all electrical labour, materials and local electrical safety authority inspection certificates.

.8 Include all costs associated with the coordination of system installation, electricity submetering equipment, commissioning, and customer training during the entire period of construction and system start-up.

.9 The Electrical Contractor shall conform to manufacturer’s installation requirements. The contractor to provide all necessary installation hardware including, but not limited to, conduit, fittings, wiring and cable.

.10 Include all costs associated with the coordination of system installation, electricity submetering equipment, commissioning, and customer training during the entire period of construction and system start-up.

.11 All mechanical meters will be supplied by Utilities Companies or by mechanical contractor, Mechanical Contractor Responsibilities, and will be equipped with dry contact pulse outputs for electricity, natural gas, water, BTU and steam meters.

1.2 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures

.2 Section 26 05 28 – Conduits, Outlet Boxes and Fittings

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

.4 Section 26 05 19 – Wires and Cables (0-1000V)

.5 Section 26 24 02 – Service Entrance Boards

.6 Section 26 24 16 – Panelboards

1.3 REFERENCES

.1 American National Standards Institute (ANSI):

.1 ANSI C39.1-1981, Requirements, Electrical Analog Indicating Instruments

.2 Canadian Standards Association, (CSA International):

.1 CAN3-C17-M84 (R1999), Alternating - Current Electricity Metering

.2 CSA C22.1-12, Canadian Electrical Code, Part 1 (22st Edition), Safety Standard for Electrical Installations

.3 Measurement Canada:

.1 S-E-06 Specification for the Approval of Type of Electricity Meters and Auxiliary Device

.2 S-E-04 Specifications for the Installation Requirements for Multiple Customer Metering Systems

1.4 PRODUCT DATA

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

.2 Indicate wiring diagrams showing all devices and wiring. Typical drawings not acceptable.

.3 CSA product safety approvals and labels will be visible on each field panel.

.4 Submit manufacturer’s certification within two (2) weeks of installation and testing.

.5 Submit meter accuracy test reports for all sub-meters within as-built documentation

Part 2 Products

2.1 ENERGY MONITORING PODS (EMP’S)

.1 Unit(s) will be supplied in enclosures suitable for surface wall mounting and designed to measure and transmit:

.1 Instantaneous RMS voltage current, phase angle and kW for each phase;

.2 Instantaneous, present and peak kW, kVa demand;

.3 kWh energy consumption.

.2 Energy Monitoring Pods to:

.1 Contain non-volatile memory;

.2 Have 35 days of 15 minute interval data storage;

.3 Have a unique individual address;

.3 Pulse output shall connect to Building Automation System.

.4 Meter displays will be provided at each Energy Monitoring Pod

.5 The manufacturer warrants the products it supplies for a period of three (3) years from the acceptance date.

.6 Warranty Service may be performed by the manufacturer or authorized representative.

2.2 CURRENT TRANSFORMERS (CT'S)

.1 Sized to accommodate any electrical service.

.2 Certified by CSA for product safety.

.3 To be equipped with pre-wired leads, three (3) meters in length, on all CTs sized at 400 amps or smaller.

2.3 POTENTIAL TRANSFORMERS (PT'S)

.1 Voltage ratings required for any electrical system.

.2 To be factory mounted in separate enclosures, complete with disconnect, fuses and CSA Certified for product safety.

.3 Step-Down Potential Transformers (120V secondary) for services of 600V or greater.

2.4 PROFILERS/AGGREGATORS

.1 Unit(s) will be supplied in enclosures suitable for surface wall mounting and designed to measure and transmit pulses from pulse-equipped utility meters. Pulse outputs include:

.1 Contact closure (cc) and/or

.2 Driven

.2 Profiler to:

.1 Provide eight (8) pulse inputs (cc and/or driven)

.2 Contain non-volatile memory

.3 Have 35 days of 15 minute interval data storage

.4 Have a unique individual address

.5 CSA certified for product safety

1.1 NETWORK-BASED SOFTWARE

1.1.1 Provide metering and measurements from all devices.

1.1.2 Monitor, acknowledge and control communications with the remote metering points to log any disruption of the communication link or unauthorized system access or tampering.

1.1.3 Software to allow monitoring and validation, in real-time, to actual metering measurements for each meter.

1.1.4 Store metering data for minimum period of 5 years.

1.1.5 Provide metering information in table or graph form.

1.1.6 Provide real-time submeter profiling, which includes automatic fifteen (15) minute interval updates.

Part 3 Execution

3.1 INSTALLATION

.1 Meters to be mounted within rooms indicated on drawings. Coordinate exact locations on site.

.2 Coordinte with Building Automation System contractor for final meter connections.

3.2 METER PROGRAMMING

.1 Meter to be programmable by software supplied by manufacturer.

.2 Software to allow the user to configure the meter, troubleshoot meter, query and display meter parameters and configuration data and stored values.

.3 Verify correctness of connections, polarities of meters, instruments, potential and current transformers, transducers, signal sources and electrical supplies.

.4 Meter firmware shall be upgradeable through one of the communications ports without removing the unit from service.

.5 Do not dismantle meters and instruments.

3.3 FOLLOW-UP VERIFICATION

.1 Upon completion of acceptance checks, settings, and tests, the Contractor shall show by demonstration in service that the meters are in good operating condition and are displaying and storing correct and accurate electrical information.

3.4 DEMONSTRATION

.1 The Contractor shall conduct a training course for meter configuration, operation, and maintenance of the system as specified. The training shall be oriented for all components and systems installed under this contract. The training shall include:

.1 Physical layout of each piece of hardware.

.2 Meter configuration, troubleshooting and diagnostics procedures.

.3 Operating instructions.

.4 Preventive maintenance procedures and schedules.

END OF SECTION

Part 1 GENERAL

1.1 REFERENCES

.1 Canadian Standards Association (CSA):

1.1.1.1 CAN/CSA C860-01, Performance of Internally Lighted Exit Signs
1.1.1.2 CAN/CSA E598-Series-98, Luminaires

.2 Underwriters' Laboratories of Canada (ULC)

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00.

.2 Product Data:

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

.2 Provide complete photometric data prepared by independent testing laboratory for luminaires where specified, for review by Departmental Representative.

.3 Samples:

.1 Submit samples of custom made luminaires for review and acceptance before starting final production.

.4 Quality assurance submittals: provide following in accordance with Section 01 45 00.

.1 Manufacturer's instructions: provide manufacturer's written installation instructions and special handling criteria, installation sequence, cleaning procedures.

1.3 QUALITY ASSURANCE

.1 Provide mock-ups in accordance with Section 01 45 00.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00.

.2 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

.3 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, paddling, and packaging materials in accordance with Section 01 74 20.

.4 Divert unused metal materials from landfill to metal recycling facility.

.5 Disposal and recycling of fluorescent lamps as per local regulations.

.6 Disposal of old PCB filled ballasts.

Part 2 PRODUCTS

2.1 LUMINAIRE

.1 Refer to Luminaire schedules on drawings.

Part 3 EXECUTION

3.1 INSTALLATION

.1 Locate and install luminaires as indicated.

.2 Provide adequate support to suit ceiling system.

3.2 WIRING

.1 Connect luminaires to lighting circuits:

.1 Install flexible or rigid conduit for luminaires as indicated.

3.3 LUMINAIRE SUPPORTS

.1 Recessed Fixtures:

.1 In areas without suspended ceilings, support fluorescent fixtures directly from the building structure by rod hangers and inserts

.2 Provide plaster frames or plaster trim as required and turn same over to the ceiling section for installation

.3 Support fixtures equal to or larger than 610 mm in width by four hangers per fixture, minimum, independent of ceiling supports or T-bars

.4 Install recessed fixtures to permit removal from below, to gain access to outlet or pre-wired fixture box.

.5 Connect recessed fixtures to boxes with flexible conduit and approved fixture wire.

.6 Coordinate installation of recessed fluorescent fixtures mounted in suspended gypsum board or T-bar ceiling systems and verify that ceiling can accept weight of fixture weight; provide additional support as follows where ceiling system cannot support weight of fixture:

.1 Provide a minimum of two (2) or four (4) hangers for each fixture for recessed fluorescent fixtures mounted in acoustical suspended ceiling systems; a minimum of four (4) hangers will be required for fixtures greater than 610 mm wide; support fixtures independent of ceiling grid.

.2 Suspended Fixtures:

.1 Install suspended linear fluorescent fixtures with airplane cable and fittings having field adjustable length.

.2 Fixtures shall be installed level unless specifically noted otherwise on Drawings, with less than 10 mm variation over 2440 mm.

.3 Fixtures shall be mounted at the same height above the floor unless specifically noted otherwise on Drawings.

3.4 LUMINAIRE ALIGNMENT

.1 Align luminaires mounted in continuous rows to form straight uninterrupted line.

.2 Align luminaires mounted individually parallel or perpendicular to building grid lines.

3.5 CLEANING

.1 Clean in accordance with Section 01 74 11.

.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 74 20.

.3 Specular reflector protection to remain in place through construction

.4 Align luminaries and clean diffusers, baskets and remove reflector protection prior to final acceptance.

END OF SECTION

Part 1 GENERAL

1.1 REFERENCES

.1 CSA International

.1 CSA C22.2 No.141-10, Emergency Lighting Equipment.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for emergency lighting and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Construction Waste Management:

.1 Submit project Waste Reduction Workplan highlighting recycling and salvage requirements.

.2 Submit calculations on end-of-project recycling rates, salvage rates, and landfill rates demonstrating that 50% of construction wastes were recycled or salvaged.

1.3 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00.

.2 Operation and Maintenance Data: submit operation and maintenance data for emergency lighting for incorporation into manual.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 and with manufacturer's written instructions.

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

.3 Storage and Handling Requirements:

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

.2 Store and protect emergency lighting from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

.4 Packaging Waste Management: remove for reuse and return of pallets, crates, padding and packaging materials as specified in Waste Reduction Workplan in accordance with Section 01 74 20.

1.5 WARRANTY

.1 For batteries in this Section 26 52 00 - Emergency Lighting, 12 months warranty period is extended to 120 months.

1.6 COORDINATION

.1 Coordinate installation of receptacles so that they are located in close proximity for connection of battery packs to building power.

Part 2 PRODUCTS

2.1 EQUIPMENT

.1 BATTERY OPERATED EMERGENCY LIGHTING UNIT

.1 Emergency lighting equipment: to CSA C22.2 No.141.

.2 Supply voltage: 120 V, AC.

.3 Output voltage: 24 V DC.

.4 Operating time: 60 minutes.

.5 Battery: sealed, maintenance free.

.6 Charger: solid state, multi-rate, voltage/current regulated, inverse temperature compensated, short circuit protected with regulated output of plus or minus 0.01 V for plus or minus 10% input variations.

.7 Solid state transfer circuit.

.8 Low voltage disconnect: solid state, modular, operates at 80% battery output voltage.

.9 Signal lights: solid state, for 'AC Power ON' and 'High Charge'.

.10 Lamp heads integral on unit and remote, 345 degrees horizontal and 180 degrees vertical adjustment.

.11 Remote heads single or double as indicated on Drawings, with high output MR-16, 20w, 35w, 50w, 24 V dc. Refer to Luminaire schedules on drawings.

.12 Cabinet: suitable for direct or shelf mounting to wall and c/w knockouts for conduit. Removable or hinged front panel for easy access to batteries.

.13 Finish: white

.14 Auxiliary equipment:

.1 Ammeter.

.2 Voltmeter.

.3 Test switch.

.4 Time delay relay.

.5 Battery disconnect device.

.6 AC input and DC output terminal blocks inside cabinet.

.7 Cord and plug connection for AC.

.8 RFI suppressors.

2.2 WIRING OF REMOTE HEADS

.1 Conduit: in accordance with Section 26 05 34.

.2 Conductors: in accordance with Section 26 05 21, sized in accordance with manufacturer's recommendations.

Part 3 EXECUTION

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for emergency lighting installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate 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 INSTALLATION

.1 Install unit equipment and remote mounted fixtures.

.2 Direct heads.

.3 Connect exit lights to unit equipment.

3.3 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11.

.3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 20.

.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.4 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by emergency lighting installation.

END OF SECTION

Part 1 GENERAL

1.1 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CSA C22.2 No.141-10, Unit Equipment for Emergency Lighting.

.2 CAN/CSA-C860-11, Performance of Internally Lighted Exit Signs.

.2 National Fire Protection Association (NFPA)

.1 NFPA 101-2012, Life Safety Code.

.3 Underwriters Laboratories of Canada (ULC)

.1 ULC/ORD-924-02, Standard for Emergency Lighting and Power Equipment.

.2 CAN/ULC-S572-10, First Edition Standard for Photoluminescent and Self-Luminous Exit Signs and Path Marking Systems.

1.2 SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00.

.2 Product Data:

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

.3 Submit WHMIS MSDS - Material Safety Data Sheets.

.4 Quality Assurance Submittals: submit following in accordance with Section 01 45 00.

.1 Instructions: submit manufacturer's installation instructions and special handling criteria, installation sequence, and cleaning procedures.

1.3 WASTE MANAGEMENT AND DISPOSAL

.1 Separate waste materials for reuse and recycling in accordance with Section 01 74 20.

Part 2 PRODUCTS

2.1 STANDARD UNITS

.1 Exit lights: to CSA C22.2 No.141 and CSA C860.

.2 Housing: extruded aluminum

.3 Face and back plates: low profile edge-lit acrylic panel. Double face panels standard with capability to modify on site for us in single-face or double-face applications

.4 Lamps: LED, 120V

.5 Operation: designed for 50,000 hours of continuous operation without relamping.

.6 Type: Green running man pictogram type.

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 exit lights to manufacturer's recommendations, listing requirements, NFPA standard and local regulatory requirements.

.2 Connect fixtures to exit light circuits.

.3 Ensure that exit light circuit breaker is locked in on position.

3.3 CLEANING

.1 Proceed in accordance with Section 01 74 11.

.2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 GENERAL

1.1 RELATED REQUIREMENTS

.1 Section 27 05 28 Pathways For Communications Systems

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00.

.2 Product Data:

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

1.3 REFERENCE STANDARDS

.1 American Society for Testing and Materials (ASTM):

.1 ASTM D4566-08, Standard Test Methods for Electrical Performance Properties of Insulations and Jackets for Telecommunications Wire and Cable

.2 Canadian Standards Association (CSA):

.1 CAN/CSA C22.2 No. 182.4-M90 (R2010), Plugs, Receptacles, and Connectors for Communication System

.2 CSA T568.1-05 (R2010), Commercial Building Telecommunications Cabling Standard - Part 1: General Requirements (and all addenda)

.3 CAN/CSA T530-99, Commercial Building Standard for Telecommunications Pathways and Spaces (Adopted ANSI/TIA/EIA-569-A)

.3 Electronic Components Association (CEA)/Electronic Industries Association (EIA):

.1 ECA/EIA 310-E-2005, Cabinets, Racks, Panels, and Associated Equipment

.4 Electronic Industries Association (EIA)/Telecommunications Industry Association (TIA):

.1 TIA/EIA 569B-2008, Commercial Building Standard for Telecommunication Pathways and Spaces

.2 TIA/EIA 606-A-2002, Administration Standard for Telecommunications Infrastructure

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 and with manufacturer's written instructions.

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

.3 Storage and Handling Requirements:

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

.2 Store and protect communications 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 and packaging materials.

Part 2 PRODUCTS

2.1 TELECOMMUNICATION ROOM

.1 Provide telecommunication rooms to contain racks, analog voice termination fields and required cable routing hardware.

.2 Racks:

.1 Place racks to provide minimum 1000 mm clearance from front, minimum 1000mm clearance from the rear, and 600mm clearance on one (1) side of racks.

.2 Place mounting rail a minimum of 150 mm to the wall to allow for vertical management where mounting rail is placed against a wall.

.3 Gang racks together using vertical management hardware to provide interbay management where more than one rack is indicated.

.4 Place racks on opposite side of room from voice termination fields.

.3 Back Panels (For termination of analog voice trunk cabling only):

.1 Mount voice termination fields on fire retardant plywood panels as specified in on wall opposite from room entrance.

.2 Mount backbone termination fields to the left of horizontal voice fields from patch panels on racks.

.3 Locate conduits for data backbone adjacent to racks; locate conduits for analog voice backbone adjacent to voice termination fields.

.4 Provide ladder and wall mount management rings to properly support and dress future cables from conduits to racks and frames.

2.2 TELECOMMUNICATION ROOM HARDWARE:

.1 Design all hardware to fit into a standard a standard 480 mm rack.

.2 4-Post Horizontal Cabling Racks: Self supporting racks, 480 mm wide x 2130 mm high x 915 mm deep; 4 post open frame, square hole design and EIA compliant. Rack shall ship unassembled. Rack shall provide a static load capacity of 2,000 lbs. and a UL listed load capacity of 800 lbs. Rack shall accept equipment mounting using cage nut style hardware. Rack rail shall be 14-gauge steel. Top, middle and bottom side brackets shall be 16-gauge steel. Base angles shall be 14-gauge steel and shall mount outward for increased stability or inward to conserve floor space. Weight capacity shall be 1,000 lbs. Rack shall be finished in a durable black powder coat. Open top shall accept mounting of optional cable ladder. Rack shall feature zero-U mounting capabilities for optional cable lacing strips, vertical power strips and cable ducts. R4 rack shall be UL listed in the US and Canada. Rack shall be GREENGUARD Indoor Air Quality Certified for Children and Schools. Rack shall be RoHS EU Directive 2002/95/EC compliant. Rack shall be manufactured by an ISO 9001 and ISO 14001 registered company. Four post open frame rack shall be warrantied to be free from defects in material or workmanship under normal use and conditions for the lifetime of the product. Supply rack with 100 pcs. of 6mm screws and cage nuts. Useable rack units: 45.

.3 Horizontal Cable Managers: Provide double sided, “D” ring style horizontal cable managers having a capacity for 48 cables on both sides; 480 mm wide, constructed from aluminum with black painted finish, pre-assembled “D” rings front and back.

.4 Vertical Cable Managers: Double sided, minimum 150mm wide x 125mm deep ducts on front and back, 2140mm high with swing-out or removable covers; constructed from aluminum with a black painted finish.

.5 Patch Panels:

.1 Provide four patch panels per rack each having a capacity of 48 ports x 2U rack spaces high; ports shall be blank to accept snap-in unshielded RJ45 jacks in for snap-in interface housings, six jacks per housing; constructed from 1.519 mm core metal thickness cold rolled steel with polyurethane powder coat finish; housings constructed from polyphenylene oxide with spaces provided for port identification labelling.

.2 Provide Category 6a modular data jacks for multimedia jack patch panels; unkeyed four (4) pair fitting into nominal 20 mm x 15 mm opening; terminate modular jacks using a non-impact termination tool to eliminate connector damage and promote consistent termination; colour code jacks for T568A wiring; wire each jack to T568A.

Part 3 EXECUTION

3.1 INSTALLATION

.1 Installation, General:

.1 Coordinate installation of network cabling system with other work in progress.

.2 Install 19 mm thick, fire retardant treated plywood backboard as indicated on Drawings for mounting of termination blocks.

.2 Communication Room Hardware Installation:

.1 Rack Installation:

.1 Install racks securely to concrete floor with 10 mm diameter expansion anchors.

.2 Ground all racks to communications ground bus bar as per TIA569.

.3 Bag any rack mounting screws not used for installing panels and other hardware, and attach to rack when installation is complete.

.4 Secure racks in accordance with regional Seismic Restraint Requirements to the satisfaction of the Authorities Having Jurisdiction.

.2 Patch Panels:

.1 Mount the patch panels securely to the equipment rack.

3.2 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11.

.3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 20.

.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 communications equipment installation.

END OF SECTION

Part 1 GENERAL

1.1 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for communication raceway systems and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Identify types of cable tray used.

.3 Show actual cable tray installation details and suspension system.

1.2 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 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 Store and protect communication raceway systems and wiring from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

.4 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding and packaging materials as specified in Waste Reduction Workplan in accordance with Section 01 74 20.

Part 2 PRODUCTS

2.1 SYSTEM DESCRIPTION

.1 Telecommunications raceways system consists wall rough-ins complete with conduits to accessible ceiling space or cable tray, the cable tray, distribution conduit, outlet boxes, service poles, cover plates, sleeves and caps, and fish wires.

.2 All low voltage cabling must be run in conduit in exposed ceilings.

2.2 MATERIAL

.1 Conduits: in accordance with Section 26 05 34.

.2 Outlet boxes, conduit boxes, and fittings: in accordance with Section 26 05 31 and 26 05 32.

.3 Fish wire: polypropylene type.

.4 Cable tray: Basket-type

.1 Basket tray in general areas, size as indicated
.2 Minimum cable tray size for Communications/LAN Room is 4”x24”, mounted 96” above fixed floor.
.3 The cable tray system shall be bonded and grounded per Canadian Electrical Code

Part 3 EXECUTION

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for communication raceway systems installation in accordance with manufacturer's written instructions.

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

3.2 INSTALLATION

.1 Install cable tray, raceway system, outlet boxes, pull boxes, cover plates, conduit, sleeves and caps, miscellaneous and positioning material to constitute complete raceway system.

.2 Support cable tray on both sides from structure above. Supports shall be sized to accommodate a full cable tray. Tray shall not be suspended from HVAC ducting, sprinkler system, etc.

.3 Remove sharp burrs or projections to prevent damage to cables or injury to personnel.

.4 Install fish wire within empty conduits

3.3 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11.

.3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 20.

.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 pathways for communications systems installation.

END OF SECTION

Part 1 GENERAL

1.1 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CSA-C22.2 No. 214-08, Communications Cables (Bi-National standard with UL 444).

.2

.2 Telecommunications Industry Association (TIA)/Electronic Industries Alliance (EIA)

.1 TIA/EIA-568-B.1-(2001), Commercial Building Telecommunications Cabling Standard, Part 1: General Requirements.

.2 TIA/EIA-568-B.2-(2001), Commercial Building Telecommunications Cabling Standard, Part 2: Balanced Twisted-Pair Cabling Components.

.3 TIA/EIA-606-A-(2002), Administration Standard for the Commercial Telecommunications Infrastructure.

1.2 DEFINITIONS

.1 Refer to TIA/EIA-598-C, Annex A for definitions of terms: distribution, and breakout cables.

1.3 SYSTEM DESCRIPTION

.1 Structured telecommunications wiring system consist of unshielded-twisted-pair, terminations, connectors, cross-connection hardware and related equipment installed inside building for occupant's telecommunications systems, including voice (telephone), and data.

.2 Installed in physical star configuration with separate horizontal and backbone sub-systems.

.1 Horizontal cables link work areas to telecommunications rooms located on same floor.

1.4 SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00.

.2 Product Data:

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

.3 As-built Records and Drawings:

.1 Provide electronic drawings in AutoCAD format depicting all construction.

.2 Provide two (2) bound complete hard-copy sets of as-built records to the Departmental Representative.

.1 Provide and place one hard copy of as-built records for each telecommunications room in plan holder in each telecommunications room.

1.5 QUALITY ASSURANCE

.1 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 35 29.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Waste Management and Disposal: separate waste materials for reuse and recycling in accordance with Section 01 74 20.

Part 2 PRODUCTS

2.1 FOUR-PAIR 100 BALANCED TWISTED PAIR CABLE

.1 Four-pair, 100 ohm balanced unshielded-twisted-pair (UTP) cable, flame test classification FT6 or FT4 to: CSA-C22.2 No. 214, Category 6 (Cat 6) to: TIA/EIA-568-B.2.

2.2 MULTI-PAIR 100 BALANCED TWISTED PAIR CABLE

.1 100 ohm, 4 pairs, sheath consists of thermoplastic jacket with underlying metallic shield, Category 3 to: TIA/EIA-568-B.2, flame test classification FT4 or FT6 to: CSA-C22.2 No. 214.

2.3 WORK AREA UTP 2-PAIR.4 MODULAR JACK

.1 Eight-position modular jack ("RJ-45"), type T568B Category 6 to: TIA/EIA-568-B.2:

.1 In self-contained surface-mount box, 4 jacks per box.

.2 Mounted in compatible single gang faceplate, flush entry, 4 jack positions per faceplate.

2.4 TERMINATION AND CROSS-CONNECTION HARDWARE FOR UTP

.1 IDC Terminal strips, 25 pair, for terminating multi pair 100 balanced twisted pair cables and supporting cross-connections using jumper wires or compatible plug-ended patch cords: Category 6 to: TIA/EIA-568-B.2.

.2 Mount or block for housing 10 IDC terminal strips, mounted on wall, rack or cabinet as indicated.

.1 Distribution rings or channels capable of externally mating with the above mount for managing cross-connection wires.

.3 Patch panel, 2 rack units high, 48 ports:

.2 Each port equipped with factory installed "RJ-45" modular type jacks, type T568A Category 6 to: TIA/EIA-568-B.2.

.3 Horizontal cable-management unit for every 48 ports.

2.5 UTP CROSS-CONNECT WIRE

.1 Category 6, 4 pairs to: TIA/EIA-568-B.2.

2.6 UTP PATCH CORDS

.1 2 meters long, with factory-installed male plug at one end to mate with "RJ-45" jack and with factory-installed male plug at other end to mate with "RJ-45" jack Category 6, 4 pairs to: TIA/EIA-568-B.2.

2.7 UTP EQUIPMENT CABLE

.1 4 pair "pigtail", 2 meters long, with factory-installed male plug on one end to mate with "RJ-45" jack and other end equipped with factory-installed male plug to mate with "RJ-45" jack: Category 6 to: TIA/EIA-568-B.2.

2.8 UTP WORK AREA CORDS

.1 3 meters long, each end equipped with "RJ-45" plug Category 6 to: TIA/EIA-568-B.2.

Part 3 EXECUTION

3.1 INSTALLATION OF TERMINATION AND CROSS-CONNECT HARDWARE

.1 Install termination and cross-connect hardware in rack as indicated and according to manufacturers' instructions. Identify and label as indicated to: TIA/EIA-606-A.

.2 Install consolidation points, as indicated according to manufacturer's instructions. Identify and label as indicated to: TIA/EIA-606-A.

3.2 INSTALLATION OF HORIZONTAL DISTRIBUTION CABLES

.1 Install horizontal cables as indicated in conduits (and cable tray where indicated) from telecommunication rooms to individual work-area jacks. Identify and label as indicated to: TIA/EIA-606-A.

.2 Terminate horizontal cables in telecommunications room and at individual work-area jacks.

.1 Identify and label as indicated to: TIA/EIA-606-A.

.3 Coil spare cables and store in ceiling space in zone.

.4 Harness slack cable in cabinets, racks, and wall-mounted termination and cross-connection hardware.

3.3 INSTALLATION OF EQUIPMENT CABLES

.1 Install equipment cables from equipment terminal strips as indicated.

.1 Identify and label as indicated to: TIA/EIA-606-A.

3.4 IMPLEMENT CROSS-CONNECTIONS

.1 Implement cross-connections using patch cords as specified.

3.5 FIELD QUALITY CONTROL

.1 Test horizontal UTP cables as specified below and correct deficiencies provide record of results as hard copy, and electronic record on CD.

.1 Perform tests for Permanent Link on installed cables, including spares:

.1 Category 6 using certified level III tester to: TIA/EIA-568-B.2.

.2 Perform tests for Channel on 20% of cross-connected data horizontal cabling installed from each telecommunications room, including shortest and longest drops from each telecommunications room: should more than 5% of tested cables fail, test remaining cross-connected data cables.

.1 Category 6 using certified level III tester to: TIA/EIA-568-B.2.

.2 Provide record of results as hard copy and electronic record on CD to: TIA/TSB-140.

END OF SECTION

Part 1 GENERAL

1.1 SUMMARY

.1 This Section includes requirements for supply and installation of a fully addressable networked sound masking system controllable from a single control panel with future options to connect a central computer.

1.2 RELATED REQUIREMENTS

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

.2 Section 26 05 32 - Outlet Boxes, Conduit Boxes and Fittings

.3 Section 26 05 34 – Conduits, Conduit Fastenings And Conduit Fittings

.4 Section 26 05 21 – Wires And Cables (0-1000V)

1.3 REFERENCE STANDARDS

.1 American National Standards Institute (ANSI):

.1 ANSI S1.4-1983 (R2001), American National Standard Specification for Sound Level Meters

.2 ANSI/ASA S1.11-2004 (R2009, American National Standard Specification for Octave-Band and Fractional-Octave-Band Analog and Digital Filters

.2 American Society for Testing and Materials (ASTM):

.1 ASTM 1130-08, Standard Test Method for Objective Measurement of Speech Privacy in Open Plan Spaces Using Articulation Index

.2 ASTM E1374-06(2011), Standard Guide for Open Office Acoustics and Applicable ASTM Standards

.3 ASTM E1433-04, Standard Guide for Selection of Standards on Environmental Acoustics

.4 ASTM E1573-09, Standard Test Method for Evaluating Masking Sound in Open Offices Using A-Weighted and One-Third Octave Band Sound Pressure Levels

1.4 ADMINISTRATIVE REQUIREMENTS

.1 Scheduling: Schedule work of this Section so that installation, testing, adjusting, and balancing is performed after above ceiling mechanical and electrical work, suspended acoustic tile ceiling are complete , and as follows:

.1 Schedule installation, testing, tuning, and balancing after normal working hours of users in occupied facilities.

1.5 SUBMITTALS

.1 Provide required information in accordance with Section 01 33 00 – Submittal Procedures.

.2 Action Submittals: Provide the following submittals before starting any work of this Section:

.1 Product Data: Submit manufacturer's product data identifying components used for the project.

.2 Shop Drawings: Submit shop drawings indicating proposed quantity and location of system components and related wiring and accessories.

.3 Informational Submittals: Provide the following submittals during the course of the work:

.1 Design Submittals: Provide network design schematics indicating general layout and types of equipment proposed for use for Departmental Representative's review and comment before preparing finalized shop drawings listed in this Section.

1.6 PROJECT CLOSEOUT SUBMISSIONS

.1 Operation and Maintenance Data: Submit manufacturer's written instructions for operations and maintenance procedures; include name of original installer and contact information in accordance with Section 01 78 00 – Closeout Submittals.

.2 Record Documentation: Submit as constructed information in accordance with Section 01 78 00 – Closeout Submittals including copy of final sound pressure level readings, accurate description of reading locations and test methods and equipment used.

.3 Spare Tools and Software: Submit unique tools and software in accordance with Section 01 78 00 – Closeout Submittals.

1.7 QUALIFICATIONS

.1 Regulatory Requirements: Provide electrical components, devices and accessories, controls and wiring conforming to CSA Standards and CSA labelled in accordance with requirements of Authority Having Jurisdiction.

.2 Qualifications: Provide proof of qualifications when requested by Departmental Representative:

.1 Manufacturer: Use manufacturer that can provide required network design in advance of providing shop drawings and site representation during set-up, testing and commissioning, and that has capacity to provide all network components and devices from a single point of responsibility.

.2 Installer: Use installer that is qualified or approved by component manufacturer having experienced personnel installing and adjusting sound masking systems of similar extent and complexity as required by this Section.

1.8 DELIVERY, STORAGE AND HANDLING

.1 Delivery and Acceptance Requirements: Deliver materials in manufacturer's original unopened and undamaged packaging with labels intact and legible.

.2 Storage and Handling Requirements: Store in dry locations and handle in accordance with manufacturer's written instructions.

1.9 WARRANTY

.1 Manufacturer Warranty: Submit manufacturer's warranty stating installed are free from defects in parts or assembly for period of five (5) years from date of Substantial Performance for the Project and will be replaced or repaired at no expense during the warranty period without disruption to use of the installed system.

Part 2 PRODUCTS

2.1 SYSTEM DESIGN

.1 Design Requirements: Design sound masking system and prepare schematics of the system showing quantity and location of network components and related cabling and accessories used to establish bid price before submitting shop drawings; obtain Departmental Representative approval for any changes in quantity or location of sound masking units after shop drawings have been reviewed and accepted.

2.2 PERFORMANCE REQUIREMENTS

.1 Sound Masking Performance: Provide systems using digital signal processing (DSP) technology to generate masking sound and adjustment of masking signals and as follows:

- .1 Masking Sound: Random with no noticeable repetitive pattern
- .2 Equalizer: Primary network devices capable of equalizing in 1/3 octave increments for masking signal and capable of equalizing zones in groups of 1 to 3 speakers.
- .3 Masking Volume: Digitally adjustable in 0.5 dBA increments at each primary network device and grouping of speakers over a range of 35 dBA to 85 dBA measured 1 metre from source
- .4 Muting: Muting masking volume control at each primary network device.
- .5 Spatial Uniformity: Provide system capable of achieving spatial uniformity of ± 0.5 dBA for masking volume with furnishings in place after adjustment.

.2 Timer Performance: Provide system having timer function allowing masking volume levels to adjust automatically according to programmed schedule and as follows:

- .1 Time Scheduling: Calendar based programmable timer function; assigned to individual or group of primary network devices and allowing for the following:
  - .1 Allow independent timer schedules for each day of the week
  - .2 Allow variable rates of volume adjustment
  - .3 Allow exception timer schedules for calendar days requiring different schedule from the normal
  - .4 Allow programmed system activation date
- .2 Daylight Savings: Automatic daylight saving time adjustments
- .3 Acclimation Period: Automatic acclimation process that increases masking volume over a period of time according to programmed schedule; allowing for independent acclimatization schedules for each timer zone.
- .4 Timer Zones: Allow for up to nine independent timer zones per control panel/programmable timer.

.3 Diagnostic Performance: Provide system capable of providing expected number of primary network devices and communicating correctly with network control panel and that provides failure indication of identifying primary network devices that fail to communicate properly over the network.

.4 Reporting Performance: Provide system network control panel capable of reading and displaying current settings for all primary network devices and generating detailed reports of system settings down to level of individual primary network devices.

.5 Security Performance: Provide locked metal enclosure for network control panel with access to control functions password protected and no physical controls located on system loudspeakers or primary network devices and that allows for settings to be backed up on an electronic storage medium with performance monitoring at each network component.

2.3 COMPONENTS

.1 Provide fully networked decentralized sound masking system comprised of manufacturer's fully addressable components including; but not limited to, the following:

.1 Primary Network Device: Include sound masking generator; equalizer for masking; individual volume control for masking; network communication components; and audio amplifier.

.2 Secondary Network Devices: Provide loudspeaker connections; and signal connections to or from other primary and secondary devices.

.3 Loudspeakers: System matched and enclosed in acoustically dampened enclosure; suspension chain, connections to network devices; and tool-less on-site adjustment of upward or downward speaker orientation.

.4 Network Control Panel: Include required network communication components; control electronics for sound masking and timer functions; connections to audio inputs, network devices, control panels and computer; Ethernet connection and IP addressable.

.5 PC Network Control Software Capable: System must have software that allows for control of system adjustments from a dedicated computer including: network set-up; sound masking volume and equalization adjustment; sound masking timer programs; and programmable keypad set-up. Software not in contract.

.6 Keypads: Fully programmable, network compatible having visual display for function and volume adjustments; infrared remote control receiver and sized to fit within a single gang box.

.7 Accessories: Provide accessories required for a complete and functioning system including; but not limited to: cable assemblies for power, audio and control signals; audio input modules for microphone, telephone and auxiliary audio sources; mounting adaptors; and power supplies.

Part 3 EXECUTION

3.1 EXAMINATION

.1 Verification of Conditions: Verify that plenum heights and power source, and other manufacturer prerequisites are met before beginning of installation of products specified in this Section.

.1 Installation of products specified in this Section will denote acceptance of site conditions.

3.2 INSTALLATION

.1 Install system components in accordance with manufacturer's written instructions and with components placed as indicated on accepted shop drawings.

3.3 CLOSEOUT ACTIVITIES

.1 Start-up and Adjusting: Perform system start-up in accordance with manufacturer’s recommended procedures and as follows:

.1 Calibrate measuring microphone and related test equipment prior to start-up and adjusting and as follows:

.2 Balance system with mechanical system and other noise generating equipment shut down, and spaces unoccupied in areas receiving sound masking for duration of start-up operations.

.3 Adjust system until sound spectrum and levels meet required performance requirements; relocate units where required.

.4 Confirm consistency of masking volume and quality.

.2 Demonstration and Training: Provide demonstration and training for operating system as required by Section 01 79 00 and as follows:

.1 Demonstrate operational system by walking the space and indicating nominal operating conditions

.2 Demonstrate functionality of system to facilities personnel; train assigned personnel to maintain system

.3 Commissioning: Provide verification and commissioning services as follows using manufacturer’s trained technical representative to measure and report on sound masking system acoustical performance requirements in accordance with ASTM E1573 and as follows:

.1 Performance verification will be performed after Substantial Performance of the Work.

.2 Perform one post-occupancy calibration to adjust sound levels to suit occupancy.

.3 Move sound generating units or replace where commissioning process shows that adjustments are required.

END OF SECTION

Part 1 GENERAL

1.1 RELATED REQUIREMENTS

1.2 REFERENCES

.1 Canada Green Building Council (CaGBC)

.1 LEED Canada-NC-2009, LEED (Leadership in Energy and Environmental Design): Green Building Rating System for New Construction and Major Renovations 2009.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for intercommunications systems and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Include riser diagram, talk paths of complete intercom system.

.3 Sustainable Design Submittals:

.1 LEED Canada submittals: in accordance with Section 01 35 21.

.2 Construction Waste Management:

.1 Submit project Waste Management Plan highlighting recycling and salvage requirements.

.2 Submit calculations on end-of-project recycling rates, salvage rates, and landfill rates demonstrating that 75% of construction wastes were recycled or salvaged.

1.4 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00.

.2 Operation and Maintenance Data: submit operation and maintenance data for intercommunications systems for incorporation into manual.

.3 Include parts list using component identification numbers standard to electronics industry.

1.5 EXTRA MATERIALS

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

1.6 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 and with manufacturer's written instructions.

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

.3 Storage and Handling Requirements:

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

.2 Store and protect intercommunications systems from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

.4 Develop Construction Waste Management Plan related to Work of this Section and in accordance with Section 01 35 21.

.5 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding and packaging materials as specified in Construction Waste Management Plan, Waste Reduction Workplan in accordance with Section 01 74 20 and Section 01 35 21.

Part 2 PRODUCTS

2.1 MATERIALS

.1 Conduits: type and size as indicated, in accordance with Section 26 05 00.

.2 Communication conductors: type, size as indicated, in accordance with Section 26 05 00.

2.2 MASTER STATIONS

.1 IP network compatible.

.2 Electronic, flush type for un-interrupted two-way voice communication.

.3 Digital pushbutton system including: hands free operation, talk back.

.1 Switches to have heavy duty cross bar palladium contacts.

.2 IP-PBX.

.3 Key Switch Units.

.4 Audible signaling by soft electronic chimes.

.5 Switching components to have, operating life expectancy exceeding 5,000,000 cycles.

.6 Speaker: built-in 57 mm cone type.

.7 Power consumption: 1.8 W at standby, 2.4 W at full output from 48V DC supply.

.8 Panel: Stainless steel, hairline.

.9 Interconnects: hardwired.

.10 Ventilation: natural convection.

2.3 SUB-STATIONS

.1 Desk type IP phones.

.1 Door unlock from sub-stations not possible.

2.4 IP NETWORK INTERCOM EXCHANGE

.1 IP network compatible.

.2 Electronic, rack/desk/surface mounted.

.3 Network LNK/ACT indication, Status lamp, Power-on indication lamp, Signal lamp, Peak lamp.

.4 Power consumption: 7W from 120V supply.

.5 Panel: Pre-coated steel plate.

2.5 AUDIO INTERFACE UNIT

.1 IP network compatible.

.2 Electronic, rack mounted.

.3 Power consumption: 50 W at standby, 75 W at full output from 120V supply.

.4 Panel: Pre-coated steel plate.

2.6 ADDITIONAL FEATURES

.1 Interface with pocket paging system.

Part 3 EXECUTION

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for intercommunications systems installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Departmental Representative.

.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 INSTALLATION

.1 Install equipment as indicated and in accordance with manufacturer's instructions.

.2 Interconnect system components.

.3 Interconnect with security system to unlock door(s) from remote locations.

3.3 TESTS

.1 Perform tests in accordance with Section 26 05 00.

.2 Conduct performance test.

3.4 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11.

.3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 20 and 01 35 21.

.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 intercommunications and program systems installation.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 This section describes the requirements for an all new microprocessor based, single stage fire alarm and detection system with addressable devices with alarm devices, horn/strobe units, and remote annunciators installed at locations indicated on Drawings and as required by the Building Code.

1.2 RELATED REQUIREMENTS

.1 Section 14 20 00 – Elevator: Coordinate with elevator homing system, and supply and installation of interconnect devices by this section.

.2 Section 21 10 00 – Water Based Fire Suppression Systems: Coordinate with sprinkler piping contractor for supply and installation of flow sensor devices by this section.

.3 Section 23 43 00 – Air Handling Units: Coordinate with mechanical contractor for supply and installation of shutdown devices by this section.

.4 Section 25 05 00 – Common Work Results for Integrated Automation

.5 Section 25 09 00 – Instrumentation and Control Devices: Coordinate with mechanical contractor for supply and installation of Building Management System devices by this section.

.6 Section 26 05 00 – Common Work Results for Electrical

.7 Section 26 05 19 – Electrical Power Conductors and Cables: Supply and installation of wiring by electrical contractor for fire alarm and detection system.

.8 Section 26 05 28 – Conduits, Outlet Boxes and Fittings for Electrical Systems: Supply and installation of conduit and outlet boxes by electrical contractor for fire alarm and detection system.

.9 Section 26 05 53 – Electrical Systems Identification

1.3 REFERENCE STANDARDS

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

.1 ASHRAE 135-2012, BACnet-A Data Communication Protocol for Building Automation and Control Networks

.2 Canadian Standards Association (CSA):

.1 CSA C22.2 No. 75-08 (R2013), Thermoplastic-Insulated Wires and Cables

.2 CSA C22.2 No. 188-13, Splicing Wire Connectors

.3 CSA C22.2 No. 203.1-14, Manufactured Wiring Products

.4 CSA C22.2 No. 208-03 (R2013), Fire Alarm and Signal Cable

.3 International Standards Organization (ISO):

.1 ISO 8201:1987, Acoustics - Audible Emergency Evacuation Signal

.4 National Electrical Manufacturers Association (NEMA):

.1 NEMA 250-2008, Enclosures for Electrical Equipment (1000 Volts Maximum)

.5 Underwriters Laboratories Canada (ULC):

.1 CAN/ULC S524-06, Installation of Fire Alarm Systems

.2 CAN/ULC S525-07, Audible Signal Devices for Fire Alarm Systems

.3 CAN/ULC S526-07, Visual Signal Devices for Fire Alarm Systems

.4 CAN/ULC S527-11, Standard Control Units for Fire Alarm Systems

.5 CAN/ULC S528-05, Manual Pull Stations for Fire Alarm Systems

.6 CAN/ULC S529-09, Smoke Detectors for Fire Alarm Systems

.7 CAN/ULC S536-13, Inspection and Testing of Fire Alarm Systems

.8 CAN/ULC S537-13, Verification of Fire Alarm Systems

.9 CAN/ULC S541-07, Speakers for Fire Alarm Systems, including Accessories

.6 Underwriters Laboratories Inc. (UL):

.1 UL 268-09, Smoke Detectors for Fire Protective Signalling Systems

.2 UL 1971-02, Signaling Devices for the Hearing Impaired

1.4 ADMINISTRATIVE REQUIREMENTS

.1 Coordination: Coordinate with manufacturer of fire alarm system to obtain number of hours and costs necessary to complete inspection, testing and verification for inclusion in bid and as follows:

.1 Coordinate with Departmental Representative to obtain costs for fire alarm verification for inclusion in bid.

.2 Coordinate number and type of conductors required by actual system installed and final layout of devices with the manufacturer; transfer this information to shop drawing submittals and record drawings.

1.5 SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00 – Administrative Requirements and Section 26 05 00.

.2 Action Submittals: Provide the following submittals before starting any work of this Section:

.1 Shop Drawings: Submit shop drawings indicating complete wiring schematics for this specific installation, and as follows:

.1 Use of typical drawings is not acceptable.

.2 Wiring diagram and module schematics shall show and individually identify all wiring from the individual field device to its termination point.

.3 Identify all terminals in panels, wiring conductors, device address and locations, and proposed field tagging system using a custom numerical labelling system.

.4 Equipment layout.

.5 Complete wiring diagram, including schematics of modules.

.3 Informational Submittals: Provide the following submittals during the course of the work:

.1 Proof of Qualifications: Submit proof that installer is authorized and approved by manufacturer to install work of this Section before commencement of work of this section.

1.6 PROJECT CLOSEOUT SUBMISSIONS

.1 Operation and Maintenance Data: Submit manufacturer's written instructions for operations and maintenance procedures, include name of original installer and contact information in accordance with Section 01 78 39 – Project Record Documents and Section 26 05 00 and as follows:

.1 Operation and maintenance instructions for complete fire alarm system to permit effective operation and maintenance.

.2 Technical data and illustrated parts lists with parts catalogue numbers.

.3 Copy of reviewed shop drawings.

.2 Record Documentation: Submit as constructed information in accordance with Section 01 78 39 – Project Record Documents and Section 26 05 00 before start of fire alarm and detection system verification process, indicating the following:

.1 Final layout of devices.

.2 Routing of conduit.

.3 Placement of components including all End of Line Resistors

.3 Spare Parts, Tools and Software: Submit unique parts, tools and software in accordance with Section 01 78 43 – Spare Parts and Section 26 05 00; provide the following system components:

.1 24 spare glass rods for manual pull box stations (if applicable)

.2 3 spare smoke detectors

.3 3 spare heat detectors of each type used

.4 3 spare manual pull stations

.5 1 EPROM programming unit for detectors, pull stations, and other devices (if applicable)

.6 3 spare horn/strobes for each type used

.7 3 spare strobe lights of each type used

1.7 QUALITY ASSURANCE

.1 Regulatory Requirements: Manufacturer of fire alarm and detection system shall provide proprietary systems in accordance with the Building Code and Underwriters Laboratories Canada, and Authorities Having Jurisdiction.

.2 Qualifications: Provide proof of qualifications when requested by Departmental Representative:

.1 Source of Supply: Limit supply of equipment and devices from a single manufacturer.

Part 2 Products

2.1 DESCRIPTION OF SYSTEM

.1 This section specifies a Fully Addressable Single Stage System including the following:

.1 Control panel to carry out fire alarm and protection functions including receiving alarm signals, initiating general alarm, supervising system continuously, actuating zone annunciators, and initiating trouble signals

.2 Trouble signal devices

.3 Power supply facilities

.4 Manual alarm stations

.5 Automatic alarm initiating devices

.6 Audible/visual signal devices

.7 End-of-line devices

.8 Annunciators

.9 Ancillary devices

.10 Zone addressable modules and cabinets

.11 Class A wiring on initiating devices data link

.12 Class B wiring on signal circuits

.13 Signal Isolators

.14 Identification of devices and wiring used in the system using a custom labelling system

.2 System will include dedicated separate loops for initiating devices and signalling devices to divide the facility into the following areas:

.1 Refer to fire alarm riser diagram.

.3 Provide for supply and installation of fire alarm devices and components as indicated.

.4 Provide for supply, installation and verification of alarm initiating and monitoring devices for the sprinkler system; determine device locations on site and from the mechanical drawings.

.5 Provide duct detectors in supply air duct of recirculating air handling systems. Refer to mechanical drawings for locations and number of air systems.

.6 Provide control modules and interposing relays to shut down all air handling systems as per the motor control schedule drawing.

.7 Refer to plan drawings and riser diagram for additional requirements.

2.2 MATERIALS

.1 Provide power supply, audible and visual signalling devices, control units, fire alarm stations, smoke and heat detectors, and other detection devices as required for a complete and operational fire alarm and detection system.

.2 Tag all field wiring using sleeve type PVC marker system and all devices using labelling system as specified in Section 26 05 53.

2.3 SYSTEM OPERATION

.1 Single Stage – General Alarm: Activation of any first stage initiating device (manual station, smoke detector, or sprinkler flow switch) to initiate the following sequence:

.1 All horns sounding in Temporal-Three (T-3) Pattern in accordance with the Building Code and ISO 8201, with strobes flashing.

.2 LCD display at the control panel and remote annunciator panels to provide full identification of point(s) in alarm.

.3 Transmit signal to the BAS that the building is in alarm condition.

.4 Transmit signal to Fire Department or to an Departmental Representative designed monitoring agency.

.5 Smoke dampers and smoke doors will close.

.6 Electrically locked doors will release.

.7 Actuate elevator homing.

.8 Indicate trouble on annunciators when fault occurs, by means of buzzer and LCD text; buzzer silence and ring-back feature.

.9 All recirculating Air Handling Systems shall shut down automatically upon any common fire alarm activation, and shall restart automatically upon fire alarm restoration to normal.

.2 Indicate trouble on annunciators when fault occurs, by means of buzzer and LCD text; buzzer silence and ring back feature.

.3 Trouble annunciation provided for supervised circuits including alarm circuits, signal circuits, sprinkler flow and tamper circuits, and annunciator wiring.

.4 Factory program system to carry out control functions as noted, with allowance for complete re-programming or "re-burns" at the completion of the project as required, and for intermediate re-programming or “re-burns” as required to fully commission, test and verify the system.

2.4 CONTROL PANEL

.1 Single Stage Operation: Fully addressable on all alarm and trouble initiating devices with class A connections; Non-coded.

.2 Enclosure: NEMA Type 2 Standard, with lockable concealed hinged door, full viewing window, flush lock and 2 keys, suitable for semi-flush installation in concrete block or metal stud walls.

.3 Components:

.1 Addressable loop controller with trouble and alarm indications per point for class A initiating circuit.

.1 The fire alarm panel shall be capable of accommodating a minimum of 2 addressable alarm loops.

.2 The exact number of loops will be determined by the number of devices required.

.3 Each loop to have minimum 30% spare capacity for future devices.

.2 Minimum 14 lines X 16 characters per line, liquid crystal display (LCD); displaying full identification of all points in alarm or trouble and providing the following information:

.1 Device address.

.2 Device type.

.3 Device general location, i.e.: Main Level – West Wing.

.4 Device specific location, i.e.: Storage Room A1.02.

.5 Submit a full point by point device list with the above information for review by the Departmental Representative.

.3 Minimum 30 LED’s to display zone in alarm.

.4 Audible signal control panel with control circuits complete with terminals for wiring and plug-in modules for DC signals up to 2.0 A load with trouble indication with class B connections.

.1 Provide audible and signalling circuits to accommodate the number of audible and signalling devices required.

.2 Signalling circuits to have 30% spare capacity for future devices.

.3 Signalling circuits shall not serve more than one floor in a building.

.4 Provide two spare audible and two spare visual signalling circuits in addition to circuits required.

.5 Common control and power units:

.1 Control panel containing following indications and controls:

.1 "Power on" LED (green) to monitor primary source of power to system.

.2 "Ground trouble" indication.

.3 "System trouble" indication.

.4 "System trouble" buzzer and silence switch with trouble resound feature.

.5 System reset switch.

.6 "LED test" switch if applicable.

.7 "Alarm silence" and LED switch to silence signals manually. If new alarm occurs after signals have been silenced, signals to resound.

.6 Site selectable disconnects for the following:

.1 Disconnects shall be manual type and shall not be part of the program function of the panel.

.2 Provide field selectable disconnects for:

.1 Smoke door release bypass.

.2 Fan shutdown bypass.

.3 Elevator recall bypass.

.4 Smoke damper operation, (where required).

.5 Fire alarm horns and strobe light bypass.

.6 Door security system bypass.

.7 Sprinkler bypass

.7 Building Management System (BMS) Connections:

.1 Dry contact outputs for monitoring of fire alarm system status by BMS.

.2 Provide dry contacts for alarm, and system trouble.

2.5 POWER SUPPLY

.1 120 VAC, 60 Hz input, 24 VDC output from rectifier to operate alarm and signal circuits, with standby power of gel cell batteries minimum expected life of 10 years, sized in accordance with ULC requirements.

2.6 MANUAL ALARM STATIONS

.1 Manual alarm stations: pull lever, glass rod, wall mounted semi--lush type, non-coded.

.2 Devices shall be fully addressable.

2.7 AUTOMATIC ALARM INITIATING DEVICES

.1 Smoke detector: Photoelectric type, microprocessor based, “Smart” detector, as follows:

.1 Plug-in type with fixed base.

.2 Wire-in base assembly with integral red alarm LED.

.3 Automatic environmental compensation.

.4 Variable sensitivity setting.

.5 Dirty sensor indication.

.6 Devices to be fully addressable.

.2 Duct smoke detector:

.1 Photoelectric type complete with duct casting and sampling tubes for installation in air system.

.2 Same features as smoke detector above.

.3 Provide remote test stations for all duct detectors. Test station shall consist of alarm indicator LED and key operated test switch.

.4 Devices to be fully addressable.

.3 Heat detector:

.1 Plug-in type with fixed base.

.2 Rate-of-rise and fixed temperature.

.3 Microprocessor based.

.4 Fully addressable.

2.8 AUDIBLE AND VISUAL SIGNAL DEVICES

.1 Wall recessed mounted audio/visual horn: Flush mounted, 24 VDC, minimum audio output of not less than an average of 95 dB at 3 metres, square white grille with integral xenon strobe and red lettering - "FIRE". Lettering to align vertically for wall mounted unit and horizontally for ceiling mounted unit.

.2 Strobe lights shall be CAN/ULC S525 listed with 15/75 candela output to UL 1971 as Signalling Devices for the Hearing Impaired.

.3 Strobe lights to be synchronized to flash in unison.

.4 Horn/strobes to be Chubb-Edwards # 757-7A-TW.

2.9 INPUT MODULES

.1 Fully addressable modules to facilitate the monitoring of the following:

.1 Sprinkler flow and tamper inputs.

.2 Generator run and trouble inputs.

.3 Dry contact devices.

.4 Other input devices as required.

.2 Supervised Class B wiring to the contact device and end of line resistor.

.3 Designed for mounting on a single gang electrical box.

2.10 OUTPUT MODULES

.1 Fully addressable modules to facilitate the following:

.1 Audible signals

.2 Visual signals

.2 Supervised Class B wiring to the output devices and end of line resistor.

.3 Provision for a separate 24 VDC input from the fire alarm control panel or local power supply (transponder).

.4 Designed for mounting on a single gang electrical box.

2.11 END-OF-LINE DEVICES

.1 End-of-line devices to control supervisory current in alarm circuits and signalling circuits, sized to ensure correct supervisory current for each circuit. Open, short or ground fault in any circuit will alter supervisory current in that circuit, producing audible and visible alarm at main control panel and remotely as indicated.

.2 End of line devices to be installed in a fully accessible location for future testing and maintenance. Clearly label all end of line devices, refer to Section 26 05 53.

2.12 REMOTE SIGNAL POWER SUPPLIES/SIGNAL CIRCUIT BOOSTERS

.1 Solid state microprocessor based electronics.

.2 Transient protection.

.3 Supervised signalling circuits via addressable output modules mounted in the enclosure.

.4 Designed to connect to the local addressable data circuit.

.5 Battery standby.

.6 Contractor is responsible for obtaining 120 volt power from nearest emergency power panel.

.7 Shall be located in electrical rooms. Any other locations must be approved by Departmental Representative.

.8 Provide sufficient amount as required to accommodate signalling devices plus 30% spare capacity in each circuit for future devices.

2.13 SIGNAL ISOLATORS

.1 Provide signal isolators on addressable device loop to comply with CAN/ULC S524 and CAN/ULC S537.

.2 Provide isolation modules when entering and leaving each fire zone so that a fault occurring in one zone will not affect the operation of devices in a different zone.

2.14 AUXILIARY RELAYS

.1 Fully addressable relays to facilitate the following:

.1 Fan shutdown.

.2 Smoke door and smoke damper closure.

.3 Elevator homing.

.4 Other control points as required.

.2 Contact terminal size: capable of accepting 22 to 12 AWG wire.

.3 Contacts: 1.0A, 120 VAC.

.4 Fully addressable relays for interconnection to card access controllers

.1 Relays shall have 4 PDT contacts rated for 5 amps at 24 VDC, 24 VAC and 120 VAC.

.2 Provide interposing relays where required to comply with requirements indicated in 2.14.4.1 above, and as follows:

.1 Where control power is required, connect to the nearest suitable emergency power panelboard.

.2 Provide all required circuit breakers, conduit, wiring and devices.

.3 Interposing relays shall be housed in NEMA Type 1 Standard enclosures.

2.15 WIRING

.1 Solid copper conductors with coded PVC insulation, and with overall red PVC jacket in accordance with CSA (300 volts, 105°C).

.2 To initiating circuits: 18 AWG minimum.

.3 To audible circuits: 14 AWG minimum.

.4 To visual circuits: 12 AWG minimum.

.5 Types and sizes of wiring shall be in accordance with manufacturer's recommendations.

2.16 CONTROLS COMMUNICATION PROTOCOL

.1 Description: Electronic controls packaged with this equipment are required to communicate with the building Direct Digital Control (DDC) system as follows:

.1 DDC system must communicate with these controls to read the information and change the control set points as shown in the points list, sequences of operation, and control schematics.

.2 Information communicated between the DDC system and these controls must be in the standard object format defined in ASHRAE 135.

.3 Controllers must communicate with other BACnet objects on the internetwork using the Read (Execute) Property service as defined in Clause 15.5 of ASHRAE 135.

.2 Distributed Processing: Controller must be capable of standalone operation and shall continue to provide control functions without being connected to the network.

.3 I/O Capacity: Controller must contain sufficient I/O capacity to control the target system.

.4 Communication: Controller must reside on a BACnet network using the MS/TP Data Link/Physical layer protocol; each network of controllers shall be connected to one building controller and as follows:

.1 Controller shall have a BACnet Data Link/Physical layer compatible connection for a laptop computer or a portable operator's tool.

.5 Environment: Hardware must be suitable for anticipated ambient conditions and as follows:

.1 Controllers used outdoors and/or in wet ambient conditions shall be mounted within waterproof enclosures and shall be rated for operation at -40°C to 65°C (-40°F to 150°F).

.2 Controllers used in conditioned space shall be mounted in dust-proof enclosures and shall be rated for operation at 0°C to 50°C (32°F to 120°F).

.6 Serviceability: Provide diagnostic LEDs for power, communication, and processor using field-removable wiring connections and modular terminal strips or to a termination card connected by a ribbon cable.

.7 Memory: Provide controller that maintain all BIOS and programming information in the event of a power loss for at least 90 days.

.8 Immunity to Power and Noise: Provide controller able to operate at 90% to 110% of nominal voltage rating and perform an orderly shutdown below 80%; protect operation against electrical noise of 5 to 120 Hz and from keyed radios up to 5 W at 1 m (3 ft.).

.9 Transformer: Power supply for the Controller must be rated at minimum of 125% of ASC power consumption and shall be fused or current limiting type.

Part 3 Execution

3.1 INSTALLATION

.1 Install wiring in conduit and system components in accordance with requirements of Ontario Electrical Safety Code, Building Code and CAN/ULC S524, and the manufacturers written instructions to meet the requirements of the authority having jurisdiction.

.2 Install main control panel as indicated and connect to AC emergency power supply, DC standby power.

.3 Install initiating device loops and allow for 30% spare capacity on each loop for future devices.

.4 Program control panel as required.

.5 Locate and install manual alarm stations as indicated and connect to alarm circuit wiring.

.6 Locate and install detectors and connect to alarm circuit wiring. Do not mount detectors within 1 m of air outlets. Maintain at least 600 mm radius clear space on ceiling, below and around detectors. Locate duct type detectors in straight portions of ducts and to manufacturer's recommendations.

.7 Connect alarm devices to main control panel.

.8 Locate and install audible/visual devices as indicated and connect to signalling circuits.

.9 Install signalling circuits and leave 30% spare capacity in each signalling circuits for future devices. Signalling circuits shall not serve more than one floor in a building.

.10 Connect signalling and visual circuits to main control panel.

.11 Install end-of-line devices at end of alarm and signalling circuits as applicable.

.12 Connect door closers with magnetic release.

.13 Locate and install remote relay units for ancillary operations. Any such units to be grouped in suitable cabinet.

.14 Sprinkler system: wire all alarm and supervisory switches and connect to control panel. Refer to Division 21 for exact requirements and quantities.

.15 Install 19 mm empty conduit to telephone panel for remote monitoring.

.16 Install transponders and provide 120 VAC power supply from nearest emergency power panel as required:

.1 Install all required wiring and conduit.

.2 Use spare breakers.

.17 Install Class A wiring for the initiating devices data communications link, and as follows:

.1 Return trunk shall be run in a separate conduit.

.2 Locate return trunk conduit a minimum of 1000 mm away from the primary trunk.

.18 Run Class A data loop “in” and “out” of each initiating device; “T” taping to the data loop will not be acceptable.

.19 Install interconnections to emergency generator to supervise generator "RUN" and "DISABLED" status.

.20 Install signal wiring to elevator controllers to facilitate elevator homing to the main floor:

.1 Install smoke detector at elevator lobby.

.2 Confirm requirements of this item with the Departmental Representative.

.21 All zone and active field device descriptions for annunciation and LCD programming are to be coordinated with and approved by U of T Fire Prevention.

3.2 TESTING VERIFICATION AND CERTIFICATION OF FIRE ALARM EQUIPMENT

.1 Manufacturer shall make, inspect and test the fire alarm equipment, including those components necessary to the direct operation of the system such as manual stations, thermal detectors, smoke detectors, flow switches, bells and controls, to ensure the following:

.1 That the type of equipment installed is that designated by the engineer's specifications.

.2 That the wiring connections to all equipment components show that the installer observed ULC and CSA requirements, as well as all local by-laws.

.3 That the manufacturer's equipment has been installed in accordance with the manufacturer's recommendations and that all signalling devices of whatever manufacturer have been operated or tested to verify their operations.

.4 That the supervisory wiring of those items of equipment connected to a supervised circuit is operating and that the governmental regulations, if any, concerning such supervisory wiring, have been met to the satisfaction of inspecting officials.

.2 Manufacturer shall supply technical assistance to the system installer with respect to any changes necessary to conform the work to paragraphs above system installer shall make available to the manufacturer any electricians as required by the manufacturer.

.3 Inspection Certificate: On completion of the inspection and when all of the above conditions have been complied with, the manufacturer shall issue to the Departmental Representative:

.1 A copy of the inspecting technician's report showing location of each device and certifying the test results of each.

.2 A certificate of verification confirming that the inspection has been completed and showing the conditions upon which such inspection and certification has been rendered.

.3 Proof of liability insurance for the inspection.

.4 Inspection costs: All costs involved in this inspection both from the manufacturer and this Division shall be included with this Division's total price and it will be the responsibility of this Division to ensure that the manufacturer carries out all the work listed herein to the satisfaction of the Departmental Representative.

.5 The manufacturer shall provide the services of a competent alarm system technician to instruct the staff in the operation and maintenance of the system.

3.3 DEMONSTRATION

.1 Arrange and pay for on-site lectures and demonstrations by fire alarm equipment manufacturer to train operational personnel in use and maintenance of fire alarm system; refer to Section 26 05 00.

3.4 CLOSEOUT ACTIVITIES

.1 Controls Communications Protocol Start-up: Start-up, check-out, and test hardware and software and verify communication between all components as follows:

.1 Verify that control wiring is properly connected and free of shorts and ground faults, and verify that terminations are tight.

.2 Verify that analog and binary input/output points read properly.

.3 Verify alarms and interlocks.

.4 Verify operation of the integrated system.

END OF SECTION

Part 1 GENERAL

1.1 REFERENCES

.1 U.S. Environmental Protection Agency (EPA) / Office of Water

.1 EPA 833-R-06-004, May 2007, Developing Your Stormwater Pollution Prevention Plan - A Guide for Construction Sites.

.2 Ontario Provincial Specifications (OPSS):

.1 (OPSS) 206, Grading

.2 (OPSS) 802, Construction Specification For Topsoil

Part 2 PRODUCTS

2.1 NOT USED

.1 Not Used.

Part 3 EXECUTION

3.1 TEMPORARY EROSION AND SEDIMENTATION CONTROL

.1 Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to sediment and erosion controls indicated on the Site Grading and Servicing Plan (C2.1).

.2 Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.

.3 Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

3.2 STRIPPING OF TOPSOIL

.1 Shall conform to OPSS 206 and OPSS 802

.2 Ensure that procedures are conducted in accordance with applicable Provincial and Municipal requirements and to the satisfaction of the Departmental Representative.

.3 Remove topsoil before any construction procedures commence to avoid compaction of topsoil.

.4 Handle topsoil only when it is dry and warm.

.5 Remove vegetation from targeted areas by non-chemical means and dispose of stripped vegetation by composting.

.6 Remove brush from targeted area by non-chemical means and dispose of through mulching.

.7 Strip topsoil to depths required to remove all topsoil. Avoid mixing topsoil with subsoil.

.8 Pile topsoil by mechanical hoe in berms in locations as directed by the Inspector. Stockpile height not to exceed 2.5 m.

.9 Dispose of unused topsoil off-site.

.10 Protect stockpiles from contamination and compaction.

.11 Topsoil that has been piled for long term storage will be covered with trefoil or grass to maintain agricultural potential of soil.

3.3 PREPARATION OF GRADE

.1 Verify that grades are correct. If discrepancies occur, notify the Departmental Representative and do not commence work until instructed by the Departmental Representative.

.1 Grade area only when soil is dry to lessen soil compaction.

.2 Grade soil establishing natural contours and eliminating uneven areas and low spots, ensuring positive drainage.

3.4 PLACING OF TOPSOIL

.1 Place topsoil only after the Departmental Representative has accepted subgrade.

.2 During dry conditions spread topsoil by mechanical hoe and/or dozer in uniform layers not exceeding 150 mm, over unfrozen subgrade free of standing water.

.3 Establish traffic patterns for equipment that will prevent driving on topsoil after it has been spread to avoid compaction.

.4 Cultivate the soil following spreading procedures.

3.5 SUB-SOILING

.1 Following the spreading and cultivating procedures sub-soil the area to improve drainage and agricultural potential of soil.

.2 With a vibrating sub-soiler work the area to a depth of 40 cm. Follow the contour lines of the natural grades of the area.

.3 Cross sub-soil the area following the first pass.

.4 Cultivate the soil with a chain harrow to de-clod the soil.

3.6 CLEANING

.1 Proceed in accordance with Section 01 74 11.

.2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 GENERAL

1.1 REFERENCES

.1 ASTM International (ASTM)

.1 ASTM D698-12e1, Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (600 kN-m/m^3).

.2 Underwriters' Laboratories of Canada (ULC)

.3 Ontario Provincial Specifications (OPSS):

.1 OPSS 206, Grading

.2 OPSS 314, Stockpiling

.3 OPSS 401, Trenching, Backfilling, and Compacting

.4 OPSS 402, Excavating, Backfilling, and Compacting For Structures

.5 OPSS 802, Topsoil

.6 OPSS 1010, Material Specification for Aggregates

1.2 EXISTING CONDITIONS

.1 Review all background information and reports for the site.

.2 Known underground and surface utility lines and buried objects are as indicated on the site grading and servicing plans. Contractor must obtain locates to confirm.

.3 Dewatering shall be completed in accordance with the City of Windsor and to the satisfaction of the Departmental Representative.

Part 2 PRODUCTS

2.1 MATERIALS

.1 Materials shall conform to applicable OPSS specifications.

.2 Fill Material to be used if surplus excavated and graded material is inadequate, unsuitable, or if special fill is needed for special conditions as directed by the Departmental Representative. Fill material: shall be in accordance with Section 31 23 33_01 - Excavating, Trenching And Backfiling.

.3 Excavated or graded material existing on site may be suitable to use as fill for grading work if approved by the Departmental Representative.

Part 3 EXECUTION

3.1 EXAMINATION

.1 Verify that survey bench mark and intended elevations for the Work are as indicated.

.2 Verify existing conditions before starting work.

3.2 PREPARATION

.1 Identify required lines, levels, contours, and datum.

.2 Stake and flag locations of known utilities.

.3 Locate, identify, and protect utilities that remain, from damage.

.4 Notify utility companies to remove and relocate utilities if required and as directed by the Departmental Representative.

.5 Protect above and below grade utilities that remain.

.6 Protect plant life, lawns, rock outcropping and other features remaining as a portion of final landscaping.

.7 Protect bench marks, survey control point, existing structures, fences, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.

.8 Provide silt and sediment fence, temporary silt sacks in structures and mud mat as indicated on engineering drawings C1.1 Site Grading, Servicing, ESC and Notes & Details Plan.

3.3 STRIPPING OF TOPSOIL

.1 Handling of topsoil shall conform to OPSS 802 and as directed by the Departmental Representative.

.2 Do not handle topsoil while in wet or frozen condition or in any manner in which soil structure is adversely affected as determined by the Departmental Representative.

.3 Commence topsoil stripping of areas as directed by the Departmental Representative after area has been cleared of brush, weeds and grasses and removed from site.

.4 Strip topsoil to depths as indicated and as directed by the Departmental Representative. Rototill weeds and grasses and retain as topsoil on site. Avoid mixing topsoil with subsoil.

.5 Stockpile in locations as indicated or as directed by the Departmental Representative. Stockpile height not to exceed 2.5 m.

.6 Dispose of unused topsoil off site at a location secured by the Contractor.

3.4 SUBSOIL EXCAVATION

.1 Excavate subsoil from areas to be further excavated, re-landscaped, or re-graded.

.2 Do not excavate wet subsoil or excavate and process wet material to obtain optimum moisture content.

.3 When excavating through roots, perform work by hand and cut roots with sharp axe.

.4 Stockpile in area designated on site to depth not exceeding 2.5 m and protect from erosion. Remove from site, subsoil not being reused.

.5 Stability: Replace damaged or displaced subsoil to same requirements as for specified fill.

3.5 FILLING

.1 Install Work in accordance with OPSS 401, OPSS 402, OPSS 1010, The City of Windsor, and to the satisfaction of the Departmental Representative.

.2 Fill areas to contours and elevations with unfrozen materials.

.3 Place fill material on continuous layers and compact.

.4 Maintain optimum moisture content of fill materials to attain required compaction density.

.5 Make grade changes gradual. Blend slope into level areas.

.6 Remove surplus fill materials from site.

3.6 GRADING

.1 Grading shall conform to OPSS 206, The City of Windsor and to the satisfaction of the Departmental Representative.

.2 Rough grade to levels, profiles, and contours allowing for surface treatment as indicated.

.3 Rough grade to following depths below finish grades:

.1 150 mm for grassed areas.

.2 490 mm for light duty asphalt paving or as indicated by the Departmental Representative.

.3 275 mm for concrete walks or as indicated by the Departmental Representative.

.4 Slope rough grade away from building as indicated on the Site Grading and Servicing Plan (C2.1).

.5 Grade ditches to depth as indicated on the Site Grading and Servicing Plan (C2.1).

.6 Prior to placing fill over existing ground, scarify surface to depth of 150 mm minimum before placing fill over existing ground. Maintain fill and existing surface at approximately same moisture content to facilitate bonding.

.7 Compact filled and disturbed areas to maximum dry density to ASTM D698, as follows:

.1 85% under landscaped areas.

.2 95% under paved and walk areas.

.3 As directed by the by the Departmental Representative.

.8 Do not disturb soil within branch spread of trees or shrubs to remain.

3.7 TESTING

.1 Inspection and testing of soil compaction will be carried out by testing laboratory designated by the Departmental Representative. Contractor responsible for coordination of inspection with the Departmental Representative.

.2 If tests indicate Work does not meet specified requirements, remove Work, replace and retest.

3.8 TOLERANCES

.1 In accordance with OPSS 206.

3.9 SURPLUS MATERIAL

.1 Remove surplus material and material unsuitable for fill, grading or landscaping off site at a location secured by the Contractor.

3.10 CLEANING

.1 Progress Cleaning: clean to the satisfaction of the Departmental Representative.

.2 Leave Work area clean at end of each day.

.3 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment to the satisfaction of the Departmental Representative.

3.11 PROTECTION

.1 Protect existing fencing ,trees, landscaping, natural features, bench marks, buildings, pavement, surface or underground utility lines which are to remain as indicated on the drawings and as directed by Departmental Representative. If damaged, restore to original or better condition unless directed otherwise.

.2 Maintain access roads to prevent accumulation of construction related debris on roads.

END OF SECTION

Part 1 GENERAL

1.1 REFERENCES

.1 American Society for Testing and Materials International (ASTM)

- .1 ASTM C117-13, Standard Test Method for Material Finer than 0.075 mm (No.200) Sieve in Mineral Aggregates by Washing.
- .2 ASTM C136/C136M-14, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
- .3 ASTM D422-63(2007)e2, Standard Test Method for Particle-Size Analysis of Soils.
- .4 ASTM D698-12e1, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3) (600 kN-m/m^3).
- .5 ASTM D751-06(2011), Standard Test Methods for Coated Fabrics.
- .6 ASTM D1557-12, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft^3) (2,700 kN-m/m^3).
- .7 ASTM D4318-10e1, Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

.2 Canadian General Standards Board (CGSB)

- .1 CAN/CGSB-8.1-88, Sieves, Testing, Woven Wire, Inch Series.
- .2 CAN/CGSB-8.2-M88, Sieves, Testing, Woven Wire, Metric.

.3 Ontario Provincial Standard Specifications (OPSS)/Ontario Ministry of Transportation

- .1 OPSS 314, Construction Specification for Untreated Granular, Subbase, Base, Surface Shoulder, and Stockpiling (November 2004).
- .2 OPSS 401, Construction Specifications for Excavating, Trenching and Backfilling (November 2009).
- .3 OPSS 402, Construction Specification for Excavating, Backfilling and Compacting for Maintenance Holes, Catch Basins, Ditch inlets and Valve Chamber.
- .4 OPSS 902, Construction Specification for Excavating and Backfilling – Structures (November 2010).
- .5 OPSS 1004, Material Specification for Aggregates - Miscellaneous.
- .6 OPSS 1010, Material Specification for Aggregates - Base, Subbase, Select Subgrade, and Backfill Material.

.4 U.S. Environmental Protection Agency (EPA)/ Office of Water

- .1 EPA 833-R-06-004, May 2007, Developing Your Stormwater Pollution Prevention Plan - A Guide for Construction Sites.

1.2 DEFINITIONS

.1 Excavation classes: two classes of excavation will be recognized; common excavation and rock excavation.

.1 Rock: solid material in excess of 1.00 m^3 and which cannot be removed by means of heavy duty mechanical excavating equipment with 0.95 to 1.15 m^3 bucket. Frozen material not classified as rock.

.2 Common excavation: excavation of materials of whatever nature, which are not included under definitions of rock excavation.

.2 Unclassified excavation: excavation of deposits of whatever character encountered in Work.

.3 Topsoil:

.1 Material capable of supporting good vegetative growth and suitable for use in top dressing, landscaping and seeding.

.2 Material reasonably free from subsoil, clay lumps, brush, objectionable weeds, and other litter, and free from cobbles, stumps, roots, and other objectionable material larger than 25 millimeters in any dimension.

.4 Waste material: excavated material unsuitable for use in Work or surplus to requirements.

.5 Borrow material: material obtained from locations outside area to be graded, and required for construction of fill areas or for other portions of Work.

.6 Recycled fill material: material, considered inert, obtained from alternate sources and engineered to meet requirements of fill areas.

.7 Unsuitable materials:

.1 Weak, chemically unstable, and compressible materials.

.2 Frost susceptible materials:

.1 Fine grained soils with plasticity index less than 10 when tested to ASTM D4318-10, and gradation within limits specified when tested to ASTM D422-63 and ASTM C136-06: Sieve sizes to CAN/CGSB-8.1-88, CAN/CGSB-8.2-M88.

.2 Coarse grained soils containing more than 20% by mass passing 0.075 mm sieve.

.8 Unshrinkable fill: very weak mixture of cement, concrete aggregates and water that resists settlement when placed in utility trenches, and capable of being readily excavated.

1.3 SUBMITTALS

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

.1 Submit condition survey of existing conditions as described in Existing Conditions article of this Section.

.2 Notify Departmental Representative a minimum of 48 hours prior to excavation work.

.3 Contractor to notify and coordinate with Departmental Representative for soil testing and compaction as required.

.2 Preconstruction Submittals:

.1 Submit construction equipment list for major equipment to be used in this section prior to start of Work.

.2 Submit records of underground utility locates, indicating: location plan of existing utilities as found in field, clearance record from utility authority, location plan of relocated and abandoned services, as required.

1.4 QUALITY ASSURANCE

.1 Where contractor is responsible for design of temporary structures, submit proof that Work is included in Contractor's insurance coverage.

.2 Submit design and supporting data at least 2 weeks prior to beginning Work.

.3 Design and supporting data submitted to bear stamp and signature of qualified professional engineer registered or licensed in Ontario, Canada.

.4 Keep design and supporting data on site.

.5 Engage services of qualified professional Engineer who is registered or licensed in Ontario, Canada in which Work is to be carried out to design and inspect cofferdams, shoring, bracing and underpinning required for Work.

.6 Do not use soil material until written report of soil test results are reviewed and approved by the Departmental Representative.

.7 Health and Safety Requirements to meet the requirements of the MOL.

1.5 EXISTING CONDITIONS

.1 Examine all drawings and reports for the site.

.2 Buried services:

.1 Before commencing work verify location of buried services on and adjacent to site.

.2 Arrange with appropriate authority for relocation of buried services that interfere with execution of work: pay costs of relocating services.

.3 Remove obsolete buried services within 2 m of foundations: cap cut-offs.

.4 Size, depth and location of existing utilities and structures as indicated are for guidance only. Completeness and accuracy are not guaranteed.

.5 Prior to beginning excavation Work, notify Departmental Representativeand applicable authorities having jurisdiction establish location and state of use of buried utilities and structures. Departmental Representative and authorities having jurisdiction to clearly mark such locations to prevent disturbance during Work.

.6 Confirm locations of buried utilities by careful test excavations or soil hydrovac methods.

.7 Maintain and protect from damage, water, sewer, gas, electric, telephone and other utilities and structures as indicated on the drawings and as encountered.

.8 Where utility lines or structures exist in area of excavation, obtain direction of Departmental Representative before removing or re-routing. Record location of maintained, re-routed and abandoned underground lines.

.9 Record location of maintained, re-routed and abandoned underground lines.

.10 Confirm locations of recent excavations adjacent to area of excavation.

.3 Existing buildings and surface features:

.1 Review existing buildings, trees and other plants, lawns, fencing, service poles, wires, rail tracks, pavement, survey bench marks and monuments which may be affected by Work and notify Departmental Representative of any concerns.

.2 Protect existing buildings and surface features from damage while Work is in progress. In event of damage, immediately make repair as directed by Departmental Representative.

.3 Where required for excavation, cut roots or branches as directed by the Departmental Representative.

Part 2 PRODUCTS

2.1 MATERIALS

.1 Type 1 and Type 2 fill: properties to the following requirements:

.1 Crushed, pit run or screened stone, gravel or sand.

.2 Gradations to be within limits specified when tested as specified in Geotechnical Report

.2 Type 3 fill: selected material from excavation or other sources, approved by Departmental Representative for use intended, unfrozen and free from rocks larger than 75 mm, cinders, ashes, sods, refuse or other deleterious materials.

.3 Granular material: to satisfaction of the Departmental Representative and Ontario Provincial Standard Specification 1010 for Granular A and B.

.4 Sand: clean, washed, minimum 100% passing 4.75 mm sieve, maximum 5% passing 0.075 mm sieve to OPSS 1004.05.04, November 2012.

.5 Drainage material: 19 mm crushed stone or 19 to 63 mm clean gravel to OPSS 1004.05.07, November 2012.

.6 Unshrinkable fill: proportioned and mixed to provide:

.1 Maximum compressive strength of 0.4 MPa at 28 days.

.2 Maximum cement content of 25 kg/m^3 with 40% by volume fly ash replacement: to CSA A3001, Type GU.

.3 Minimum strength of 0.07 MPa at 24 h.

.4 Concrete aggregates: to CSA A23.1/A23.2.

.5 Cement: Type GU.

.6 Slump: 160 to 200 mm.

Part 3 EXECUTION

3.1 TEMPORARY EROSION AND SEDIMENTATION CONTROL

.1 Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to sediment and erosion control plan and shall comply with EPA 833-R-06-004 and to the satisfaction of the Departmental Representative.

.2 Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.

.3 Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

3.2 SITE PREPARATION

.1 Remove obstructions, ice and snow, from surfaces to be excavated within limits indicated.

.2 Cut pavement or sidewalk neatly along limits of proposed excavation in order that surface may break evenly and cleanly.

3.3 PREPARATION/PROTECTION

.1 Protect existing features in accordance the drawings and as directed by the Departmental Representative.

.2 Keep excavations clean, free of standing water, and loose soil.

.3 Where soil is subject to significant volume change due to change in moisture content, cover and protect to the satisfaction of the Departmental Representative.

.4 Protect natural and man-made features required to remain undisturbed. Unless otherwise indicated or located in an area to be occupied by new construction, protect existing trees from damage.

.5 Protect buried services that are required to remain undisturbed.

3.4 STRIPPING OF TOPSOIL

.1 In accordance with Section 31 22 13.

3.5 STOCKPILING

.1 Stockpile in accordance with OPSS 314.

.2 Stockpile fill materials in areas designated by the Departmental Representative.

.1 Stockpile granular materials in manner to prevent segregation.

.3 Protect fill materials from contamination.

.4 Implement sufficient erosion and sediment control measures to prevent sediment release off construction boundaries and into water bodies.

3.6 DEWATERING AND HEAVE PREVENTION

.1 Keep excavations free of water while Work is in progress.

.2 If required, provide for the Departmental Representative's review details of proposed dewatering or heave prevention methods, including dikes, well points, and sheet pile cut-offs.

.3 Avoid excavation below groundwater table if quick condition or heave is likely to occur.

.1 Prevent piping or bottom heave of excavations by groundwater lowering, sheet pile cut-offs, or other means.

.4 Protect open excavations against flooding and damage due to surface run-off.

.5 Dispose of water in accordance with City standards to an approved location in a manner not detrimental to public and private property, or portion of Work completed or under construction.

.1 Provide and maintain temporary drainage ditches and other diversions outside of excavation limits as directed by the Departmental Representative.

.6 Provide flocculation tanks, settling basins, or other treatment facilities to remove suspended solids or other materials before discharging to storm sewers, watercourses or drainage areas as directed by the City.

3.7 EXCAVATION

.1 Advise Departmental Representative at least 7 days in advance of excavation operations for initial cross sections to be taken.

.2 Excavate subsoil to accommodate paving, site structures, site services, and construction operations.

.3 Grade top perimeter of excavating to prevent surface water from draining into excavation.

.4 Remove concrete and paving and other obstructions encountered during excavation as required.

.5 Hand trim excavation as required and remove loose matter.

.6 Excavation must not interfere with bearing capacity of adjacent foundations.

.7 Do not disturb soil within branch spread of trees or shrubs that are to remain.

.1 If excavating through roots, excavate by hand and cut roots with sharp axe or saw.

.8 For trench excavation, unless otherwise authorized by the Departmental Representative in writing, do not excavate more than 30 m of trench in advance of installation operations and do not leave open more than 15 m at end of day's operation.

.9 Keep excavated and stockpiled materials safe distance away from edge of trench as directed by Departmental Representative.

.10 Restrict vehicle operations directly adjacent to open trenches.

.11 Dispose of surplus and unsuitable excavated material in an approved location off site secured by the contractor.

.12 Do not obstruct flow of surface drainage or natural watercourses.

.13 Earth bottoms of excavations to be undisturbed soil, level, free from loose, soft or organic matter.

.14 Notify Departmental Representative when bottom of excavation is reached.

.15 Obtain Departmental Representative's approval of completed excavation.

.16 Remove unsuitable material from trench bottom including those that extend below required elevations to extent and depth as directed by the Departmental Representative.

.17 Correct areas over excavated in accordance with OPSS 402 and OPSS 902.

.18 Excavation shall conform to OPSS 402 and OPSS 902.

.19 Trenching and Backfilling shall conform to OPSS 401 and OPSS 902.

.20 Perform compaction in accordance with the Departmental Representative's recommendations and OPSS 401

.21 Grading shall conform to OPSS 206.

3.8 FILL TYPES AND COMPACTION

.1 Use types of fill as directed by the Departmental Representative.

3.9 BEDDING AND SURROUND OF UNDERGROUND SERVICES

.1 Place and compact granular material for bedding and surround of underground services as indicated and as specified in Section 33 11 16 - Site Water Utility Distribution Piping, Section 33 31 13 - Public Sanitary Utility Sewerage Piping, Section 33 41 00 - Storm Utility Drainage Piping.

.2 Place bedding and surround material in unfrozen condition.

3.10 BACKFILLING

.1 Backfilling activities shall conform to OPSS 401 and OPSS 902 and the engineering drawings.

.2 Do not proceed with backfilling operations until completion of following:

.1 The Departmental Representative has inspected and approved installations.

.2 The Departmental Representative has inspected and approved of construction below finish grade.

.3 Inspection, testing, approval, and recording location of underground utilities.

.4 Removal of concrete formwork.

.5 Removal of shoring and bracing; backfilling of voids with satisfactory soil material.

.3 Areas to be backfilled to be free from debris, snow, ice, water and frozen ground.

.4 Do not use backfill material which is frozen or contains ice, snow or debris.

.5 Place backfill material in uniform layers not exceeding 300 mm compacted thickness up to grades indicated. Compact each layer before placing succeeding layer.

.6 Backfilling around installations:

.1 Place bedding and surround material as specified elsewhere.

.2 Do not backfill around or over cast-in-place concrete within 24 hours after placing of concrete.

.3 Place layers simultaneously on both sides of installed Work to equalize loading.

.4 Where temporary unbalanced earth pressures are liable to develop on walls or other structures:

.1 Permit concrete to cure for minimum 14 days or until it has sufficient strength to withstand earth and compaction pressure and approval obtained from the Departmental Representative or:

.2 If approved by the Departmental Representative, erect bracing or shoring to counteract unbalance, and leave in place until removal is approved by the Departmental Representative.

.7 Place geotextile fabric as indicated on the engineering drawings and as directed by the Departmental Representative prior to placing next lift of fill.

.8 Granular Fill: Place and compact materials as per Section 33 23 18 - Trenching.

.9 Soil Fill: Place and compact material in equal continuous layers not exceeding 300 mm compacted depth.

.10 Place unshrinkable fill in areas as indicated.

.11 Employ a placement method that does not disturb or damage other work.

.12 Maintain optimum moisture content of backfill materials to attain required compaction density.

.13 Slope grade away from building minimum 50 mm in 3 m, unless noted otherwise.

.14 Make gradual grade changes. Blend slope into level areas.

.15 Remove surplus backfill materials from site.

.16 Leave fill material stockpile areas free of excess fill materials.

.17 Consolidate and level unshrinkable fill with internal vibrators.

.18 Install drainage or filter system in backfill as directed by the Departmental Representative.

3.11 FIELD QUALITY CONTROL

.1 Compaction testing will be performed in accordance with the Departmental Representative.

.2 If tests indicate Work does not meet specified requirements, remove Work, replace, compact, and retest.

.3 Proof roll compacted fill surfaces under paving, and concrete in accordance with the Departmental Representative.

.4 Frequency of Tests: As per the Departmental Representative’s recommendations.

3.12 PROTECTION OF FINISHED WORK

.1 Protect installed work.

.2 Reshape and re-compact fills subjected to vehicular traffic.

3.13 RESTORATION

.1 Upon completion of Work, remove waste materials and debris, trim slopes, and correct defects as directed by the Departmental Representative.

.2 Replace topsoil as indicated and as directed by the Departmental Representative.

.3 Reinstate lawns to elevation which existed before excavation.

.4 Reinstate pavements and sidewalks disturbed by excavation to thickness, structure and elevation which existed before excavation.

.5 Clean and reinstate areas affected by Work as directed by the Departmental Representative.

.6 Use temporary plating to support traffic loads over unshrinkable fill for initial 24 hours.

.7 Protect newly graded areas from traffic and erosion and maintain free of trash or debris.

END OF SECTION

Part 1 GENERAL

1.1 REFERENCES

.1 ASTM International

.1 ASTM C117-04, Standard Test Methods for Material Finer Than 0.075 mm Sieve in Mineral Aggregates by Washing.

.2 ASTM C131-06, Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.

.3 ASTM C136-06, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.

.4 ASTM D422-63(2007), Standard Test Method for Particle-Size Analysis of Soils.

.5 ASTM D698-07e1, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400ft-lbf/ft^3) (600kN-m/m^3).

.6 ASTM D1557-09, Standard Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000ft-lbf/ft^3) (2,700kN-m/m^3).

.7 ASTM D1883-07e2, Standard Test Method for CBR (California Bearing Ratio) of Laboratory Compacted Soils.

.8 ASTM D4318-10, Standard Test Methods for Liquid Limit, Plastic Limit and Plasticity Index of Soils.

.2 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-8.1-88, Sieves, Testing, Woven Wire, Inch Series.

.2 CAN/CGSB-8.2-M88, Sieves, Testing, Woven Wire, Metric.

.3 U.S. Environmental Protection Agency (EPA) / Office of Water

.1 EPA 832/R-92-005, Storm Water Management for Construction Activities: Developing Pollution Prevention Plans and Best Management Practices.

.4 Ontario Provincial Standard Specifications (OPSS)/Ontario Ministry of Transportation

.1 OPSS 1004, Material Specification for Aggregates - Miscellaneous.

.2 OPSS 1010, Material Specification for Aggregates - Base, Subbase, Select Subgrade, and Backfill Material.

1.2 DELIVERY, STORAGE AND HANDLING

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

.2 Storage and Handling Requirements:

.1 Store materials in accordance with manufacturer's recommendations.

.2 Replace defective or damaged materials with new.

Part 2 PRODUCTS

2.1 MATERIALS

.1 Refer to OPSS 1010.

.2 Granular sub-base material to be tested and approved by the Departmental Representative.

Part 3 EXECUTION

3.1 EXAMINATION

.1 Verification of Conditions: verify conditions of substrate previously installed under other Sections or Contracts are acceptable for granular sub-base installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of the Departmental Representative.

.2 Inform the 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 the Departmental Representative.

3.2 PREPARATION

.1 Temporary Erosion and Sedimentation Control:

.1 Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to sediment and erosion controls on Site Grading and Servicing Plan (C2.1).

.2 Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.

.3 Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

3.3 PLACING

.1 Place granular sub-base after subgrade is inspected and approved by the Departmental Representative.

.2 Construct granular B sub-base to depth and grade in areas indicated.

.3 Ensure no frozen material is placed.

.4 Place material only on clean unfrozen surface, free from snow or ice.

.5 Place material to full width in uniform layers not exceeding 150 mm compacted thickness.

.1 Departmental Representative may authorize thicker lifts if specified compaction can be achieved.

.6 Shape each layer to smooth contour and compact to specified density before succeeding layer is placed.

.7 Remove and replace portion of layer in which material has become segregated during spreading.

3.4 COMPACTION

.1 Compaction equipment to be capable of obtaining required material densities.

.2 Compact to density of not less than 98% maximum dry density in accordance with ASTM D698, ASTM D1557 and the Departmental Representative's recommendations.

.3 Shape and roll alternately to obtain smooth, even and uniformly compacted sub-base.

.4 Apply water as necessary during compaction to obtain specified density.

.5 In areas not accessible to rolling equipment, compact to specified density with mechanical tampers approved by the Departmental Representative.

.6 Correct surface irregularities by loosening and adding or removing material until surface is within specified tolerance.

3.5 CLEANING

.1 Progress Cleaning: clean to satisfaction of the Departmental Representative.

.2 Leave Work area clean at end of each day.

.3 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment as required.

3.6 SITE TOLERANCES

.1 Finished sub-base surface to be within 5 mm of elevation as indicated but not uniformly high or low.

3.7 PROTECTION

.1 Maintain finished sub-base in condition conforming to this section until succeeding base is constructed, or until granular sub-base is accepted by Departmental Representative.

END OF SECTION

Part 1 GENERAL

1.1 REFERENCES

.1 American Society for Testing and Materials (ASTM)

.1 ASTM C117-04, Standard Test Methods for Material Finer Than 0.075 mm Sieve in Mineral Aggregates by Washing.

.2 ASTM C131-06, Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.

.3 ASTM C136-06, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.

.4 ASTM D698-07e1, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400ft-lbf/ft^3) (600kN-m/m^3).

.5 ASTM D1557-09, Standard Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000ft-lbf/ft^3) (2,700kN-m/m^3).

.6 ASTM D1883-07e2, Standard Test Method for CBR (California Bearing Ratio) of Laboratory Compacted Soils.

.7 ASTM D4318-10, Standard Test Methods for Liquid Limit, Plastic Limit and Plasticity Index of Soils.

.2 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-8.1-88, Sieves, Testing, Woven Wire, Inch Series.

.2 CAN/CGSB-8.2-M88, Sieves, Testing, Woven Wire, Metric.

.3 Ontario Provincial Standard Specifications (OPSS)/Ontario Ministry of Transportation

.1 OPSS 1004 November 2006, Ontario Provincial Standard Specification, Material Specification for Aggregates - Miscellaneous.

.2 OPSS 1010 April 2004, Ontario Provincial Standard Specification, Material Specification for Aggregates - Base, Subbase, Select Subgrade, and Backfill Material.

1.2 DELIVERY, STORAGE, AND HANDLING

.1 Deliver and stockpile aggregates in accordance with suppliers reccomndations. Stockpile minimum 50% of total aggregate required prior to beginning operation.

.2 Store cement in weathertight bins or silos that provide protection from dampness and easy access for inspection and identification of each shipment.

Part 2 PRODUCTS

2.1 MATERIALS

.1 Granular base to conform to OPSS 1010.

.2 Material to be tested and approved by the Departmental Representative prior to placement.

Part 3 EXECUTION

3.1 SEQUENCE OF OPERATION

.1 Place granular base after sub-base surface is inspected and approved by the Departmental Representative.

.2 Placing

.1 Construct granular base to depth and grade in areas indicated.

.2 Ensure no frozen material is placed.

.3 Place material only on clean unfrozen surface, free from snow and ice.

.4 Place material to full width in uniform layers not exceeding 150 mm compacted thickness.

.5 Shape each layer to smooth contour and compact to specified density before succeeding layer is placed.

.6 Remove and replace that portion of layer in which material becomes segregated during spreading.

.3 Compaction Equipment

.1 Compaction equipment to be capable of obtaining required material densities.

.4 Compacting

.1 Compact to density not less than 100% corrected maximum dry density in accordance with ASTM D698, ASTM D1557 and to the satisfaction of the Departmental Representative.

.2 Shape and roll alternately to obtain smooth, even and uniformly compacted base.

.3 Apply water as necessary during compacting to obtain specified density.

.4 In areas not accessible to rolling equipment, compact to specified density with mechanical tampers approved by Departmental Representative.

.5 Correct surface irregularities by loosening and adding or removing material until surface is within specified tolerance.

3.2 SITE TOLERANCES

.1 Finished base surface to be within plus or minus 5 mm of established grade and cross section but not uniformly high or low.

3.3 PROTECTION

.1 Maintain finished base in condition conforming to this Section until succeeding material is applied or until acceptance by the Departmental Representative.

END OF SECTION

Part 1 GENERAL

1.1 REFERENCES

.1 American Society for Testing and Materials International, (ASTM)

.1 ASTM D698-07e1, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3 (600 kN-m/m^3)).

.2 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-1.5-M91(March 1999), Low Flash Petroleum Spirits Thinner (Reaffirmation of December 1991).

.2 CAN/CGSB-1.74-2001, Alkyd Traffic Paint.

.3 Asphalt Institute (AI)

.1 AI MS-2-1994, Mix Design Methods for Asphalt Concrete and Other Hot-Mixes.

.4 ASTM International

.1 ASTM C88-05, Standard Test Method for Soundness of Aggregates by Use of Sodium Sulphate or Magnesium Sulphate.

.2 ASTM D698-12, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)).

.5 Ontario Provincial Standard Specifications (OPSS)

.1 OPSS 302, Construction Specification for Primary Granular Base.

.2 OPSS 310, Construction Specification for Hot Mixed Asphalt.

.3 OPSS 1001, Material Specification for Aggregates - General.

.4 OPSS 1010, Material Specification for Aggregates - Base, Subbase, Select Subgrade, and Backfill Material.

.5 SP 110S13, Amendment to OPSS 1010, Material Specification for Aggregates, Granular A, B, M and Select Subgrade Material.

.6 OPSS 1150, Material Specification for Hot Mixed Asphalt.

.6 The Master Painters Institute (MPI)

.1 Architectural Painting Specification Manual - current edition.

.2 MPI #32, Traffic Marking Paint, Alkyd.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for asphalt mixes and aggregate and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Submit viscosity-temperature chart for asphalt cement to be supplied showing either Saybolt Furol viscosity in seconds or Kinematic Viscosity in centistokes, temperature range 105 to 175 degrees C 4 weeks prior to beginning Work.

.2 Samples:

.1 Inform Departmental Representativeof proposed source of aggregates and provide access for sampling 4 weeks prior to beginning Work.

.2 Submit asphalt concrete mix design and trial mix test results for approval.

.3 Inform the Departmental Representative of proposed source of aggregates and provide access for sampling at least 4 weeks prior to commencing work.

.4 Submit samples of proposed materials for use at least 4 weeks prior to commencing work as directed by the Departmental Representative.

.3 Test and Evaluation Reports:

.1 Materials to be tested by accredited testing laboratory and approved by the Departmental Representative.

.2 Submit test certificates showing suitability of materials at least 4 weeks prior to commencing work.

1.3 DELIVERY, STORAGE AND HANDLING

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

Part 2 PRODUCTS

2.1 MATERIALS

.1 Aggregates: in accordance with OPSS 1010, OPSS 1001 and Section 31 05 16 - Aggregate Materials: General.

.2 Asphalt Cement: OPSS 1101

.3 Performance graded asphalt cement: to AASHTO M320-10, grade PG 58 - 28 when tested to AASHTO R29-08.

.4 Asphalt Materials:

.1 Hot mixed, hot laid asphalt meeting OPSS 1150, designation HL4 or HL8 for Binder Coarse and HL3 for surface course in accordance with OPSS 310.

.2 As dictated by the Departmental Representative: tack and primer coat: OPSS 1103 Grade SS-1.

2.2 ASPHALT PAVING MIX

.1 Contractor to consult Departmental Representative for Mix design requirements and specifications.

.2 Mix design to be approved in writing by the Departmental Representative and submitted to the Departmental Representative prior to the start of construction.

.3 Mix design to be developed by testing laboratory approved in writing by Departmental Representative.

.4 Do not change job-mix without prior approval of Departmental Representative.

Part 3 EXECUTION

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for asphalt paving in accordance with manufacturer's written instructions.

.2 Visually inspect substrate in presence of Departmental Representative.

.3 Inform Departmental Representative of unacceptable conditions immediately upon discovery.

.4 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

.5 Verify that compacted granular base is dry and ready to support paving and imposed loads.

.6 Verify gradients and elevations of base are correct.

3.2 SUBGRADE SURFACE PREPARATION AND INSPECTION

.1 Do not over excavate. Subgrade to be proof rolled and inspected by the Departmental Representative prior to placing the sub base material.

.2 Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to requirements of authorities having jurisdiction and according to Drawings, whichever is more stringent.

.3 Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.

.4 Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

.5 Verify grades of subgrade drains and other items set in paving area for conformity with elevations and sections before placing granular base and sub-base material.

.6 Obtain written approval of subgrade by the Departmental Representative before placing granular sub-base and base.

3.3 TRANSPORTATION OF MIX

.1 To be in accordance with manufacturer recommendations.

3.4 PAVEMENT DESIGN

.1 Pavement design for roadways comprise:

.1 300 mm compacted thickness of granular B subbase

.2 150 mm compacted thickness of granular A base

.2 Pavement design for parking lots to comprise:

.1 300 mm compacted thickness of granular A base

.3 Construction of granular foundations: OPSS 314

.4 Compaction: compact each lift of granular material to 100% maximum density to ASTM D698. Maximum lift thickness: 150 mm.

3.5 PAVEMENT THICKNESS

.1 Pavements for roadways:

.1 Base course: 50 mm HL8

.2 Wear course: 40 mm HL3.

.2 Pavements for parking lots:

.1 Wear course: 50 mm HL3.

3.6 PAVEMENT CONSTRUCTION

.1 Application of prime coat: OPSS 302.

.2 Construction of asphalt concrete: OPSS 310.

3.7 PLACING GRANULAR SUB-BASE AND BASE

.1 Obtain Departmental Representative's approval of subgrade prior to placing subbase and base.

.2 Place granular sub-base and base as directed by the Departmental Representative, in accordance with section 31 05 16, OPSS 302 and the Departmental Representative's recommendations and the geotechnical report.

3.8 PLACING ASPHALT

.1 Obtain Departmental Representative's approval of subbase and base prior to placing asphalt.

.2 Place asphalt as directed by the Departmental Representative and per OPSS 310

.3 Contractor to consult Departmental Representative prior to the start of construction for compacting requirements. Departmental Representative compacting requirements shall supersede all other specifications.

3.9 FIELD QUALITY CONTROL

.1 Perform field inspection and testing as required by OPSS 310 and Departmental Representative recommendations.

.2 Conduct tests and analysis of asphaltic concrete paving in accordance with OPSS 310 and ASTM D698.

.3 Compaction testing shall be completed in the presence of the Departmental Representative and preformed as directed by the Departmental Representative. Contractor shall contact geotechnical 48 hours prior to the start of paving for inspection.

.4 If tests indicate Work does not meet specified requirements, remove Work and replace and retest at no extra cost.

3.10 DEFECTIVE WORK

.1 Correct irregularities which develop before completion of rolling by loosening surface mix and removing or adding material as required.

.1 If irregularities or defects remain after final compaction, remove surface course promptly and lay new material to form true and even surface and compact immediately to specified density.

.2 Repair areas showing checking, rippling, or segregation.

.3 Adjust roller operation and screed settings on paver to prevent further defects such as rippling and checking of pavement

3.11 TRAFFIC MARKINGS

.1 Paint parking space divisions and other pavement markings in accordance with manufacturers recommendations and as indicated.

.2 Use paint thinner in accordance with manufacturer's requirements.

3.12 CLEANING

.1 Progress Cleaning: Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment as required and as directed by the Departmental Representative.

3.13 PROTECTION

.1 Keep vehicular traffic off newly paved areas until paving surface temperature has cooled below 38 degrees C.

.2 Do not permit stationary loads on pavement until 24 hours after placement.

.3 Provide access to buildings as required.

.4 Arrange paving schedule so as not to interfere with normal use of premises as directed by the Departmental Representative.

END OF SECTION

Part 1 GENERAL

.1 ASTM International

.1 ASTM A53/A53M-12, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.

.2 ASTM A90/A90M-13, Standard Test Method for Weight Mass of Coating on Iron and Steel Articles with Zinc or Zinc-Alloy Coatings.

.3 ASTM A123/A123M-13, Standard Specification for Zinc (Hot Dip Galvanized) coatings on Iron and Steel Products.

.4 ASTM A653/A653M-13, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

.5 ASTM C618-12a, Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete.

.6 ASTM F1664-08(2013), Standard Specification for Poly(Vinyl Chloride) (PVC)-Coated Steel Tension Wire Used with Chain-Link Fence.

.2 Canada Green Building Council (CaGBC)

.1 LEED Canada For New Construction and Major Renovations 2009.

.3 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-138.1-96, Fabric for Chain Link Fence.

.2 CAN/CGSB-138.2-96, Steel Framework for Chain Link Fence.

.3 CAN/CGSB-138.3-96, Installation of Chain Link Fence.

.4 CAN/CGSB-138.4-96, Gates for Chain Link Fence.

.5 CAN/CGSB-1.181-99, Ready-Mixed Organic Zinc-Rich Coating.

.4 CSA International

.1 CAN/CSA-A3000-13, Cementitious Materials Compendium.

.5 Master Painters Institute (MPI)

.1 Architectural Painting Specification Manual - current edition.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for concrete mixes, fences, posts and gates and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Sustainable Design Submittals:

.1 LEED Submittals: in accordance with Section 01 35 21.

.2 Erosion and Sedimentation Control: submit copy of erosion and sedimentation control plan in accordance with Section 01 35 21 - LEED Requirements.

.3 Construction Waste Management:

.1 Submit project Waste Management Plan highlighting recycling and salvage requirements.

.2 Submit calculations on end-of-project recycling rates, salvage rates, and landfill rates demonstrating that 75% of construction wastes were recycled or salvaged.

.4 Recycled Content:

.1 Submit listing of recycled content products used, including details of required percentages or recycled content materials and products, showing their costs and percentages of post-consumer and post-industrial content, and total cost of materials for project.

.2 Submit evidence, when Supplementary Cementing Materials (SCMs) are used, to certify reduction in cement from Base Mix to Actual SCMs Mix, as percentage.

.5 Regional Materials: submit evidence that project incorporates required percentage 20% of regional materials and products, showing their cost, distance from project to furthest site of extraction or manufacture, and total cost of materials for project.

1.3 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 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 accordance with manufacturer's recommendations.

.2 Store and protect fence and gate materials from damage.

.3 Replace defective or damaged materials with new.

.4 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding and packaging materials as specified in Waste Reduction Workplan in accordance with Section 01 74 20.

Part 2 PRODUCTS

2.1 MATERIALS

.1 Concrete mixes and materials: in accordance with Section 03 30 00.01.

.1 Nominal coarse aggregate size: 20-5.

.2 Compressive strength: 20 MPa minimum at 28 days.

.3 Additives: fly ash to CAN/CSA A3000.

.2 Chain-link fence fabric: to CAN/CGSB-138.1.

.1 Fabric Type 1, Class A, Style to match existing.

.2 Height of fabric: as indicated.

.3 Posts, braces and rails: to CAN/CGSB-138.2, galvanized steel pipe. Dimensions as indicated.

.4 Top and bottom tension wire: to CAN/CGSB-138.2, single strand, galvanized steel wire.

.5 Tie wire fasteners: steel wire.

.6 Tension bar: to ASTM A653/A653M, 5 x 20 mm minimum galvanized steel.

.7 Gates: to CAN/CGSB-138.4, Type II cold rolled, electric resistance welded; Style 1 single swing, frame, braces and post sizes to Table 1.

.1 Gates fabricated as indicated with electrically welded joints, and hot-dip galvanized after welding. Gate frames: to ASTM A53/A53M, standard weight, 45 mm outside diameter pipe for outside frame, 35 mm outside diameter pipe for interior bracing.

.2 Fasten fence fabric to gate with twisted selvage at top.

.3 Furnish swing gates with galvanized malleable iron hinges, latch and latch catch with provision for padlock which can be attached and operated from either side of installed gate.

.4 Furnish double swing gates with chain hook to hold gates open and centre rest with foot bolt for closed position.

.5 Single swing gate lock: 7A5 electro-mechanical model, keyed from both sides.

.6 Rollers: factory-lubricated, permanently sealed bearings, adjustable on shaft with locking set screw.

.8 Organic zinc rich coating: to CAN/CGSB-1.181, MPI #18.

2.2 FINISHES

.1 Galvanizing:

.1 For chain link fabric: to CAN/CGSB-138.1 Grade 2.

.2 For pipe: 550 g/m^2 minimum to ASTM A90.

.3 For other fittings: to ASTM A123/A123M, minimum Coating Grade 85, minimum 600 g/m^2.

Part 3 EXECUTION

3.1 EXAMINATION

.1 Verification of Conditions: verify conditions of substrate previously installed under other Sections or Contracts are acceptable for fence and gate 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 PREPARATION

.1 Grading: Remove debris and correct ground undulations along fence line to obtain smooth uniform gradient between posts.

.1 Provide clearance between bottom of fence and ground surface of centre of bottom rail and ground of 50 mm.

3.3 ERECTION OF FENCE

.1 Erect fence along lines as indicated and to CAN/CGSB-138.3.

.2 Excavate post holes to dimensions and depth indicated.

.3 Space line posts maximum 3 m apart, measured parallel to ground surface.

.1 Space straining posts at equal intervals not to exceed 150 m if distance between end or corner posts on straight continuous lengths of fence over reasonably smooth grade, is greater than 150 m.

.1 Install additional straining posts at sharp changes in grade and where directed by Departmental Representative.

.2 Install corner post where change in alignment exceeds 10 degrees.

.3 Install end posts at end of fence and at buildings.

.1 Install gate posts on both sides of gate openings.

.4 Place concrete in post holes then embed posts into concrete to depths indicated.

.1 Extend concrete 50 mm above ground level and slope to drain away from posts.

.2 Brace to hold posts in plumb position and true to alignment and elevation until concrete has set.

.5 Install fence fabric after concrete has cured, minimum of 5 days.

.6 Install brace between end and gate posts and nearest line post, placed in centre of panel and parallel to ground surface.

.1 Install braces on both sides of corner and straining posts in similar manner.

.7 Install overhang tops and caps.

.8 Install top and bottom rail between posts and fasten securely to posts with waterproof caps.

.9 Lay out fence fabric. Stretch tightly to tension recommended by manufacturer and fasten to end, corner, gate and straining posts with tension bar secured to post with tension bar bands spaced at 300 mm intervals.

.1 Knuckled selvedge at bottom.

.2 Twisted selvedge at top.

.10 Secure fabric to top rails, line posts and bottom rail with tie wires at 450 mm intervals. Give tie wires minimum two twists.

.11 Install grounding rods as indicated.

3.4 INSTALLATION OF GATES

.1 Install gates in locations as indicated.

.2 Level ground between gate posts and set gate bottom approximately 40 mm above ground surface.

.3 Determine position of centre gate rest for double gate.

.1 Cast gate rest in concrete as directed.

.2 Dome concrete above ground level to shed water.

.4 Install gate stops where indicated.

3.5 TOUCH UP

.1 Clean damaged surfaces with wire brush removing loose and cracked coatings. Apply two coats of organic zinc-rich paint to damaged areas as indicated.

.1 Pre-treat damaged surfaces according to manufacturers' instructions for zinc-rich paint.

3.6 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11.

.1 Clean and trim areas disturbed by operations. Dispose of surplus excavated material and replace damaged sod.

.3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 20.

.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 Agriculture and Agri-Food Canada

.1 The Canadian System of Soil Classification, Third Edition, 1998.

.2 U.S. Environmental Protection Agency (EPA) / Office of Water

.1 EPA 833-R-06-004, May 2007, Developing Your Stormwater Pollution Prevention Plan - A Guide for Construction Sites.

.3 Canadian Nursery Landscape Association (CNLA)

.1 Canadian Standards for Nursery Stock, 8th Edition, 2006.

.4 Ontario Provincial Standard Specification (OPSS)

.1 OPSS 802 (November 2010) Construction Specification for Topsoil

1.2 DEFINITIONS

.1 Compost:

.1 Mixture of soil and decomposing organic matter used as fertilizer, mulch, or soil conditioner.

.2 Compost is processed organic matter containing 40% or more organic matter as determined by Walkley-Black or Loss On Ignition (LOI) test.

.3 Product must be sufficiently decomposed (i.e. stable) so that any further decomposition does not adversely affect plant growth (C:N ratio below 25), and contain no toxic or growth inhibiting contaminates.

.4 Composed bio-solids to: CCME Guidelines for Compost Quality.

1.3 SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00.

.2 Quality control submittals:

.1 Soil testing: submit certified test reports showing compliance with specified performance characteristics and physical properties as described in PART 2 - SOURCE QUALITY CONTROL.

.2 Certificates: submit product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

1.4 WASTE MANAGEMENT AND DISPOSAL

.1 Separate waste materials for reuse and recycling in accordance with Section 01 74 20.

.2 Divert unused soil amendments from landfill to official hazardous material collections site approved by Departmental Representative.

.3 Do not dispose of unused soil amendments into sewer systems, into lakes, streams, onto ground or in locations where it will pose health or environmental hazard.

Part 2 PRODUCTS

2.1 TOPSOIL

.1 Topsoil to conform to OPSS 802

- .1 Contain no toxic elements or growth inhibiting materials.
- .2 Finished surface free from:
  - .1 Debris and stones over 50 mm diameter.
  - .2 Course vegetative material, 10 mm diameter and 100 mm length, occupying more than 2% of soil volume.
- .3 Consistence: friable when moist.

2.2 SOIL AMENDMENTS

.1 Fertilizer:

- .1 Fertility: major soil nutrients present in following amounts:
- .2 Nitrogen (N): 20 to 40 micrograms of available N per gram of topsoil.
- .3 Phosphorus (P): 40 to 50 micrograms of phosphate per gram of topsoil.
- .4 Potassium (K): 75 to 110 micrograms of potassium per gram of topsoil.
- .5 Calcium, magnesium, sulfur and micro-nutrients present in balanced ratios to support germination and/or establishment of intended vegetation.
- .6 Ph value: 6.5 to 8.0.

.2 Peatmoss:

- .1 Derived from partially decomposed species of Sphagnum Mosses.
- .2 Elastic and homogeneous, brown in colour.
- .3 Free of wood and deleterious material which could prohibit growth.
- .4 Shredded particle minimum size: 5 mm.

.3 Sand: washed coarse silica sand, medium to course textured.

.4 Organic matter: compost Category A in accordance with CCME PN1340, unprocessed organic matter, such as rotted manure, hay, straw, bark residue or sawdust, meeting the organic matter, stability and contaminant requirements.

.5 Use composts meeting Category B requirements for land fill reclamation and large scale industrial applications.

.6 Limestone:

- .1 Ground agricultural limestone.
- .2 Gradation requirements: percentage passing by weight, 90% passing 1.0 mm sieve, 50% passing 0.125 mm sieve.

.7 Fertilizer: industry accepted standard medium containing nitrogen, phosphorous, potassium and other micro-nutrients suitable to specific plant species or application or defined by soil test.

2.3 SOURCE QUALITY CONTROL

.1 Advise Departmental Representative of sources of topsoil to be utilized with sufficient lead time for testing.

.2 Contractor is responsible for amendments to supply topsoil as specified.

.3 Soil testing by recognized testing facility for PH, P and K, and organic matter.

.4 Testing of topsoil will be carried out by testing laboratory designated by Departmental Representative.

.1 Soil sampling, testing and analysis to be in accordance with Provincial standards.

Part 3 EXECUTION

3.1 PREPARATION OF EXISTING GRADE

.1 Verify that grades are correct.

.1 If discrepancies occur, notify Departmental Representative and do not commence work until instructed by Departmental Representative.

.2 Grade soil, eliminating uneven areas and low spots, ensuring positive drainage.

.3 Remove debris, roots, branches, stones in excess of 50 mm diameter and other deleterious materials.

.1 Remove soil contaminated with calcium chloride, toxic materials and petroleum products.

.2 Remove debris which protrudes above surface.

.3 Dispose of removed material off site.

3.2 PLACING AND SPREADING OF TOPSOIL/PLANTING SOIL

.1 Place topsoil after Departmental Representative has accepted subgrade.

.2 Spread topsoil in uniform layers not exceeding 150 mm.

.3 For sodded areas keep topsoil 15 mm below finished grade.

.4 Spread topsoil to following minimum depths after settlement.

.1 100 mm for seeded areas.

.2 100 mm for sodded areas.

.5 Manually spread topsoil/planting soil around trees, shrubs and obstacles.

3.3 SOIL AMENDMENTS

.1 Commercial processing and thorough mixing of the growing medium components shall be done thoroughly by a mechanized screening process. No hand mixing shall occur. The resulting product shall be homogeneous mixture having the required properties throughout. Product shall not be stored for excessive periods if a fertilizer component has been mixed.

.2 Contaminations of components or finished media shall be avoided by keeping amendments in closed bags or by covering outdoor piles.

.3 Mixes containing a significant amount of peat moss shall not be permitted to dry out. The moisture content of the peat moss at the time of mixing shall not be less than 60% to 75%.

.4 Growing medium shall be moist (25% to 75% of field capacity) but not wet, muddy or frozen when placed.

3.4 FINISH GRADING

.1 Grade to eliminate rough spots and low areas and ensure positive drainage.

.1 Prepare loose friable bed by means of cultivation and subsequent raking.

.2 Consolidate topsoil to required bulk density using equipment approved by Departmental Representative.

.1 Leave surfaces smooth, uniform and firm against deep footprinting.

3.5 ACCEPTANCE

.1 Departmental Representative will inspect and test topsoil in place and determine acceptance of material, depth of topsoil and finish grading.

3.6 CLEANING

.1 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

END OF SECTION

Part 1 GENERAL

1.1 RELATED SECTIONS

.1 32 91 19.13 Topsoil Placement and Grading

1.2 REFERENCES

.1 Ontario Provincial Standard Specification (OPSS)

.1 OPSS 803 (November 2010) Construction Specification for Sodding.

1.3 ADMINISTRATIVE REQUIREMENTS

.1 Scheduling:

.1 Schedule sod laying to coincide with preparation of soil surface.

.2 Schedule sod installation when frost is not present in ground.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00.

.2 Product Data:

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

.3 Certificates: submit product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements of seed mix, seed purity, and sod quality.

.4 Test Reports: submit certified test reports showing compliance with specified performance characteristics and physical properties of seed mix, seed purity, and sod quality.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 and with manufacturer's written instructions.

Part 2 PRODUCTS

2.1 MATERIALS

.1 Number One Turf Grass Nursery Sod: sod that has been especially sown and cultivated in nursery fields as turf grass crop.

.1 Turf Grass Nursery Sod types:

.1 Number One Kentucky Bluegrass Sod: Nursery Sod grown solely from seed of cultivars of Kentucky Bluegrass, containing not less than 50% Kentucky Bluegrass cultivars.

2.2 SOURCE QUALITY CONTROL

.1 Obtain written approval from Departmental Representative of sod at source.

.2 When proposed source of sod is approved, use no other source without written authorization from Departmental Representative.

Part 3 EXECUTION

3.1 PREPARATION

.1 Verify that grades are correct and prepared in accordance with Section 32 91 19.13. If discrepancies occur, notify Departmental Representative and commence work when instructed by Departmental Representative.

.2 Do not perform work under adverse field conditions such as frozen soil, excessively wet soil or soil covered with snow, ice, or standing water.

.3 Fine grade surface free of humps and hollows to smooth, even grade, surface to drain naturally.

.4 Remove and dispose of weeds; debris; stones; soil contaminated by oil, gasoline and other deleterious materials; in accordance with Section 01 74 20.

3.2 SOD PLACEMENT

.1 Ensure sod placement is done under supervision of certified Landscape Planting Supervisor.

.2 Lay sod within 24 hours of being lifted if air temperature exceeds 20 degrees C.

.3 Lay sod sections in rows, joints staggered. Butt sections closely without overlapping or leaving gaps between sections. Cut out irregular or thin sections with sharp implements.

.4 Roll sod as directed by Departmental Representative. Provide close contact between sod and soil by light rolling. Use of heavy roller to correct irregularities in grade is not permitted.

3.3 SOD PLACEMENT ON SLOPES AND PEGGING

.1 Install and secure geotextile fabric in areas indicated, in accordance with manufacturer's instructions.

.2 Start laying sod at bottom of slopes.

3.4 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11.

.1 Leave Work area clean at end of each day.

.2 Keep pavement and area adjacent to site clean and free from mud, dirt, and debris at all times.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11.

.1 Clean and reinstate areas affected by Work.

3.5 PROTECTION BARRIERS

.1 Protect newly sodded areas from deterioration as directed by Departmental Representative.

.2 Remove protection as directed by Departmental Representative.

3.6 MAINTENANCE DURING ESTABLISHMENT PERIOD

.1 Perform following operations from time of installation until acceptance.

.1 Water sodded areas in sufficient quantities and at frequency required to maintain optimum soil moisture condition to depth of 75 to 100 mm.

.2 Cut grass to 50 mm when or prior to it reaching height of 75 mm.

.3 Maintain sodded areas weed free.

.4 Temporary barriers or signage to be maintained where required to protect newly established sod.

3.7 ACCEPTANCE

.1 Turf Grass Nursery Sod areas will be accepted by Departmental Representative provided that:

.1 Sodded areas are properly established.

.2 Sod is free of bare and dead spots.

.3 Sodded areas have been cut minimum 2 times prior to acceptance.

.2 Areas sodded in fall will be accepted in following spring one month after start of growing season provided acceptance conditions are fulfilled.

.3 When environmental conditions allow, all sodded areas showing shrinkage cracks shall be top-dressed and seeded with a seed mix matching the original.

3.8 MAINTENANCE DURING WARRANTY PERIOD

.1 Perform following operations from time of acceptance until end of warranty period:

.1 Water sodded areas at weekly intervals to obtain optimum soil moisture conditions to depth of 100 mm.

.2 Repair and resod dead or bare spots to satisfaction of Departmental Representative.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section includes:

.1 Materials and installation for plant material, accessories, mulch, planting, tree support, mulching and maintenance.

1.2 REFERENCES

.1 Agriculture and Agri-Food Canada (AAFC).

.1 Plant Hardiness Zones in Canada-2000.

.2 Canada Green Building Council (CaGBC)

.1 LEED Canada-NC 2009, LEED (Leadership in Energy and Environmental Design): Green Building Rating System Reference Package For New Construction and Major Renovations (including Addenda).

.3 Canadian Nursery Landscape Association (CNLA).

.1 Canadian Standards for Nursery Stock 8th Edition.

1.3 DEFINITIONS

.1 Mycorrhiza: association between fungus and roots of plants. This symbiosis, enhances plant establishment in newly landscaped and imported soils.

1.4 SUBMITTALS

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

.2 Submit product data for:

.1 Fertilizer.

.2 Mycorrhiza.

.3 Anti-desiccant.

.4 Guying assembly including clamps, collar, guying wire, anchors and wire tightener.

.5 Mulch.

.3 Submit samples for:

.1 Mulch.

.2 Mycorrhiza.

.4 Sustainable Design Submittals:

.1 LEED Canada-NC Submittals: in accordance with Section 01 35 21.

.2 Erosion and Sedimentation Control: submit copy of erosion and sedimentation control plan in accordance with EPA 832/R-92-2005 and Section 01 35 21 - LEED Requirements.

.3 Construction Waste Management:

.1 Submit project Waste Management Plan highlighting recycling and salvage requirements.

.2 Submit calculations on end-of-project recycling rates, salvage rates, and landfill rates demonstrating that 75% of construction wastes were recycled or salvaged.

.4 Regional Materials: submit evidence that project incorporates required percentage 20% of regional materials and products, showing their cost, distance from project to furthest site of extraction or manufacture, and total cost of materials for project.

.5

1.5 SOURCE QUALITY CONTROL

.1 Supply and deliver Products such as fertilizer and mulches, in standard containers clearly indicating contents, weight, analysis and name of manufacturer. If products are supplied in bulk, submit written statements indicating above information.

.2 Make all material available for inspection at source of supply and notify Departmental Representative at least seven days in advance of shipment. No work in this section is to proceed without approval.

.3 Acceptance of plant material at its source does not prevent rejection on site prior to or after planting operations.

.4 Plant Material: True to genus, species and variety having normal growth habit; structurally sound, well branched, healthy densely foliated when in leaf and with healthy and well developed root system.

.5 Supply and deliver Products such as fertilizer and mulches, in standard containers clearly indicating contents, weight, analysis and name of manufacturer. If products are supplied in bulk, submit written statements indicating above information.

.6 Imported plant material must be accompanied with necessary permits and import licenses. Conform to federal and provincial regulations. Submit inspection certificates as required from Federal, provincial and/or other regulatory agency.

.7 Do not substitute plants without written submitted proof that specified plants or sizes are unobtainable.

.8 Do not remove labels from plants until plants have been inspected and approved by the Departmental Representative.

.9 Conform to Horticultural standards of the Canadian Nursery Trades Association with respect to grading and quality. Supply in accordance to the plant list.

.10 Coordinate shipping of plants and excavation of holes to ensure minimum time laps between digging and planting.

1.6 STORAGE AND PROTECTION

.1 Protect plant material from frost, excessive heat, wind and sun during delivery.

.2 Immediately store and protect plant material that will not be installed within 1 hour after arrival at site in storage location approved by Departmental Representative.

.3 Protect plant material from damage during transportation:

.1 When delivery distance is less than 30 km and vehicle travels at speeds under 80 km/h, tie tarpaulins around plants or over vehicle box.

.2 When delivery distance exceeds 30 km or vehicle travels at speeds over 80 km/h, use enclosed vehicle where practical.

.3 Protect foliage and root balls using anti-desiccants and tarpaulins, where use of enclosed vehicle is impractical due to size and weight of plant material.

.4 Protect stored plant material from frost, wind and sun and as follows:

.1 For bare root plant material, preserve moisture around roots by heeling-in or burying roots in sand or topsoil and watering to full depth of root zone.

.2 For pots and containers, maintain moisture level in containers.

.3 For balled and burlapped and wire basket root balls, place to protect branches from damage. Maintain moisture level in root zones.

.4 For aquatic plants, keep plants moist and do not allow to dry out between time of delivery to site and installation.

.5 Store and manage hazardous materials in accordance with Section 01 45 16.19 – Site Quality Control Procedures: Waste Management During Construction.

.6 Waste Management and Disposal:

.1 Separate waste materials for reuse and/or recycling.

.2 Remove from site and dispose of packaging materials at appropriate recycling facilities.

.3 Collect and separate for disposal: paper, plastic, polystyrene and corrugated cardboard packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan (WMP).

.4 Separate for reuse and/or recycling and place in designated containers for Steel, Metal, Plastic waste in accordance with Waste Management Plan.

.5 Place materials defined as hazardous or toxic in designated containers.

.6 Handle and dispose of hazardous materials in accordance with National, Provincial, Regional and Municipal regulations.

.7 Divert unused metal materials from landfill to metal recycling facility as approved by Departmental Representative.

.8 Fold up metal and plastic banding, flatten and place in designated area for recycling.

.9 Divert discarded plastic plant containers materials from landfill to plastic recycling facility approved by Departmental Representative.

.10 Dispose of unused fertilizer at official hazardous material collection site approved by Departmental Representative.

.11 Dispose of unused anti-desiccant at official hazardous material collections site approved by Departmental Representative.

.12 Divert unused wood and mulch materials from landfill to appropriate recycling or composting facility as approved by Departmental Representative.

1.7 SCHEDULING

.1 Obtain approval from Departmental Representative of schedule 7 days in advance of shipment of plant material.

.2 Schedule to include:

.1 Quantity and type of plant material.

.2 Shipping dates.

.3 Arrival dates on site.

.4 Planting Dates.

1.8 MAINTENANCE PERIOD

.1 Commence landscape maintenance immediately following installation of plant material.

.2 The Contractor to be responsible for the scheduled maintenance of plant, shrub, sod, and seed areas from the date of planting installation until Departmental Representative has fully occupied the facility.

.3 Perform maintenance work during regular working hours of 07:00 to 18:00, Monday to Friday.

1.9 WARRANTY

.1 For plant material plant material the 12 months warranty period is extended to 24 months.

.2 Contractor hereby warrants that plant material will remain free of defects in accordance with General Conditions GC 12.3, but for 1 full growing season, providing adequate maintenance has been provided.

.3 End-of-warranty inspection will be conducted by Departmental Representative.

.4 Departmental Representative reserves the right to extend Contractor's warranty responsibilities for an additional one year if, at end of initial warranty period, leaf development and growth is not sufficient to ensure future survival.

Part 2 Products

2.1 PLANT MATERIAL

.1 Type of root preparation, sizing, grading and quality: comply to Canadian Standards for Nursery Stock.

.1 Plant material must be planted in zone indicated as appropriate for its species.

.2 Plant material in location appropriate for its species.

.2 Plant material: Refer to Planting plan for quantities and material

.3 Sound, healthy, vigorous, well branched and densely foliated when in leaf, free of disease, insects, defects or injuries and structurally sound with strong, well developed fibrous root system.

.4 Freshly dug and in healthy condition at arrival on site. Heeled in plants or plants from cold storage will not be accepted. Whenever possible supply plants from the same hardiness zone and having the same soil characteristics as area of site.

.5 Conform to measurements specified in plant list, except that plant lists larger than specified may be used if acceptable to the Departmental Representative without increase in Contract Price. If larger plants are accepted increase ball of earth in proportion to size of plant.

.6 Stems: free of sunscalds, frost cracks, abrasions, fire and crust, with old injuries completely calloused over. Pruning wounds: showing vigorous bark on edges and parts with live, green cambium tissue.

.7 Trees: with straight trunks, well and characteristically branched for species except where specified otherwise.

.8 Trees larger than 200 mm in calliper: half root pruned during each of two successive growing seasons, the latter at least one growing season prior to arrival on site.

.9 Bare root stock: nursery grown, in dormant stage, not balled and burlapped or container grown.

.10 Collected stock: maximum 40 mm in calliper, with well developed crowns and characteristically branched; no more than 40% of overall height may be free of branches.

.11 Material - Should the Contractor proceed to use material that is not shown on the approved planting plan and plant list, the Departmental Representative shall proceed to have such works corrected at the Contractor's expense.

2.2 TOPSOIL

.1 Fertile, friable natural loam containing 4% minimum organic matter; acidity range from pH 6.0 to 7.5 and capable of sustaining vigorous plant growth; free of admixture of subsoil, lumps, stones and roots over 25mm diameter and other extraneous matter and reasonably free of weeds, weed seeds and rhizomes.

2.3 PEAT

.1 Partially decomposed fibrous or cellular stems and leaves of Sphagnum Mosses with texture verying from porous to spongy fibrous with pH value ranging from 4.5 to 6.0 baled and free of decomposed colloidal residue, wood, sulphur and iron, brown in colour, finely shredded with particles 6mm maximum in size.

.2 Peat, supplied in bulk, is not permitted unless acceptable to Departmental Representative upon submission of sample and location of source and supply.

2.4 BONEMEAL

.1 Commercial, raw bonemeal, finely ground and with minimum analysis of 2% nitrogen and 11% phosphoric acid

2.5 LIME

.1 Where pH of topsoil is less that 6.0, 8% minimum of calcium and magnesium carbonates combined, finely ground to pass #10 mesh sieve. Rate of application: Selected after determining pH of topsoil

2.6 WATER

.1 Free of impurities that would inhibit plant growth.

2.7 WRAPPING MATERIAL

.1 First quality burlap or heavy-duty waterproof crepe paper.

2.8 WIRE TIGHTENER

.1 Type 1: galvanized steel, stamped plate type, rod, triangular in shape.

.2 Type 2: turnbuckle, galvanized steel, 9.5 mm diameter with 270 mm open length.

2.9 GUYING WIRE

.1 Type 1: steel, 3 mm wire.

.2 Type 2: 1.5 mm diameter multi-wire steel cable.

.3 Type 3: 3 mm diameter multi-wire steel cable.

.4 Tree Straps to be soft polymer webbing, capable of breathing, not damaging or bruising young trees and available in 12 or 14 gauge

2.10 CLAMPS

.1 U-bolt: galvanized, 13 mm diameter, c/w curved retaining bar and hex nuts.

.2 Crimp type.

2.11 ANCHORS

.1 Metal T bars, 38 x 38 x 5mm, painted black

or

.2 Wood:

.1 Type 1: 38 x 38 x 460 mm.

.2 Type 2: 38 x 67 x 600 mm.

.3 Drive-in type.

.1 Type 1: 13 mm diameter x 75 mm long, aluminum.

.2 Type 2: 18 mm diameter x 120 mm long, aluminum.

.4 Screw-in type:

.1 Type 1: 100 mm diameter steel disc.

2.12 GUYING COLLAR

.1 Tube: plastic, 13 mm diameter, nylon reinforced.

.2 Coco rope, belting or tree straps in order to secure the tree firmly to the stakes.

2.13 TRUNK PROTECTION

.1 Plastic: perforated spiralled strip.

.2 Burlap: clean, minimum 2.5 kg/m2 mass and 150 mm wide, and twine fastener.

2.14 MULCH

.1 Trees and Shrub Beds – shredded pine mulch (SPM) or shredded well-decayed compost with oak leaf content not greater than 30% or Seasoned Pine or Black Beauty Mulch.

.2 Wood Chip mulch collected from tree removal operation – EXCLUDING placement in areas near walkways.

.3 Groundcover and Perennials Area – Shredded Compost.

.4 All mulch as supplied by Gro-Bark Ont. Ltd., P.O. Box 453, Waterloo, N2J 4A0, (519) 885-3411 or Grower's Choice Kitchener, (519) 896-9459 or All Treat Farms, (519) 848-3145.

2.15 FERTILIZER

.1 Complete commercial fertilizer, 50% of the elements of which shall be derived from organic sources, and containing no less than 60% urea-formaldehyde with percentages by weight of nitrogen, phosphoric acid and potash required to make up chemical deficiencies of soil and as required by plant growth.

.2 Incorporate finely ground commercial superphosphate with a minimum analysis of 20% phosphorous (v) oxide.

.3 Slow release fertilizers are to be used in case of late fall plantings.

2.16 ANTI-DESICCANT

.1 Wax-like emulsion permeable enough to permit transpiration and delivered, missed and applied in accordance with manufacturer's recommendations.

2.17 FLAGGING TAPE

.1 Fluorescent, red/orange colour.

2.18 SOURCE QUALITY CONTROL

.1 Obtain approval from Departmental Representative of plant material prior to planting.

.2 Imported plant material must be accompanied with necessary permits and import licenses. Conform to Federal, Provincial or Territorial regulations

Part 3 Execution

3.1 PRE-PLANTING PREPARATION

.1 Do construction occupational health and safety in accordance with Section 01 35 20 Site Safety Requirements.

.2 Ensure plant material acceptable to Departmental Representative.

.3 Remove damaged roots and branches from plant material.

.4 Apply anti-desiccant to conifers and deciduous trees in leaf in accordance with manufacturer's instructions.

.5 Before excavating, ascertain location of electrical cables, conduits, utility lines, supply lines and sub-surface drainage. If such items are uncovered or if subsurface debris is uncovered, notify Departmental Representative and obtain instructions before relocating plant material or moving obstructions.

.6 Within the Area of Concern for ALHB (Asian Long Horned Beatle), the Contractor shall provide the following information to the Contract Administrator a minimum of two weeks prior to commencement of the work:

.1 The Name, Address and Location of the Nursery that will be supplying plant materials for the contract.

.2 Written confirmation that the Contractor has notified the Area Office of the Canadian Food Inspection Agency (CFIA) about the proposed host tree removals and a description of CFIA's response and any action taken.

3.2 EXCAVATION AND PREPARATION OF PLANTING BEDS

.1 Establishment of sub-grade for planting beds is specified in Section 31 22 13 - Rough Grading.

.2 Preparation of planting beds is specified in Section 32 91 21 - Topsoil Placement and Finish Grading.

.3 For individual planting holes:

.1 Stake out location and obtain approval from Departmental Representative prior to excavating.

.2 Excavate to depth and width as indicated.

.3 Remove subsoil, rocks, roots, debris and toxic material from excavated material that will be used as planting soil for trees and individual shrubs. Dispose of excess material off site.

.4 Scarify sides of planting hole.

.5 Remove water which enters excavations prior to planting. Notify Departmental Representative if water source is ground water.

.6 Backfill planting beds and tree pits with soil mixture consisting of 4 parts topsoil to one part peat.

.7 Add bonemeal to soil at rate of 0.6 kg/m3.

.8 Mix topsoil soil mixture, peat moss and other additives thoroughly on site 2 days maximum before backfilling.

.9 Do not mix or backfill when topsoil is in muddy or frozen condition.

.10 Backfill to height above finished grade sufficient to allow for normal, natural settlement.

.11 Finish grade, after settlement: As shown on Contract Documents

.12 Tamp each layer firmly before placing subsequent layers to ensure the absence of air pockets.

3.3 PLANTING

.1 For bare root stock, place 50 mm backfill soil in bottom of hole. Plant trees and shrubs with roots placed straight out in hole.

.2 For jute burlapped root balls, cut away top one third of wrapping and wire basket without damaging root ball. Do not pull burlap or rope from under root ball.

.3 For container stock or root balls in non-degradable wrapping, remove entire container or wrapping without damaging root ball.

.4 Plant vertically in locations as indicated. Orient plant material to give best appearance in relation to structure, roads and walks.

.5 For trees and shrubs:

.1 Backfill soil in 150 mm lifts. Tamp each lift to eliminate air pockets. When two thirds of depth of planting pit has been backfilled, fill remaining space with water. After water has penetrated into soil, backfill to finish grade.

.2 Form watering saucer as indicated.

.6 For ground covers, backfill soil evenly to finish grade and tamp to eliminate air pockets.

.7 Water plant material thoroughly.

.8 After soil settlement has occurred, fill with soil to finish grade.

.9 Dispose of burlap, wire and container material off site.

3.4 TRUNK PROTECTION

.1 Install trunk protection on deciduous trees as indicated.

.2 Install trunk protection prior to installation of tree supports when used

3.5 TREE SUPPORTS

.1 Install tree supports as indicated.

.2 Use single stake tree support for deciduous trees less than 3 m and evergreens less than 2 m.

.1 Place stake on prevailing wind side and 450 mm from trunk.

.2 Drive stake minimum 150 mm into undisturbed soil beneath roots. Ensure stake is secure, vertical and unsplit.

.3 Install 150 mm long guying collar 1500 mm above grade.

.4 Coco rope belting or tree straps. Secure guying to support post as per standard tree and nursery practices to ensure tree is supported from prevailing wind. Cut off any excess material.

.3 Use 3 guy wires and anchors for deciduous trees greater than 3 m and evergreens greater than 2 m.

.1 Use Type 2 guying wire with clamps for trees less than 75 mm in diameter and Type 3 guying wire with clamps for trees greater than 75 mm in diameter.

.2 Use Type 1 anchors for trees less than 75 mm in diameter and Type 2 anchors for trees greater than 75 mm in diameter.

.3 Install guying collars above branch to prevent slipping at approximately 2/3 height for evergreens and 1/2 height for deciduous trees. Collar mounting height is not to exceed 2.5 m above grade.

.4 Guying collars to be of sufficient length to encircle tree plus 50 mm space for trunk clearance. Thread guy wire through collar encircling tree trunk and secure to lead wire by clamp or multi-wraps; cut wire ends close to wrap. Spread lead wires equally proportioned about trunk at 120 degrees.

.5 Install anchors at equal intervals about tree and away from trunk so that guy wire will form 45 degree angle with ground. Install anchor at angle to achieve maximum resistance for guy wire.

.6 Attach guy wire to anchors. Tension wire and secure by installing clamps.

.7 Install wire tightener ensuring that guys are secure and leave room for slight movement of tree.

.8 Saw tops off wooden anchors which extend in excess of 100 mm above grade or as directed by Departmental Representative.

.9 Install flagging tape to guys as indicated.

.4 After tree supports have been installed, remove broken branches with clean, sharp tools.

3.6 MULCHING

.1 Spread Mulch in planting beds and around trees to a minimum depth of 75mm

.2 Groundcover and Perennials Area – Shredded Compost spread to min. 50mm

3.7 MAINTENANCE DURING ESTABLISHMENT PERIOD

.1 Perform following maintenance operations from time of planting to acceptance by Departmental Representative.

.1 Water to maintain soil moisture conditions for optimum establishment, growth and health of plant material without causing erosion.

.2 For evergreen plant material, water thoroughly in late fall prior to freeze-up to saturate soil around root system.

.3 Remove weeds monthly.

.4 Replace or re-spread damaged, missing or disturbed mulch.

.5 For non-mulched areas, cultivate as required to keep top layer of soil friable.

.6 If required to control insects, fungus and disease, use appropriate control methods in accordance with Federal, Provincial and Municipal regulations. Obtain product approval from Departmental Representative prior to application.

.7 Remove dead or broken branches from plant material.

.8 Keep trunk protection and guy wires in proper repair and adjustment.

.9 Remove and replace dead plants and plants not in healthy growing condition. Make replacements in same manner as specified for original plantings.

3.8 MAINTENANCE DURING WARRANTY PERIOD

.1 From time of acceptance by Departmental Representative to end of warranty period, perform following maintenance operations.

.1 Water to maintain soil moisture conditions for optimum growth and health of plant material without causing erosion.

.2 Reform damaged watering saucers.

.3 Remove weeds monthly.

.4 Replace or re-spread damaged, missing or disturbed mulch.

.5 For non-mulched areas, cultivate monthly to keep top layer of soil friable.

.6 If required to control insects, fungus and disease, use appropriate control methods in accordance with Federal, Provincial and Municipal regulations. Obtain product approval from Departmental Representative prior to application.

.7 Apply fertilizer in early spring as indicated by soil test.

.8 Remove dead, broken or hazardous branches from plant material.

.9 Keep trunk protection and tree supports in proper repair and adjustment.

.10 Remove trunk protection, tree supports and level watering saucers at end of warranty period.

.11 Remove and replace dead plants and plants not in healthy growing condition. Make replacements in same manner as specified for original plantings.

.12 The Contractor shall not be responsible for the cost of replacements resulting from theft, vandalism, carelessness or neglect on the part of others or any other causes due to circumstances beyond his control.

.13 Submit monthly written reports to Departmental Representative identifying:

.1 Maintenance work carried out.

.2 Development and condition of plant material.

.3 Preventative or corrective measures required which are outside Contractor's responsibility.

3.9 VERIFICATION

.1 Contractor's Verification, include:

.1 Materials and resources.

.2 Storage and collection of recyclables.

.3 Construction waste management.

.4 Local/regional materials.

END OF SECTION

Part 1 GENERAL

1.1 REFERENCES

.1 ASTM International

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

.2 ASTM A123/A123M-2012, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

.3 ASTM C117-13, Standard Test Method for Materials Finer than 75-mm (No. 200) Sieve in Mineral Aggregates by Washing.

.4 ASTM C136-06, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.

.5 ASTM C139-11, Standard Specification for Concrete Masonry Units for Construction of Catch Basins and Manholes.

.6 ASTM C478M-13, Standard Specification for Precast Reinforced Concrete Manhole Sections (Metric).

.7 ASTM D698-12, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3 (600 kN-m/m^3)).

.2 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-8.1-88, Sieves, Testing, Woven Wire, Inch Series.

.2 CAN/CGSB-8.2-M88, Sieves, Testing, Woven Wire, Metric.

.3 CSA Group

.1 CSA A23.1-14/A23.2-14, Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete.

.2 CSA A165 Series-14, CSA Standards on Concrete Masonry Units (Consists of A165.1, A165.2 and A165.3).

.3 CAN/CSA-A3000-13, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).

.4 CSA G30.18-09, Carbon Steel Bars for Concrete Reinforcement.

.4 Ontario Provincial Standard Specifications (OPSS)

.1 OPSS 407, Construction Specification For Maintenance Hole, Catch Basin, Ditch Inlet And Valve Chamber Installation.

.2 OPSS 401, Trenching Backfilling and Compaction.

.3 OPSS 1850, Frames, Grates, Covers, and Gratings.

.5 City Of Windsor Design Guidelines (latest edition).

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Shop Drawings: Indicate maintenance hole locations, sizes, ladder rungs, sections, benching, riser sections, elevations as well as all incoming and outgoing pipe sizes, elevations and alignments.

.2 Product Data: Provide maintenance hole covers, component construction, features, configuration and dimensions.

1.3 QUALIFICATIONS

.1 Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

1.4 ENVIRONMENTAL REQUIREMENTS

.1 Maintain hole materials and surrounding air temperature to minimum 10 degrees C prior to, during, and 48 hours after completion of masonry work.

.2 Cold Weather Requirements: IMIAC Recommended Practices and Specifications for Cold Weather Masonry Construction.

1.5 DELIVERY, STORAGE AND HANDLING

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

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

.3 Storage and Handling Requirements:

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

.2 Store and protect maintenance holes and catch basin structures from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

1.6 MATERIAL CERTIFICATES

.1 Submit manufacturer’s test data and certification at least 4 weeks prior to commencing work.

.2 Certification to be marked on structures.

Part 2 PRODUCTS

2.1 MATERIALS

.1 Concrete Reinforcement: new billet steel, deformed bars, to CAN/CSA G30.18_M, Grade 400 R, unless indicated otherwise.

.2 Precast maintenances holes to be 1200mm diameter with aluminum steps at 300mm centres as per OPSD 701.010 with no sumps unless otherwise noted and follow OPSS 407 /ASTM C478M.

.3 Joints: To be made watertight using rubber gasket rings.

.4 Core’nSeal maintenance hole adapter assemblies or approved equivalent shall be used for all PVC pipes entering the maintenance hole so the structure is watertight.

.5 Mortar and Grout: As specified in Section 04 04 05, CSA A179, Type S.

.6 Ladder Rungs: to CAN/CSA – G30.18, 25m size; billet steel deformed bars, hot dipped galvanized to CAN/CSA-G164-m. 20mm / 3/4inch rungs to be safety pattern (Drop Step Type). Refer to standard drawings.

.7 Frames, covers grates and grating to conform to OPSS 1850 unless indicated otherwise.

.8 Maintenance Hole and Catch Basin, Frames, grates, castings, and lids to quality grey iron ASTM A48, Class 30B.

.9 Maintenance hole frames and covers to conform to OPSD 401.010 as noted on the engineering drawings.

.10 Adjusting rings: to ASTM C 478M, OPSD 704.010.

.11 Granular bedding and backfill to conform to the engineering drawings, OPSS 407 and the Departmental Representative's recommendations.

2.2 CONCRETE WORK

.1 Do concrete work in accordance with CSA A23.1

.2 Place concrete reinforcement in accordance with CSA A23.1

Part 3 EXECUTION

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for maintenance holes and catch basin structures installation in accordance with manufacturer's written instructions.

.1 Verify items provided by other sections of Work are properly sized and located.

.2 Verify that built in items are in proper location, and ready for roughing into Work.

.3 Verify excavation for maintenance hole is correct.

3.2 PREPARATION

.1 Coordinate placement of Work with other Work.

3.3 EXCAVATION AND BACKFILL

.1 Excavate and backfill in accordance with Section 31 23 33.01 and as indicated.

3.4 CONCRETE WORK

.1 Do concrete work in accordance with Section 03 30 00.

.2 Place concrete reinforcement in accordance with Section 03 20 00.

.3 Position metal inserts in accordance with dimensions and details as indicated.

3.5 INSTALLATION

.1 Shall be in conformance with The City of Windsor, the Departmental Representative and OPSS 407.

.2 If required, dewater excavation to approval of Departmental Representative if required; remove soft and foreign material before placing concrete base.

.3 Set precast concrete base on 150mm minimum of granular bedding compacted to 98% (SPMDD).

.4 Place base pad, trowel top surface level.

.5 Place structure sections plumb and level, trim to correct elevations, anchor to base pad.

.6 Cut and fit for pipe as required.

.7 Grout base of shaft sections to achieve slope to exit piping. Trowel smooth. Contour as required.

.8 Set cover frames and covers level without tipping, to correct elevations.

.9 For Precast units:

.1 Set bottom section of precast unit in bed of cement mortar and bond to concrete slab or base.

.2 Make each successive joint watertight with manufacturer's rubber ring gaskets, as related to structures specifications.

.3 Clean surplus mortar and joint compounds from interior surface of unit as work progresses.

.10 Set frame and cover to required elevation on no more than 3 concrete moduloc adjustment units per OPSD 704.010.

.1 Clean collars of debris and foreign materials.

.2 Adhere adjustment collars to frame and grate with mortar.

.3 Parge and make smooth and watertight.

.4 Prevent debris from entering system.

3.6 ADJUSTING TOPS OF EXISTING UNITS

.1 Shall be in conformance with OPSD 704.010.

.2 Remove existing gratings and frames and store for re-use at locations designated by the Departmental Representative.

.3 Sectional units:

.1 Raise or lower straight walled sectional units by adding or removing precast sections as required.

.2 Raise or lower tapered units by removing cone section, adding, removing, or substituting riser sections to obtain required elevation, then replace cone section.

.4 Monolithic units:

.1 Raise monolithic units by roughening existing top to ensure proper bond and extend to required elevation with cast-in-place concrete.

.2 Lower monolithic units with straight wall by removing concrete to elevation indicated for rebuilding.

.5 When monolithic units with tapered upper section are lowered more than 150 mm, remove concrete for entire depth of taper plus as much straight wall as necessary, then rebuild upper section to required elevation with cast-in-place concrete.

.6 Install additional maintenance hole ladder rungs in adjusted portion of units as required.

.7 Re-use existing gratings, frames as directed by the Departmental Representative.

3.7 SEALING OVER EXISTING UNITS

.1 Cut galvanized iron sheet to extend 50 mm beyond opening of existing maintenance hole or catch basin grating.

.1 Center iron sheet over existing grating and spot or stitch weld to grating.

.2 Fill with cast-in-place contractor as directed by the Departmental Representative.

3.8 BACKFILL AND EXCAVATION

.1 Excavate and backfill in accordance with Section 31 23 16, Section 31 23 23, OPSS 407 and as directed by the Departmental Representative.

.2 Obtain approval of Departmental Representative before backfilling around maintenance hole or ditch inlet structures.

3.9 CLEANING

.1 Progress Cleaning: clean to satisfaction of Departmental Representative.

.2 Leave Work area clean at end of each day.

.3 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment as required.

END OF SECTION

Part 1 GENERAL

1.1 REFERENCES

.1 American National Standards Institute/American Water Works Association (ANSI/AWWA)

- .1 ANSI/AWWA C500-09, Standard for Metal-Seated Gate Valves for Water Supply Service.
- .2 ANSI/AWWA C504-10, Standard for Rubber-Seated Butterfly Valves.
- .3 ANSI/AWWA C651-05, Standard for Disinfecting Water Mains.
- .4 ANSI/AWWA C800-05, Standard for Underground Service Line Valves and Fittings.
- .5 ANSI/AWWA C900-07, Standard for Polyvinyl Chloride (PVC) Pressure Pipe, and Fabricated Fittings, 4 Inch through 12 Inch (100 mm - 300 mm), for Water Transmission and Distribution.

.2 ASTM International (ASTM)

- .1 ASTM C117-04, Standard Test Methods for Material Finer Than 0.075 mm (No. 200) Sieve in Mineral Aggregates by Washing.
- .2 ASTM C136-06, Standard Method for Sieve Analysis of Fine and Coarse Aggregates.
- .3 ASTM D698-12, Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3 (600 kN-m/m^3)).

.3 Canadian General Standards Board (CGSB)

- .1 CAN/CGSB-8.2-M88, Sieves, Testing, Woven Wire, Metric.

.4 CSA International (CSA)

- .1 CAN/CSA-B137 Series-09, Thermoplastic Pressure Piping Compendium.
  - .1 CAN/CSA-B137.3-09, Rigid Polyvinyl Chloride (PVC) Pipe for Pressure Applications.

.5 Ontario Building Code

.6 Ontario Provincial Standard Specifications (OPSS)

- .1 OPSS 441, Construction Specification for Watermain Installation in Open Cut
- .2 OPSS 442, Construction Specification for Cathodic Protection of Watermains and Fittings
- .3 OPSS 493, Construction Specification for Temporary Potable Water Supply Services
- .4 OPSS 490, Site Preparation for Pipelines, Utilities, and Associated Structures

.7 City of Windsor

- .1 Design Guidelines And Specifications For The Installation Of Water Mains And Services

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00.

.2 Product Data: Provide data on pipe materials, pipe fittings, valves, chambers and accessories.

.3 Shop Drawings: Provide shop drawings for watermain chambers.

.4 Provide watermain commissioning plan in accordance with the City of Windsor.

1.3 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00.

.2 Manufacturer's Certificate: Certify that products meet or exceed specified requirements. Pipe certification to be on pipe.

.3 Record actual locations of piping mains, valves, connections, thrust restraints, and invert elevations.

.4 Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.4 DELIVERY, STORAGE AND HANDLING

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

1.5 SCHEDULING OF WORK

.1 Schedule Work to minimize interruptions to existing services.

.2 Submit schedule of expected interruptions for approval and adhere to interruption schedule as approved by Departmental Representative.

.3 Notify Departmental Representative minimum of 48 hours in advance of interruption in service.

.4 Notify fire department of planned or accidental interruption of water supply to hydrants.

.5 Advise local police department of anticipated interference with movement of traffic.

Part 2 PRODUCTS

2.1 PIPE, JOINTS AND FITTINGS

.1 Polyvinyl chloride pressure pipe: to ANSI/AWWA C900, pressure class 150, DR 18, gasket bell end, cast iron outside diameter.

.1 Certified to CAN/CSA-B137.3, PVC series 160, 1.1 MPa elastomeric gasket coupling as per City of Windsor Design Guidelines.

.2 Bends, Tees, Reducers and couplings to be Ductile Iron or Polyvinyl Chloride as per City of Windsor Design Guidelines.

2.2 VALVES AND VALVE BOXES

.1 Valves to open clockwise.

.2 Gate valves: to ANSI/AWWA C509, standard iron body valves with non-rising stems, with flanged joints as per City of Windsor Design Guidelines.

.3 Butterfly valves: to ANSI/AWWA C504, with flanged joints as per City of Windsor Design Guidelines.

.4 Cast iron valve boxes: In accordance with OPSS 1850 and as per City of Windsor Design Guidelines

2.3 VALVE CHAMBERS

.1 Precast concrete sections to ASTM C478M. Cast ladder rungs integral with unit; field installation not permitted.

.2 Valve chamber frames and covers: gray iron castings, minimum tensile strength 200 MPa, with two coats, shop applied, approved asphalt coating with a mass of approximately 215 kg per set.

.1 Design and dimensions as indicated.

.2 Cover to be marked "WATER"/"EAU".

.3 Jointing materials:

.1 Manufacturer's rubber ring gaskets.

.2 Mastic joint filler.

.3 Cement mortar.

.4 Mortar:

.1 Aggregate in accordance with Section 04 05 12.

.2 Masonry cement to CAN/CSA-A3000.

.5 Ladder rungs for valve chambers: 20 mm diameter deformed rail steel bars to CSA G30.18, hot-dipped galvanized after fabrication to ASTM A123/A123M. Rungs to be safety pattern.

.6 All chambers to be as per City of Windsor Design Guidelines

2.4 TRACER WIRE

.1 #12 AWG Conductor Solid White as per City of Windsor Design Guidelines.

2.5 CATHODIC PROTECTION

.1 As per City of Windsor Design Guidelines.

.2 All iron fittings shall be CAD welded with a 10.9 Kg (24 lb) anode. All bolts and nuts on mechanical joints shall be capped with a sacrificial zinc nut. When an existing watermain is not cathodically protected, anodes shall be installed wherever the existing watermain or associated services are exposed during the course of other work (e.g. another utility installation or watermain break repair). CAD weld on mains and large D.I. or C.I. service pipes. All restrainers on a pipe that is 400mm (16") or larger shall have a 5.4kg (12 lb) anode CAD welded to each restraint device. Use approved connectors and clamps on service pipes. Denso wrapping shall be applied on pipe or fittings as per manufacturers specifications where shown on drawings.

2.6 PIPE BEDDING AND SURROUND MATERIAL

.1 As per Windsor Utilities Commission Drawing 50.01.01.

.2 The water main pipe shall be laid on this flat bottom trench with a minimum of 100 mm (4 in.) of compacted granular material under the pipe to give the pipe uniform support.

.3 Backfill consisting of coarse sand (granular material) shall be placed in 150 mm (6 in.) layers under and around the underside of the pipe to a minimum of 300 mm (12 in.) above the top of the pipe and shall be thoroughly tamped and consolidated by hand tampers within the pipe zone. The balance of the backfill to the top of the pipe shall be placed in layers not exceeding 100 mm (4 in.) in thickness and thoroughly tamped by power tampers. If the rest of the back fill material is of aggregate size greater than 19mm, then the above coarse sand cover shall extend to a height of 600mm (24") above the pipe.

2.7 BACKFILL MATERIAL

.1 As per Windsor Utilities Commission Drawing 50.01.01.

.2 Where the trench has been excavated in a roadway, it shall be backfilled above the limit of the granular fill for its full depth with granular material to City of Windsor specification or as specified otherwise.

.3 Where the trench has been excavated in boulevards or parkland, the remaining depth of trench shall be backfilled with good clean native material; compacted in 150 mm (6 in.) lifts to 95 per cent Standard Proctor Density and the top 150 mm (6 in.) shall be loam or stone.

2.8 PIPE DISINFECTION

.1 Disinfect water mains in accordance with ANSI/AWWA C651.

.2 All new water mains and services shall be flushed by WUC personnel as per DWQMS approved standard operating procedures. It is the contractors responsibility to provide adequate removal locations for waste water from flushing procedure.

.3 All new watermains and services shall be disinfected by WUC personnel as per DWQMS (SOP-DWQMS-Disinfection of New Watermain) approved procedures.

Part 3 EXECUTION

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for distribution piping 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 PREPARATION

.1 Clean pipes, fittings, valves, hydrants, and appurtenances of accumulated debris and water before installation.

.1 Inspect materials for defects to approval of Departmental Representative.

.2 Remove defective materials from site as directed by Departmental Representative.

3.3 TRENCHING

.1 Do trenching work in accordance with Section 31 23 33.01.

.2 Ensure trench depth allows coverage over pipe of 1.5 m minimum from finished grade as per Windsor Utilities Commission Drawing 50.01.01.

.3 Trench alignment and depth require Departmental Representative's approval prior to placing bedding material and pipe.

3.4 GRANULAR BEDDING

.1 Place granular bedding material in uniform layers not exceeding 150 mm compacted thickness and ensure conformance with Windsor Utilities Commission Drawing 50.01.01.

.2 Do not place material in frozen condition.

.3 Shape bed true to grade to provide continuous uniform bearing surface for pipe.

.4 Shape transverse depressions in bedding as required to suit joints.

.5 Compact each layer full width of bed to 95% S.P.M.D.D.

.6 Backfill in accordance with Section 31 23 33.01.

3.5 PIPE INSTALLATION

.1 Terminate building water service 1 m outside building wall opposite point of connection to main.

.1 Install coupling necessary for connection to building plumbing.

.2 If plumbing is already installed, make connection; otherwise cap or seal end of pipe and place temporary marker to locate pipe end.

.2 Lay pipes to ANSI/AWWA C600 and manufacturer's standard instructions and specifications.

.1 Do not use blocks except as specified.

.3 Join pipes in accordance with ANSI/AWWA C600 and manufacturer's recommendations.

.4 Bevel or taper ends of PVC pipe to match fittings.

.5 Handle pipe by methods approved by Departmental Representative and recommended by pipe manufacturer. Do not use chains or cables passed through pipe bore so that weight of pipe bears on pipe ends.

.6 Lay pipes on prepared bed, true to line and grade.

.1 Ensure barrel of each pipe is in contact with shaped bed throughout its full length.

.2 Take up and replace defective pipe.

.3 Correct pipe which is not in true alignment or grade or pipe which shows differential settlement after installation greater than 10 mm in 3 m.

.7 Face socket ends of pipe in direction of laying. For mains on grade of 2% or greater, face socket ends up-grade.

.8 Do not exceed permissible deflection at joints as recommended by pipe manufacturer.

.9 Keep jointing materials and installed pipe free of dirt and water and other foreign materials.

.1 Whenever work is stopped, install a removable watertight bulkhead at open end of last pipe laid to prevent entry of foreign materials.

.10 Position and join pipes with equipment and methods approved by Departmental Representative.

.11 Cut pipes in approved manner as recommended by pipe manufacturer, without damaging pipe or its coating and to leave smooth end at right angles to axis of pipe.

.12 Align pipes before jointing.

.13 Install gaskets to manufacturer's recommendations. Support pipes with hand slings or crane as required to minimize lateral pressure on gasket and maintain concentricity until gasket is properly positioned.

.14 Avoid displacing gasket or contaminating with dirt or other foreign material.

.1 Remove disturbed or contaminated gaskets.

.2 Clean, lubricate and replace before jointing is attempted again.

.15 Complete each joint before laying next length of pipe.

.16 Minimize deflection after joint has been made.

.17 Apply sufficient pressure in making joints to ensure that joint is completed to manufacturer's recommendations.

.18 Ensure completed joints are restrained by compacting bedding material alongside and over installed pipes or as otherwise approved by Departmental Representative.

.19 When stoppage of work occurs, block pipes in an approved manner to prevent creep during down time.

.20 Recheck plastic pipe joints assembled above ground after placing in trench to ensure that no movement of joint has taken place.

.21 Do not lay pipe on frozen bedding.

.22 Do hydrostatic and leakage test and have results approved by Departmental Representative before surrounding and covering joints and fittings with granular material.

.23 Backfill remainder of trench.

3.6 VALVE INSTALLATION

.1 Install valves to manufacturer's recommendations at locations as indicated.

.2 Support valves located in valve boxes or valve chambers by means of concrete located between valve and solid ground. Maximum length of pipe on each end of valve shall be 1 m. Valves not to be supported by pipe.

3.7 VALVE CHAMBERS

.1 Use precast units as approved by Departmental Representative.

.2 Set bottom section of precast unit in bed of cement mortar and bond to bottom slab.

.1 Make each successive joint watertight with approved rubber ring gaskets, mastic joint filler, cement mortar, or combination thereof.

.3 Clean surplus mortar and joint compounds from interior surface of valve chamber as work progresses.

.4 Plug lifting holes with precast concrete plugs set in cement mortar.

.5 Set frame and cover to required elevation.

.6 Place frame and cover on top section to elevation indicated. If adjustment is required use concrete ring.

.7 Clean valve chambers of debris and foreign materials; remove fins and sharp projections.

3.8 UNDERCROSSING

.1 Dewater excavation and area of undercrossing as required in accordance with the City of Windsor.

.2 Existing sewers, catch basin leads and drains shall be supported as per City of Windsor Specifications, except as noted below.

.3 When the earth has been removed from the top of the pipe, the pipe shall be temporarily suspended from timbers spanning across the trench at ground level to provide adequate support. Suspending cables shall be well tightened to prevent sagging of the pipe. The temporary supports for the pipe shall remain in place until the permanent supports have been completed.

.4 Water or gas mains or Bell cables crossing the trench shall be supported by means of timber placed on top of concrete support similar to the support for sewers, as described above. A 50 mm (2 in.) plank of sufficient width shall be placed under the water or gas main and the concrete support poured to the underside of the wooden plank. Concrete shall be as per City Specification.

.5 Ensure conformance to Windsor Utilities Commission Drawing 50.01.03

3.9 THRUST BLOCKS AND RESTRAINED JOINTS

.1 For thrust blocks: do concrete Work in accordance with City specifications and OPSS 1350.

.2 Concrete to be 20mpa at 28 days, 10mpa as per OBA.

.3 Place concrete thrust blocks between valves, tees, plugs, caps, bends, changes in pipe diameter, reducers, hydrants and fittings and undisturbed ground as indicated or as directed by Departmental Representative.

.4 Keep joints and couplings free of concrete.

.5 Do not backfill over concrete within 24 hours after placing.

.6 The use of restrained joints shall be approved by Departmental Representative. Only WUC approved mechanical restrainers will be allowed. The length of watermain to be restrained shall be as per WUC standard drawings.

3.10 HYDROSTATIC AND LEAKAGE TESTING

.1 Do tests in accordance with ANSI/AWWA C600 and OPSS 441.

.2 All watermains and services three inches and larger shall be pressure tested by WUC only. All new watermains shall be tested at a pressure of 1035 Kpa (150 psi) for 2 hours. The fire mains and the appurtenances in the private property shall be tested at 1380 Kpa (200 psi) for two hours as per NFPA 24. All compression fittings used on the fire line shall be rated for minimum of 200 psi.

.3 Provide labour, equipment and materials required to perform hydrostatic and leakage tests hereinafter described.

.4 Notify Departmental Representative at least 24 hours in advance of proposed tests.

.1 Perform tests in presence of Departmental Representative.

3.11 BACKFILL

.1 As per Windsor Utilities Commission Drawing 50.01.01.

.2 Backfill in accordance with Section 31 23 33.01.

3.12 FLUSHING AND DISINFECTING

.1 Disinfect water mains in accordance with ANSI/AWWA C651.

.2 All new water mains and services shall be flushed by WUC personnel as per DWQMS approved standard operating procedures. It is the contractors responsibility to provide adequate removal locations for waste water from flushing procedure.

.3 All new watermains and services shall be disinfected by WUC personnel as per DWQMS (SOP-DWQMS-Disinfection of New Watermain) approved procedures.

3.13 SURFACE RESTORATION

.1 After installing and backfilling over water mains, restore surface to original condition as directed by Departmental Representative.

3.14 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11.

END OF SECTION

Part 1 GENERAL

1.1 SECTION INCLUDES

.1 Materials and installation for gravity sewers.

1.2 DEFINITIONS

.1 Pipe section is defined as length of pipe between successive manholes and/or between manhole and any other structure which is part of sewer system.

1.3 REFERENCES

.1 ASTM International

.1 ASTM C117-04, Standard Test Method for Material Finer Than 75 MU m (No. 200) Sieve in Mineral Aggregates by Washing.

.2 ASTM C136-06, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.

.3 ASTM D3034-08, Standard Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.

.2 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-8.2-M88, Sieves, Testing, Woven Wire, Metric.

.3 CSA International

.1 CSA B1800-11, Thermoplastic Non-pressure Pipe Compendium.

.1 CSA B182.2-11, PSM Type Polyvinylchloride PVC Sewer Pipe and Fittings.

.4 Ontario Provincial Standard Specifications (OPSS):

.1 OPSS 410, Construction Specification for Pipe Sewer Installation in Open Cut

.2 OPSS 503, Construction Specification for Site Preparation for Pipelines, Utilities and Associated Structures in Open Cut

.3 OPSS 507 – Construction Specification for Site Restoration Following Installation of Pipelines, Utilities and Associated Structures in Open Cut

.4 OPSS 514 – Construction Specification for Trenching, Backfilling and Compaction

.5 OPSS 1004, Material Specification for Aggregates - Miscellaneous.

.6 OPSS 1010, Material Specification for Aggregates - Granular A, B, M and Select Subgrade Material.

.5 U.S. Environmental Protection Agency (EPA) / Office of Water

.1 EPA 832/R-92-005, Storm Water Management for Construction Activities: Developing Pollution Prevention Plans and Best Management Practices.

.6 Department of Justice Canada (Jus)

.1 Canadian Environmental Protection Act, 1999 (CEPA).

.7 Ontario Building Code

.8 Department of Justice Canada (Jus)

.1 Canadian Environmental Protection Act, 1999 (CEPA).

.9 City of Windsor

.1 Development Manual, latest edition.

1.4 SCHEDULING

.1 Schedule Work to minimize interruptions to existing services and maintain existing sewage flows during construction.

.2 Submit schedule of expected interruptions for approval and adhere to approved schedule.

.3 Notify Departmental Representative and building manager 24 hours minimum in advance of any interruption in service.

1.5 ACTION AND INFORMATIONAL SUBMITTALS

.1 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for pipes, and backfill and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Certificates:

.1 Certification to be marked on pipe.

1.6 DELIVERY, STORAGE AND HANDLING

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

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

.3 Storage and Handling Requirements:

.1 Store materials in accordance with manufacturer's recommendations.

.2 Store and protect pipes from damage.

.3 Replace defective or damaged materials with new.

1.7 PLASTIC PIPE

.1 Type PSM Polyvinyl Chloride (PVC): to ASTM D3034, certified to CSA B182.2.

.1 Standard Dimensional Ratio (SDR) for pipes 150mm and smaller: 28.

.2 Standard Dimensional Ratio (SDR) for pipes 200mm and larger: 35.

.3 Locked-in gasket and integral bell system.

.4 Nominal lengths: 4 m.

1.8 CEMENT MORTAR

.1 Portland cement: to CAN/CSA-A3000, normal type GU.

.2 Mix mortar 1 part by volume of cement to two parts of clean, sharp sand mixed dry.

.1 Add only sufficient water after mixing to give optimum consistency for placement.

.2 Do not use additives.

1.9 PIPE BEDDING AND SURROUND MATERIALS

.1 Per city of Windsor Design Manual and city standard drawing AS-310B and OPSS 401.

.2 Granular material: to OPSS 1001 and 1010.

.3 Grout: Per OPSS 410.

.4 Granular material to Section 31 05 16 and following requirements:

.1 Crushed or screened stone, gravel or sand.

.2 Gradations to be within limits specified when tested to ASTM C136 and ASTM C117.

1.10 BACKFILL MATERIAL

.1 In accordance with Section 31 23 33.01, city of Windsor Design Manual and city standard drawing AS-310B and OPSS 401.

Part 2 EXECUTION

2.1 EXAMINATION

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

2.2 PREPARATION

.1 Temporary Erosion and Sedimentation Control:

.1 Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according sediment and erosion controls as indicated on Site grading and Servicing Plan (C2.1).

.2 Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.

.3 Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

.2 Clean pipes and fittings of debris and water before installation, and remove defective materials from site to approval of Departmental Representative.

.3 Clean and dry pipes and fittings before installation.

.4 Obtain Departmental Representative's approval of pipes and fittings prior to installation.

.5 Hand trim excavations to required elevations. Correct over excavation with approved bedding material.

.6 Remove large stones or other hard matter which could damage pipe or impede consistent backfilling or compaction.

2.3 TRENCHING

.1 Do trenching Work in accordance with Section 31 23 33.01.

.2 Protect trench from contents of sewer or sewer connection.

.3 Trench alignment and depth require approval of Departmental Representative prior to placing bedding material and pipe.

2.4 GRANULAR BEDDING

.1 Excavate pipe trench in accordance with OPSS 401 and Section 31 23 33.01 for work of this section. Hand trim excavation for accurate placement of pipe to elevations indicated.

.2 Place bedding in unfrozen condition.

.3 Trench backfill to be replaced in 300mm Lifts and compacted to 95% standard Proctor density

.4 Shape bed true to grade and to provide continuous, uniform bearing surface for pipe.

.1 Do not use blocks when bedding pipe.

.5 Shape transverse depressions as required to suit joints.

.6 Fill excavation below bottom of specified bedding adjacent to manholes or structures with compacted bedding material.

2.5 INSTALLATION

.1 Lay and join pipes to: ASTM C12.

.2 Handle pipe using methods approved by Departmental Representative.

.1 Do not use chains or cables passed through rigid pipe bore so that weight of pipe bears upon pipe ends.

.3 Lay pipes on prepared bed, true to line and grade, with pipe invert smooth and free of sags or high points.

.1 Ensure barrel of each pipe is in contact with shaped bed throughout its full length.

.4 Begin laying at outlet and proceed in upstream direction with socket ends of pipe facing upgrade.

.5 Joint deflection permitted within limits recommended by pipe manufacturer.

.6 Water to flow through pipe during construction, only as permitted by Departmental Representative.

.7 Whenever Work is suspended, install removable watertight bulkhead at open end of last pipe laid to prevent entry of foreign materials.

.8 Install plastic pipe and fittings in accordance with CSA B182.11.

.9 Pipe jointing:

.1 Install gaskets in accordance with manufacturer's written recommendations.

.2 Support pipes with hand slings or crane as required to minimize lateral pressure on gasket and maintain concentricity until gasket is properly positioned.

.3 Align pipes before joining.

.4 Maintain pipe joints free from mud, silt, gravel and foreign material.

.5 Avoid displacing gasket or contaminating with dirt or foreign material. Gaskets so disturbed to be removed, cleaned and lubricated and replaced before joining is attempted.

.6 Complete each joint before laying next length of pipe.

.7 Minimize joint deflection after joint has been made to avoid joint damage.

.8 At rigid structures, install pipe joints not more than 1.2 m from side of structure.

.9 Apply sufficient pressure in making joints to ensure that joint is complete as outlined in manufacturer's recommendations.

.10 When stoppage of Work occurs, block pipes as directed by Departmental Representative to prevent creep during down time.

.11 Services to have minimum 1.2m cover.

.12 Cut pipes as required for special inserts, fittings or closure pieces as recommended by pipe manufacturer, without damaging pipe or its coating and to leave smooth end at right angles to axis of pipe.

.13 Make watertight connections to manholes.

.1 Use shrinkage compensating grout when suitable gaskets are not available.

.14 Use prefabricated saddles or field connections approved by Departmental Representative, for connecting pipes to existing sewer pipes.

.1 Joints to be structurally sound and watertight.

.15 Flush and clean all sewers per OPSS 410.

2.6 PIPE SURROUND

.1 In accordance with Section 31 23 33.01.

.2 Place surround material in unfrozen condition.

.3 Upon completion of pipe laying, and after Departmental Representative has inspected pipe joints, surround and cover pipes as indicated.

.1 Leave joints and fittings exposed until field testing is completed.

.4 Hand place surround material in uniform layers not exceeding 150 mm compacted thickness as indicated.

.5 Place layers uniformly and simultaneously on each side of pipe.

.6 Compact each layer from pipe invert to mid height of pipe to at least 95% maximum density to ASTM D698.

.7 Compact each layer from mid height of pipe to underside of backfill to at least 95% maximum density to ASTM D698.

.8 When field test results are acceptable to Departmental Representative, place surround material at pipe joints.

2.7 BACKFILL

.1 Backfill in accordance with Section 31 23 33.01.

.2 Place backfill material in unfrozen condition.

.3 Place backfill material, above pipe surround in uniform layers not exceeding 300 mm compacted thickness up to grades as indicated.

.4 Under paving and walks, compact backfill to at least 95% corrected maximum dry density.

.1 In other areas, compact to at least 90% corrected maximum dry density.

2.8 UNDERCROSSING

.1 Dewater excavation and area of undercrossing as required in accordance with the City of Windsor.

.2 Existing sewers, catch basin leads and drains shall be supported as per City of Windsor Specifications, except as noted below.

.3 When the earth has been removed from the top of the pipe, the pipe shall be temporarily suspended from timbers spanning across the trench at ground level to provide adequate support. Suspending cables shall be well tightened to prevent sagging of the pipe. The temporary supports for the pipe shall remain in place until the permanent supports have been completed.

.4 Water or gas mains or Bell cables crossing the trench shall be supported by means of timber placed on top of concrete support similar to the support for sewers, as described above. A 50 mm (2 in.) plank of sufficient width shall be placed under the water or gas main and the concrete support poured to the underside of the wooden plank. Concrete shall be as per City Specification.

2.9 FIELD TESTING

.1 Repair or replace pipe, pipe joint or bedding found defective.

.2 Infiltration and Deflection Testing: In accordance with OPSS 410 and to the satisfaction of the city of Windsor and the Departmental Representative.

.3 Provide CCTV Video and Report per OPSS 409 if required.

2.10 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11.

END OF SECTION

Part 1 GENERAL

1.1 SECTION INCLUDES

.1 Materials and installation for gravity sewers.

1.2 DEFINITIONS

.1 Pipe section is defined as length of pipe between successive manholes and/or between manhole and any other structure which is part of sewer system.

1.3 REFERENCES

.1 ASTM International

- .1 ASTM C117-04, Standard Test Method for Material Finer Than 75 MU m (No. 200) Sieve in Mineral Aggregates by Washing.
- .2 ASTM C136-06, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
- .3 ASTM D3034-08, Standard Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.

.2 Canadian General Standards Board (CGSB)

- .1 CAN/CGSB-8.2-M88, Sieves, Testing, Woven Wire, Metric.

.3 CSA International

- .1 CSA B1800-11, Thermoplastic Non-pressure Pipe Compendium.
  - .1 CSA B182.2-11, PSM Type Polyvinylchloride PVC Sewer Pipe and Fittings.

.4 Ontario Provincial Standard Specifications (OPSS):

- .1 OPSS 410, Construction Specification for Pipe Sewer Installation in Open Cut
- .2 OPSS 503, Construction Specification for Site Preparation for Pipelines, Utilities and Associated Structures in Open Cut
- .3 OPSS 507 – Construction Specification for Site Restoration Following Installation of Pipelines, Utilities and Associated Structures in Open Cut
- .4 OPSS 514 – Construction Specification for Trenching, Backfilling and Compaction
- .5 OPSS 1004, Material Specification for Aggregates - Miscellaneous.
- .6 OPSS 1010, Material Specification for Aggregates - Granular A, B, M and Select Subgrade Material.

.5 U.S. Environmental Protection Agency (EPA) / Office of Water

- .1 EPA 832/R-92-005, Storm Water Management for Construction Activities: Developing Pollution Prevention Plans and Best Management Practices.

.6 Department of Justice Canada (Jus)

- .1 Canadian Environmental Protection Act, 1999 (CEPA).

.7 Ontario Building Code

.8 Department of Justice Canada (Jus)

.1 Canadian Environmental Protection Act, 1999 (CEPA).

.9 City of Windsor

.1 Development Manual, latest edition.

1.4 SCHEDULING

.1 Schedule Work to minimize interruptions to existing services and maintain existing sewage flows during construction.

.2 Submit schedule of expected interruptions for approval and adhere to approved schedule.

.3 Notify Departmental Representative and building manager 24 hours minimum in advance of any interruption in service.

1.5 ACTION AND INFORMATIONAL SUBMITTALS

.1 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for pipes, and backfill and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Certificates:

.1 Certification to be marked on pipe.

1.6 DELIVERY, STORAGE AND HANDLING

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

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

.3 Storage and Handling Requirements:

.1 Store materials in accordance with manufacturer's recommendations.

.2 Store and protect pipes from damage.

.3 Replace defective or damaged materials with new.

1.7 PLASTIC PIPE

.1 Type PSM Polyvinyl Chloride (PVC): to ASTM D3034, certified to CSA B182.2.

.1 Standard Dimensional Ratio (SDR) for pipes 150mm and smaller: 28.

.2 Standard Dimensional Ratio (SDR) for pipes 200mm and larger: 35.

.3 Locked-in gasket and integral bell system.

.4 Nominal lengths: 4 m.

1.8 CEMENT MORTAR

.1 Portland cement: to CAN/CSA-A3000, normal type GU.

.2 Mix mortar 1 part by volume of cement to two parts of clean, sharp sand mixed dry.

.1 Add only sufficient water after mixing to give optimum consistency for placement.

.2 Do not use additives.

1.9 PIPE BEDDING AND SURROUND MATERIALS

.1 Per city of Windsor Design Manual and city standard drawing AS-310B and OPSS 401.

.2 Granular material: to OPSS 1001 and 1010.

.3 Grout: Per OPSS 410.

.4 Granular material to Section 31 05 16 and following requirements:

.1 Crushed or screened stone, gravel or sand.

.2 Gradations to be within limits specified when tested to ASTM C136 and ASTM C117.

1.10 BACKFILL MATERIAL

.1 In accordance with Section 31 23 33.01, city of Windsor Design Manual and city standard drawing AS-310B and OPSS 401.

Part 2 EXECUTION

2.1 EXAMINATION

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

2.2 PREPARATION

.1 Temporary Erosion and Sedimentation Control:

.1 Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according sediment and erosion controls as indicated on Site grading and Servicing Plan (C2.1).

.2 Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.

.3 Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

.2 Clean pipes and fittings of debris and water before installation, and remove defective materials from site to approval of Departmental Representative.

.3 Clean and dry pipes and fittings before installation.

.4 Obtain Departmental Representative's approval of pipes and fittings prior to installation.

.5 Hand trim excavations to required elevations. Correct over excavation with approved bedding material.

.6 Remove large stones or other hard matter which could damage pipe or impede consistent backfilling or compaction.

2.3 TRENCHING

.1 Do trenching Work in accordance with Section 31 23 33.01.

.2 Protect trench from contents of sewer or sewer connection.

.3 Trench alignment and depth require approval of Departmental Representative prior to placing bedding material and pipe.

2.4 GRANULAR BEDDING

.1 Excavate pipe trench in accordance with OPSS 401 and Section 31 23 33.01 for work of this section. Hand trim excavation for accurate placement of pipe to elevations indicated.

.2 Place bedding in unfrozen condition.

.3 Trench backfill to be replaced in 300mm Lifts and compacted to 95% standard Proctor density

.4 Shape bed true to grade and to provide continuous, uniform bearing surface for pipe.

.1 Do not use blocks when bedding pipe.

.5 Shape transverse depressions as required to suit joints.

.6 Fill excavation below bottom of specified bedding adjacent to manholes or structures with compacted bedding material.

2.5 INSTALLATION

.1 Lay and join pipes to: ASTM C12.

.2 Handle pipe using methods approved by Departmental Representative.

.1 Do not use chains or cables passed through rigid pipe bore so that weight of pipe bears upon pipe ends.

.3 Lay pipes on prepared bed, true to line and grade, with pipe invert smooth and free of sags or high points.

.1 Ensure barrel of each pipe is in contact with shaped bed throughout its full length.

.4 Begin laying at outlet and proceed in upstream direction with socket ends of pipe facing upgrade.

.5 Joint deflection permitted within limits recommended by pipe manufacturer.

.6 Water to flow through pipe during construction, only as permitted by Departmental Representative.

.7 Whenever Work is suspended, install removable watertight bulkhead at open end of last pipe laid to prevent entry of foreign materials.

.8 Install plastic pipe and fittings in accordance with CSA B182.11.

.9 Pipe jointing:

.1 Install gaskets in accordance with manufacturer's written recommendations.

.2 Support pipes with hand slings or crane as required to minimize lateral pressure on gasket and maintain concentricity until gasket is properly positioned.

.3 Align pipes before joining.

.4 Maintain pipe joints free from mud, silt, gravel and foreign material.

.5 Avoid displacing gasket or contaminating with dirt or foreign material. Gaskets so disturbed to be removed, cleaned and lubricated and replaced before joining is attempted.

.6 Complete each joint before laying next length of pipe.

.7 Minimize joint deflection after joint has been made to avoid joint damage.

.8 At rigid structures, install pipe joints not more than 1.2 m from side of structure.

.9 Apply sufficient pressure in making joints to ensure that joint is complete as outlined in manufacturer's recommendations.

.10 When stoppage of Work occurs, block pipes as directed by Departmental Representative to prevent creep during down time.

.11 Services to have minimum 1.2m cover.

.12 Cut pipes as required for special inserts, fittings or closure pieces as recommended by pipe manufacturer, without damaging pipe or its coating and to leave smooth end at right angles to axis of pipe.

.13 Make watertight connections to manholes.

.1 Use shrinkage compensating grout when suitable gaskets are not available.

.14 Use prefabricated saddles or field connections approved by Departmental Representative, for connecting pipes to existing sewer pipes.

.1 Joints to be structurally sound and watertight.

.15 Flush and clean all sewers per OPSS 410.

2.6 PIPE SURROUND

.1 In accordance with Section 31 23 33.01.

.2 Place surround material in unfrozen condition.

.3 Upon completion of pipe laying, and after Departmental Representative has inspected pipe joints, surround and cover pipes as indicated.

.1 Leave joints and fittings exposed until field testing is completed.

.4 Hand place surround material in uniform layers not exceeding 150 mm compacted thickness as indicated.

.5 Place layers uniformly and simultaneously on each side of pipe.

.6 Compact each layer from pipe invert to mid height of pipe to at least 95% maximum density to ASTM D698.

.7 Compact each layer from mid height of pipe to underside of backfill to at least 95% maximum density to ASTM D698.

.8 When field test results are acceptable to Departmental Representative, place surround material at pipe joints.

2.7 BACKFILL

.1 Backfill in accordance with Section 31 23 33.01.

.2 Place backfill material in unfrozen condition.

.3 Place backfill material, above pipe surround in uniform layers not exceeding 300 mm compacted thickness up to grades as indicated.

.4 Under paving and walks, compact backfill to at least 95% corrected maximum dry density.

.1 In other areas, compact to at least 90% corrected maximum dry density.

2.8 UNDERCROSSING

.1 Dewater excavation and area of undercrossing as required in accordance with the City of Windsor.

.2 Existing sewers, catch basin leads and drains shall be supported as per City of Windsor Specifications, except as noted below.

.3 When the earth has been removed from the top of the pipe, the pipe shall be temporarily suspended from timbers spanning across the trench at ground level to provide adequate support. Suspending cables shall be well tightened to prevent sagging of the pipe. The temporary supports for the pipe shall remain in place until the permanent supports have been completed.

.4 Water or gas mains or Bell cables crossing the trench shall be supported by means of timber placed on top of concrete support similar to the support for sewers, as described above. A 50 mm (2 in.) plank of sufficient width shall be placed under the water or gas main and the concrete support poured to the underside of the wooden plank. Concrete shall be as per City Specification.

2.9 FIELD TESTING

.1 Repair or replace pipe, pipe joint or bedding found defective.

.2 Infiltration and Deflection Testing: In accordance with OPSS 410 and to the satisfaction of the city of Windsor and the Departmental Representative.

.3 Provide CCTV Video and Report per OPSS 409 if required.

2.10 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 This Section includes requirements for design, supply and installation of grid-connected, photovoltaic, collector based solar energy electrical power generation equipment including requirements for power sharing, inverters, instrumentation and monitoring systems, connection and testing, and structural support and racking systems required for a complete and functional electrical power generation system.

1.2 RELATED REQUIREMENTS

.1 Section 05 05 00 – Common Work Results for Metals: Delegated design responsibilities and common welding and materials requirements for structural supports and racking.

.2 Section 26 05 00 – Common Work Results for Electrical: General electrical installation and coordination requirements.

.3 Section 26 05 19 – Electrical Power Conductors and Cables: Requirements for wiring and wiring devices.

.4 Section 26 05 26 - Grounding and Bonding for Electrical Systems: Requirements for personnel safety and to provide a low impedance path for ground fault currents.

.5 Section 26 05 28 – Conduits, Outlet Boxes and Fittings for Electrical Systems

.6 Section 26 18 00 – Building Voltage Circuit Protective Devices: Overcurrent breakers and fuses.

1.3 DEFINITIONS

.1 Governing Definitions: Terms relating to solar energy conversion and solar energy electrical power generation equipment used in this Section and on the Drawings are consistent with terms defined in ASTM E722.

.2 Delegated Design Professional Engineer: The professional engineer hired or contracted to the fabricator or manufacturer to design structural support assemblies, produce delegated design submittals and shop drawings meeting the requirements of the Contract; who is registered in the province of Ontario; and who is not the Departmental Representative.

1.4 REFERENCE STANDARDS

.1 ASTM International (formerly American Society for Testing and Materials) (ASTM):

.1 ASTM E772-11, Standard Terminology of Solar Energy Conversion

.2 ASTM E1038-10, Standard Test Method for Determining Resistance of Photovoltaic Modules to Hail by Impact with Propelled Ice Balls

.2 Canadian Standards Association (CSA):

.1 CAN/CSA C22.2 No. 107.2-01 (R2011), Battery Chargers

.2 CAN/CSA C22.2 No. 61730-1:11, 61730-1-04 Photovoltaic (photovoltaic) Module Safety Qualification – Part 1: Requirements for Construction (IEC 61730-1-04)

.3 CAN/CSA C61215-08, Crystalline Silicon Terrestrial Photovoltaic (photovoltaic) Modules – Design Qualification and Type Approval (IEC 61215-05)

.4 CAN/CSA C61646-10, Thin-Film Terrestrial Photovoltaic (photovoltaic) Modules – Design Qualification and Type Approval (IEC 61646-08)

.5 CSA G40.20-13/G40.21-13, General Requirements for Rolled or Welded Structural Quality Steel Structural Quality Steel

.6 CAN/CSA F382-M89 (R2009), Characterization of Storage Batteries for Photovoltaic Systems

.3 Institute of Electrical and Electronics Engineers (IEEE):

.1 IEEE Standards Dictionary: Glossary of Terms and Definitions

.2 IEEE 519-92, Recommended Practices and Requirements for Harmonic Control in Electric Power Systems

.3 IEEE 1526-03, Recommended Practice for Testing the Performance of Stand-Alone Photovoltaic Systems

.4 IEEE 1547-03, Standard for Interconnecting Distributed Resources with Electric Power Systems

.4 International Electrotechnical Commission (IEC):

.1 IEC62446-09Grid-Connected Photovoltaic (photovoltaic) Systems – Minimum Requirements for System Documentation, Commissioning Tests and Inspection

.5 National Electrical Manufacturer's Association (NEMA):

.1 NEMA250-08Enclosures for Electrical Equipment (1,000 Volts Maximum)

.6 Underwriters Laboratories Canada (ULC):

.1 ULC/ORD C1703-02, Standard for Flat-Plate Photovoltaic Modules and Panels

1.5 ADMINISTRATIVE REQUIREMENTS

.1 Delegated Design Requirements: Design structural steel support assemblies and connections required by the Contract Documents to withstand panel loads and wind loadings in accordance with requirements of the Ontario Building Code and CAN/CSA S16 to resist forces, moments and shears, and allow for movements without damaging the photovoltaic panels:

.1 Engage fabricator who utilizes registered professional engineer to prepare calculations, shop drawings, and other structural data for steel supports and connections.

.2 Retain registered professional engineer to ascertain and confirm that fabrication and erection of work meets design criteria required for the Work.

.2 Pre-Construction Meetings: Conduct a pre-construction meeting before starting work of this Section, attended by the Contractor, the Departmental Representative, the electricity utility provider and other Subcontractors affected by work of this Section in accordance with Section 01 31 19 to discuss the following:

.1 Review coordination of work with other Subcontractors to establish appropriate lead times and construction sequence.

.2 Review conditions required by electricity utility provider for isolation switch and metering device placement to meet their safety requirements and parallel grid connectivity compliance requirements.

.3 Review placement of equipment components within spaces provided.

.4 Review conditions affecting work of this Section required to meet manufacturer's installation requirements.

.5 Confirm that manufacturers of major pieces of equipment have reviewed drawings and specifications from each of the other manufacturers, where more than one manufacturer is providing equipment, and have jointly coordinated and properly integrated their equipment and controls to provide a complete and operational installation.

.6 Review installation procedures and schedule including method of delivery and handling of photovoltaic panels.

.7 Review structural load limitations for existing structures.

.8 Review and finalize construction schedule and verify availability of materials, installer's personnel, equipment, and facilities needed to make progress and avoid delays.

1.6 SUBMITTALS

.1 Provide required information in accordance with Section 01 33 00.

.2 Action Submittals: Provide the following submittals before starting any work of this Section:

.1 Solar Shading Analysis:Provide field shading analysis of site (such as Solmetric SunEye)

.2 Product Data: Submit manufacturer's Product data and installation instructions for each piece of equipment required by work of this Section; provide catalogue pages illustrating Products that are incorporated into the Work including the following:

.1 Micro-Inverter

.2 Photovoltaic Panels and Modules

.3 Collector Supports

.4 Instrumentation

.5 Isolation Switch and Switch Gear

.6 DC and AC Disconnects (if any)

.7 Combiner Boxes (if any)

.8 Equipment Racking (if any)

.9 Monitoring and Metering Systems, including interfacing with facility data collection systems and telecommunication facilities

.3 Shop Drawings: Submit shop drawings prepared at a scale sufficient to convey required information including the following:

.1 Layout and orientation of photovoltaic modules

.2 Roof surfaces and slopes

.3 Location of inverter, combiner box and disconnects

.4 Locations of penetrations and methods of weather sealing

.5 Mounting details, and structural supports and foundations racking assemblies, signed and sealed by Delegated Design Professional Engineer

.6 Electrical connection details, instrument mounting and interconnections

.7 Wiring and grounding details

.8 Solar module control sequences

.9 All other components, parts and pieces required for a complete and functioning installation

.3 Informational Submittals: Provide the following submittals during the course of the Work:

.1 Certification: Submit certified test and evaluation reports prepared by solar energy electrical power generation equipment manufacturer indicating compliance with specified performance requirements and physical properties.

.2 Installation References: Submit installer's references before starting any work of this Section; indicate successful installations of a minimum of four (4) systems of similar size and complexity; include address and contact information for each installation; include copies of training certificates or permits applicable to work of this Section.

.3 Delegated Design Submittals: Brief description of submittals.

.4 Source Quality Control Submittals: Submit written documentation verifying that components and materials supplied for the Work are compatible and approved by primary power generation system manufacturer.

.5 Site Quality Control Submittals: Submit written reports describing manufacturers Site services, inspection results and corrective actions made during Site quality control Site inspections.

1.7 PROJECT CLOSEOUT SUBMISSIONS

.1 Operation and Maintenance Data: Submit manufacturer's written instructions for repair and cleaning, and operations and maintenance procedures; include name of original installer and contact information in accordance with Section 01 78 23 and as follows:

.1 Preventive maintenance and inspection data, including a schedule for system operators and the following:

.1 Safety precautions

.2 Operator restart

.3 Start-up, shutdown, and post-shutdown procedures

.4 Normal operations

.5 Emergency operations

.6 Environmental conditions

.7 Troubleshooting guides and diagnostic techniques

.8 Wiring and control diagrams

.9 Maintenance and repair procedures

.10 Removal and replacement instructions

.2 Solar photovoltaic system verification certificate as required by IEC 62446.

.3 Plastic laminated wiring identification codes and diagrams of solar photovoltaic systems, operating instructions, control matrix, and troubleshooting instructions; posted in close proximity to solar energy electrical power generation equipment mounted in an acrylic glazed frame.

.4 Spare parts and supply list, and parts identification.

.5 Testing equipment and special tool information.

.6 Testing and performance data.

.2 Spare Parts, Tools and Software: Submit unique parts, tools and software in accordance with Section 01 78 43 and as follows:

.1 Label system components for type, manufacturer, and model number matching descriptions in Operation and Maintenance Data Manuals.

.2 Identify sources of equipment for replacement parts.

.3 Complete set of replacement fuses of the same type and rating used in the system.

1.8 QUALITY ASSURANCE

.1 Regulatory Requirements: Install solar energy electrical power generation equipment in accordance with requirements of the Ontario Electrical Safety Code (CEC) governing solar photovoltaic systems, and as required by the electricity utility and the authorities having jurisdiction:

.1 Labelling: Use only equipment and components that are listed by ULC or that are labelled by CSA for configuration and installation required for the Work of the Contract.

.2 Qualifications: Provide proof of qualifications during the course of the work of this Section:

.1 Delegated Design Professional Engineer: Retain Delegated Design Professional Engineer to design fabrication and erection of structural supports in accordance with applicable Building Code and Contract Documents including the following:

.1 Seal and signature on fabrication and erection documents and design submittals.

.2 Site review of installed components.

.2 Installers: Use installers qualified as Construction Electrician (NOC 7241) Solar Photovoltaic (photovoltaic) Systems through a CSA recognized third party, independent personnel certification program for construction electricians installing photovoltaic equipment in Canada, having experience with systems similar size and complexity as that required for the work of this Section.

.3 Manufacturers: Obtain Products from manufacturers having sufficient capacity to fabricate and deliver required materials without causing delay to the Work, that can provide Site review services, and that will provide a qualified representative to certify that equipment is installed in accordance with manufacturer’s requirements and meets specified performance requirements.

1.9 MOCK-UPS

.1 Provide required Mock-Up in accordance with Section 01 45 00, and as follows:

.1 Purpose: Construct to illustrate quality of work, substrate preparation, operation of equipment and material application.

.2 Dimensions and Process: Construct one (1) rack of photovoltaic modules using proposed procedures and Products.

.3 Location: Construct where directed by Departmental Representative.

.2 Proceed with work after Departmental Representative has reviewed and issued written acceptance of mock-up; accepted mock-up will demonstrate minimum standard of quality required for this work.

.3 Accepted mock-up may remain part of finished work; remove or repair unacceptable mock-up and dispose of materials when no longer required or when directed by Departmental Representative.

1.10 DELIVERY, STORAGE AND HANDLING

.1 Delivery and Acceptance Requirements: Deliver Products in accordance with manufacturer's written instructions in original packaging with identification labels intact.

.2 Storage and Handling Requirements: Store materials protected from harmful weather conditions and within temperature limitations recommended by the manufacturer.

1.11 SITE CONDITIONS

.1 Site Measurements: Verify dimensions by Site measurements before fabrication and indicate measurements on shop drawings where photovoltaic panel supports are indicated to mount onto or around other construction; coordinate fabrication schedule with construction progress to avoid delaying the Work.

.2 Established Dimensions: Establish dimensions and proceed with fabricating photovoltaic panel supports without Site measurements where Site measurements cannot be made without delaying the Work; coordinate construction to ensure that actual Site dimensions correspond to established dimensions; allow for trimming and fitting.

1.12 WARRANTY

.1 Manufacturer's Warranty: Provide manufacturer's solar photovoltaic module warranty covering defects in materials and workmanship for complete solar energy electrical power generation system.

.2 Modules shall be free from defects in materials and workmanship that have an effect on module functionality under normal application, installation, use and service conditions as specified in manufacturer's standard product documentation.

.1 Photovoltaic Panels: 10 years.

.2 Microinverters and cables:25 years

.3 Special Warranty: Provide manufacturer's warranty covering power output for a period of 25 years from date of Substantial Performance of the Work, and phased as follows:

.1 During the first year, the actual power output of the module will be no less than 97% of the labeled power output.

.2 From year 2 to year 24, the actual annual power decline will be no more than 0.7%; by the end of year 25, the actual power output will be no less than 80% of the labeled power output.

Part 2 Products

2.1 DESIGN REQUIREMENTS

.1 System Description: Provide materials and equipment to fabricate a complete and operational solar energy power generation system meeting performance requirements specified in this Section and as follows:

.1 Design complete photovoltaic power system, including structural support structures necessary to mount systems on roof tops.

.2 Solar panel modules to be optimized for north/south orientation. Locate arrays to avoid casting shadow on next array and output.

.3 Solar panel modules to be located as close to the Drawing locations as possible. Notify the Departmental Representative if design quantity differs from Drawings by more than 5 panels.

.4 Establish layout and location of photovoltaic power system at the Site.

.5 Deliver, assemble, and install the equipment at the Site.

.6 Design roof mounted systems to be either out-of-sight or aesthetically pleasing if visible to the public eye after installation.

.7 Coordinate work of this Section with roofing Subcontractor and take measures to prevent damage to roofing membranes resulting from installation of photovoltaic power system.

.8 Investigate if the installation is entitled for a FIT program offered by the Utility company and provide assistance to partake in the applicable programming including all applications, approvals and permits etc. All fees for any such work shall be paid from the cash allowance.

.9 Coordinate installation of the solar PV system with Hydro One and adhere to all pertinent requirements during installation.

.10 Refer to drawings for further information on basis of design.

.2 Structural Connections and Anchorages: Design connections using materials and fabrication methods in accordance with Section 05 05 00, using Delegated Design Professional Engineer responsible for providing submissions required by this Section.

.3 Structural Supports and Racking: Design structural supports for solar photovoltaic system prepared using Delegated Design Professional Engineer registered in the province of Ontario and as follows:

.1 Material Selection: Fabricate structural supports from structural steel or structural aluminum at the choice of the Delegated Design Professional Engineer using materials specified in this Section.

.2 Delegated Design Criteria: Fabricator is required to design and submit details for structural steel supports and panel racks not otherwise detailed on the Drawings using loads and forces indicated on the Drawings and as follows:

.1 Loads and forces shown on Drawings are not factored, unless specifically indicated otherwise in the Contract Documents.

.2 Use 1 in 100 year environmental factors from the Ontario Building Code for seismic, wind and snow loads and forces for proposed configuration of solar photovoltaic panels.

.3 Request from Departmental Representative any loads and forces not shown on Drawings, but that may be required to complete fabrication detailing requirements for shop drawing submission.

.3 Roof Structure: Perform adequate review and structural analysis to confirm that load bearing capability of existing roof structure can support proposed solar photovoltaic panel system.

2.2 MATERIALS

.1 Structural Aluminum Supports: Fabricate structural aluminum supports to be attached to ballast blocking. No provision for attaching to roof structure allowed:

.1 Extruded Pipe and Tubes: ASTM B429/B429M, alloy and temper AA6016-T6.

.2 Structural Shapes: ASTM B308/B308M, alloy and temper AA6016-T6.

.3 Extruded Bars and Profiles: ASTM B221, alloy and temper AA6016-T6.

.4 Surface Preparation: Mill finish, cleaned of rolling marks and oxides, fabricated to provide a clean aesthetic appearance.

.2 Solar Photovoltaic Modules: Frame mounted poly-crystalline type 60 cell photovoltaic array 1600mm x 1000mm x 40mm, rated at 250W at STC, manufactured in accordance with ULC/ORD C1703, capable of withstanding minimum 2400 Pa mounting loads and 5400 Pa snow loads and as follows:

.1 Module Efficiency: Provide array and configuration to achieve maximum design power output indicated on Drawings.

.2 Mounting: Manufacturer’s recommended mounting materials and methods; based on installation orientation and environmental conditions.

.3 Electrical Connections: Manufacturer’s standard weatherproof connections.

.4 Bypass Diodes: Built into each photovoltaic module; between each cell or each string of cells.

.5 Hail Protection: Tested in accordance with ASTM E1038.

.3 Photovoltaic Array AC Circuit Combiner Box: Disconnecting combiner box meeting requirements of OESC and ULC/ORD C1703, equipped with internal overcurrent protection device.

.4 Inverter: Microinverter having AC output rated as described on Drawings, capable of automatic and continuous operation in accordance with IEEE 929 including ancillary equipment and hardware required (Basis of Design - Enphase M250).

.5 Isolating Switch: Isolating switch meeting requirements of the OESC, IEEE 1547 and as follows:

.1 Power Sharing Disconnect Switch: Equip isolating switch with anti-islanding capability making; shutting down exported power to utility distribution system in the absence of utility power.

.2 Utility External Disconnect Switch: Utility approved disconnect switch placed between meter and power generation equipment in a visible and accessible location beside the meter; lockable by the utility to permit crews to work safely on distribution grid.

.6 Wiring Specialties: Manufacturer's recommended materials meeting requirements of the OESC and as follows:

.1 Direct Current Conductor: Refer to Section 26 05 19; 3BEVA Zero Halogen Cable, Class 1 stranded 61/24 conductor, minimum 10 AWG; use 6 AWG when location of inverter exceeds 15 metres from photovoltaic array; 105°C wet rated, sunlight resistant insulation at exposed locations; 90°C wet rated insulation for conduit installation.

.2 Conduits and Raceways: Refer to Section 26 05 28; rigid steel conduit with expansion joints for cable runs; weather tight, galvanized steel EMT for DC wiring in weather protected areas.

.3 Weather Enclosures: NEMA 3R rated for exterior installations.

.4 Cable Assemblies and Junction Boxes: CSA labelled and certified components.

.5 Terminations: Stranded wire terminal, sized appropriately to suit wire and connection screws within photovoltaic junction boxes.

2.3 INSTRUMENTATION, MONITORING AND COMMUNICATIONS

.1 Meters: Provide metering to meet Hydro One standards:

.1 Data Line: Provide phone connection as directed by electricity utility provider.

.2 Sensors: Provide manufacturer's standard sensors integral to system components or as standalone components as follows:

.1 Email alarms.

.2 Conduit: Place data wiring in a conduit separate from conductor conduit.

.3 Data-Logger/Monitoring System: Packaged system capable of monitoring and logging an individual module's information within micro-inverter system.

.4 Monitoring to be provided at no additional cost for a minimum of 20 years.

2.4 SOFTWARE

.1 Enlighten for Solar Professionals.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: Verify that conditions of substrates installed by other Subcontractors to the Work are acceptable before installation of Products specified in this Section:

.1 Installation of Products specified in this Section will denote acceptance of Site conditions.

3.2 PREPARATION

.1 Field Shading Analysis: Provide shading analysis of roof (Solmetric SunEye), to be submitted after completion of roof construction as part of product shop drawings.

.2 Protection of Existing Conditions: Protect roofing materials and membranes from damage during the installation of photovoltaic modules and structural support systems and as follows:

.1 Arrange for roof inspection by the installing roofing Subcontractor and obtain written certification that roof membrane is undamaged and that roofing warranties provided to the Region are valid after completion of work of this Section.

3.3 INSTALLATION

.1 Install the solar photovoltaic system in accordance with the OESC and manufacturer's written installation requirements, fitted accurately and securely fastened free from distortion and other defects and as follows:

.1 Safety Precautions: Post signage and educate other workers on Site that photovoltaic modules generate electricity from any ambient light; protect exposed leads and connections to prevent physical contact with workers.

.2 Wiring Installation: Measure wiring on Site and test-fit layout before making permanent connections; install wires free of snags and protected from sharp edges.

.3 Instrumentation: Install instruments in accordance with control manufacturer's written instructions.

3.4 SITE QUALITY CONTROL

.1 Manufacturer's Site Services: Manufacturer's qualified personnel are required to make periodic Site visits throughout the installation of solar energy electrical power generation equipment and verify that system is installed in accordance with manufacturer's written instructions; schedule Site visits as follows:

.1 After delivery and storage of system components, when preparatory work of this Section is complete and before installation begins.

.2 Schedule two (2) inspections during progress of the work of this Section at 25% and 60% completion stages.

.3 Perform final inspection at completion of the work of this Section, and after cleaning and performance testing is completed.

.2 Site Inspection: Inspect photovoltaic system before initial operation to confirm specified performance requirements indicated on Drawings and in this Section; note the following information on each solar collector:

.1 Manufacturer's name or trademark

.2 Model name or number

.3 Certifying agency label and rating

.3 Initial Testing: Provide equipment and apparatus required for performing tests; correct defects identified by testing and repeat tests to confirm repair; conduct tests with Departmental Representative present:

.1 Module String Voltage Test: Prior to connecting wiring to the combiner box, use a digital multi-meter to verify each series string's polarity is correct in accordance with IEC 62446.

.2 Operation Tests: Perform tests on electrical systems, in accordance with the manufacturer's written recommendations and IEEE 1526 for standalone systems.

.4 Follow-Up Verification: Upon completion of acceptance checks, settings, and tests, demonstrate that solar photovoltaic electrical power generation system is in good operating condition and performing as intended.

.5 Reporting: Submit written report of Site observations, measured test results, any performance recommendations made during Site inspections and corrective actions made necessary to meet Site condition variable.

3.5 CLOSEOUT ACTIVITIES

.1 Start-Up and Adjustments: Start-up solar energy electrical power generation equipment in accordance with manufacturer's written start-up procedures and make adjustments to system components for correct function and optimal operation parameters.

.2 Commissioning: Arrange with electricity utility provider to establish interconnection agreement for grid-connected systems and connect solar array to the electricity utility grid only after receiving approval from the utility company; make connection using qualified personnel acceptable to the electricity utility provider.

.3 Demonstration and Training: Provide training of facility personnel as required by Section 01 79 00 and as follows:

.1 Provide a minimum of two (2) training sessions conducted by a factory trained technician, length of sessions as necessary to fully convey requirements, performed on dates and times agreed upon by the Departmental Representative.

.2 Provide video recording of training session on DVD.

.3 Topics covered during training must include theory of operation, operating requirements, component descriptions and specifications, maintenance requirements and schedule, safety precautions, and overview of the system manual and recordkeeping.

.4 Submit statement signed by instructor and facility personnel confirming that instruction was completed.

.4 Protection: Protect installed equipment from damage during construction; and remove prior to Substantial Performance of the Work.

.5 Repairs: Repair damage to adjacent materials caused by installation of solar energy electrical power generation equipment.

END OF SECTION

DESIGNATED SUBSTANCES SURVEY
Revision A

441 University Avenue
Windsor, Ontario

PWGSC SOA No: EN438-140932/001/FK

Prepared for:

Public Works and Government Services Canada

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Report Valid as of: January 29, 2017

DST File No.: GV-SO-028018

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Executive Summary

DST Consulting Engineers Inc. (DST) was retained by Public Works and Government Services Canada (PWGSC) to conduct a Designated Substance Survey (DSS) in support of the future rehabilitation project associated with the building located at 441 University Avenue in Windsor, Ontario.

In general, the objectives of the DSS were to:

- Review, compile and summarize past/existing pertinent data for the building with respect to designated substances;
- Conduct a data gap analysis and non-destructive investigation and sampling (as required) for any additional materials suspected of containing designated substances (e.g. asbestos, lead) or other hazardous materials not previously identified;
- Collect and analyze the required number of additional suspect Asbestos Containing-Material (ACM) samples to satisfy the requirements of O.Reg. 278/05 (as amended) where applicable; and
- Determine the extent of Designated Substances and Hazardous Materials for the building;

The DSS scope of work included an assessment for the presence of the 11 Designated Substances, as identified in the Ontario Occupational Health and Safety Act, as well as Polychlorinated Biphenyls (PCBs), Halocarbons, Fecal Matter/Animal Droppings, Urea-Formaldehyde Insulation (UFFI), Radioactive Materials and other miscellaneous hazardous materials or chemicals (as deemed prudent)

DST conducted the site visit for this building on December 13th and 14th, 2016.

Table I below provides a general overview of Designated Substances and Hazardous Materials identified at Centre Block.

Table I: Overview of Designated Substances and Hazardous Materials

Designated Substances and Hazardous Materials Identified	Designated Substances and Hazardous Materials Not Identified[1]
• Asbestos; • Lead; • Mercury; • Silica; • Halocarbons; • Mould; and • Stored Chemicals.	• Acrylonitrile; • Arsenic; • Benzene; • Coke Oven Emissions; • Ethylene Oxide; • Fecal Matter/Droppings; • Isocyanates; • Radioactive Materials; • Vinyl Chloride; • Urea-Formaldehyde Insulation; and • PCBs.

[1] Nor suspected of being present, in forms or quantities that would either impact future work or pose risks to human health or the environment.

The subsequent table summarizes the findings and recommendations for the Designated Substances and Hazardous Materials observed as part of the survey.

Table II: Summary of Findings and Recommendations for Designated Substances and Hazardous Materials Observed at Centre Block.		
Designated/ Hazardous Substance	**Findings**	**Recommendations**
Asbestos	Asbestos was observed to be present within the following materials in select locations: • Parging cement applied to pipe elbows; • Plaster applied to walls; • Vinyl Floor Tiles; • Aircell Insulation on pipe straights; • Drywall joint compound; • Plaster soffit on the exterior of the building; and • Window caulking on the exterior of the building. Please refer to Section 6.1 on further details regarding asbestos-containing materials	The disturbance of ACMs in the province of Ontario is governed by *O.Reg. 278/05, Asbestos on Construction Projects and in Buildings and Repair Operations, as amended,* enabled under the *Occupational Health and Safety Act (R.S.O. 1990, Chapter 0.1).* Refer to Section 6.1 for additional recommendations on identified ACMs. Worker exposure to airborne asbestos is regulated under Ontario Regulation 490/09 – Designated Substances, as amended. The transport and disposal of asbestos waste is governed by *O.Reg 347/90 – General – Waste Management*, as amended. This regulation requires that asbestos waste be sealed in appropriately labelled, double containers resistant to puncture and tears. The waste must be disposed at a licensed waste disposal site.

Table II: Summary of Findings and Recommendations for Designated Substances and Hazardous Materials Observed at Centre Block.		
Designated/ Hazardous Substance	**Findings**	**Recommendations**
Lead	Based on historical documentation, the yellow, mauve, green, yellow/white, orange, pink, beige, green and grey wall paints were known to contain detectable concentrations of lead. Refer to Section 6.2 for further information and details regarding lead and lead paints Lead is suspected to be present in the following materials: • Solder on the joints of copper piping; • Ceramic tile glazing; • Emergency light batteries; and • Cast iron drain pipe joint caulking;	The Occupational Health and Safety Branch of the Ontario Ministry of Labour publication *Guideline: Lead on Construction Projects* should be followed during the disturbance of materials containing lead. Although the Federal Canada Consumer Product Safety Act's *Surface Coating Materials Regulations SOR/2005-109*, as amended, has set a limit of 90 parts per million (ppm) for surface coating materials, there may be a potential for exposure to high levels of lead depending on the activities performed that disturb the lead-containing materials even at low lead concentrations. Conducting a risk assessment to assess the potential for exposure to lead should be performed to determine the need to follow procedures such as those in the MOL guideline referenced above. Worker exposure to lead is regulated under *Ontario Regulation 490/09 – Designated Substances*, as amended. The disposal of lead waste is regulated under *Ontario Regulation 347/90 – General – Waste Management,* as amended. Refer to Section 6.2 for additional recommendations on materials suspected of containing lead.
Mercury	Mercury is assumed to be present within the following materials: • Fluorescent light tubes;	The Occupational Health and Safety Division of the Ontario Ministry of Labour publication *The Safe Handling of Mercury: A Guide for the Construction Industry*, should be followed during the disturbance of materials containing mercury. Worker exposure to mercury is regulated under *Ontario Regulation 490/09 – Designated Substances*, as amended. The disposal of mercury waste is regulated under *Ontario Regulation 347/90 – General – Waste Management,* as amended. Refer to Section 6.3 for additional recommendations on materials suspected of containing mercury.

Table II: Summary of Findings and Recommendations for Designated Substances and Hazardous Materials Observed at Centre Block.		
Designated/ Hazardous Substance	**Findings**	**Recommendations**
Silica	Silica is assumed to be present within the following materials: • Concrete and cement materials; • Interior and exterior stone and masonry building materials (including terracotta) and associated mortars of the building; • Plaster building elements; • Ceramic tiles, marble, grouts, other stone materials, mortar; • Drywall building elements; • Suspended and acoustic ceiling tiles; • Flooring compound layers; and • Vinyl flooring products.	Dust control measures should be adopted during the disturbance of silica, including those outlined within the Occupational Health and Safety Branch of the Ontario Ministry of Labour *Guideline: Silica on Construction Projects.* Worker exposure to silica is regulated under *Ontario Regulation 490/09* – Designated *Substances*, as amended. Refer to Section 6.4 for additional recommendations on materials suspected of containing silica.
Mould and Water Damage	Mould was observed within the ground floor of the building at the time of inspection. Refer to Section 6.5 for further information and details regarding mould and water damaged building materials.	Mould remediation, if required, should follow CCA 82-2004 guidelines, dependent on the quantity of affected building materials Appropriate worker precautionary measures should be implemented where worker exposure to elevated bacteria and/or fungal levels may occur. Refer to Section 6.6 for additional recommendations on materials containing, or suspected to contain mould.

Table II: Summary of Findings and Recommendations for Designated Substances and Hazardous Materials Observed at Centre Block.		
Designated/ Hazardous Substance	**Findings**	**Recommendations**
Halocarbons	Halocarbons are suspected to be present in the following pieces of equipment: • A Refrigerator located in location 105. The equipment outlined above may be tenant owned but could not be readily confirmed by DST at the time of the site visit.	The handling, transport and disposal of halocarbon-containing equipment are governed by the Ozone-Depleting Substances Regulations under the Canadian Environmental Protection Act (CEPA), 1998, as amended. The use of halocarbons is governed by the Federal Halocarbon Regulations (FHR) for federal facilities. The FHR is enforced under CEPA by Environment Canada (EC). CEPA permits for the routine inspection of halocarbon-containing equipment by EC enforcement officers. Compliance with the FHR is mandatory and violations of the regulation are subject to fines, imprisonment or other court orders, as per CEPA. Refer to Section 6.5 for additional recommendations for halocarbons.
Stored Chemicals	Stored chemicals used for janitorial purposes were observed present at the facility during the survey	The handling and use of these materials should be undertaken by those with proper training (e.g. Workplace Hazardous Materials Information System, etc.) and adhere to any applicable guidelines and/or regulations. The transport and disposal of chemical waste is governed by O. Reg. 347/90 – General – Waste Management, as amended.

The Executive Summary should be read in conjunction with, and is subject to the limitations outlined in this report.

DESIGNATED SUBSTANCES SURVEY

The Centre Block Building
111 Wellington Street, Parliament Hill
Ottawa, Ontario

TABLE OF CONTENTS

Attached Appendices

1.0 INTRODUCTION

DST Consulting Engineers Inc. (DST) was retained by Public Works and Government Services Canada (PWGSC) to prepare a Designated Substances and Hazardous Materials Survey (DSHMS) Report at 441 University Avenue, Windsor, Ontario.

The Designated Substances Report is required under the *Ontario Occupational Health and Safety Act* in order to identify designated substances that may be present within the project areas. The *Canada Labour Code also* stipulates under *Part II, Section 124* that every employer shall ensure that the health and safety at work of every person employed by the employer is protected. By having a DSHMS conducted, the Project Manager will be able to inform his or her employees, contractors, and tenants of any designated substances or hazardous materials that may be present and possibly disturbed throughout the duration of the project.

DST staff completed a visual evaluation of building materials for the presence of suspected designated substances and hazardous materials on December 13 and 14, 2016.

2.0 BACKGROUND SITE INFORMATION

The building located at 441 University Avenue is a rectangular, two-storey structure with a below grade basement, approximately 7000 m^2 in area. There are no landscaped areas, but there is a parking lot with a garbage storage shed outside. The building is organized into office spaces on each floor, with the exception of the basement, which is mostly purposed for mechanical equipment.

3.0 SCOPE OF WORK

The survey implemented by DST included the 11 designated substances listed in Section 30 of the *Occupational Health and Safety Act, R.S.O. 1990, Chapter 0.1*. Designated Substances, as identified under the Ontario Occupational Health and Safety Act, are as follows:

- Acrylonitrile;
- Arsenic;
- Asbestos;
- Coke Oven Emissions;
- Ethylene Oxide;
- Isocyanates;
- Lead;
- Mercury;
- Silica; and
- Vinyl Chloride.

Other Hazardous Materials that are not classified as Designated Substances, but were included as part of the survey and considered pertinent due to applicable regulations, best practice guidelines and/or potential risks to human health and/or the environment, are:

- Poly Chlorinated Biphenyl (PCB) containing equipment;
- Halocarbons;

- Urea Formaldehyde Foam Insulation (UFFI);
- Fuel, Oil and/or Waste Oil Storage;
- Stored Chemicals;
- Radioactive materials;
- Mould; and
- Hazardous film or residue within the ducts.

4.0 BACKGROUND INFORMATION REVIEW

Prior to the commencement of field work, DST project personnel reviewed past bulk sampling documentation, as pertinent to the project areas. As part of the project, DST reviewed the following reports:

- Asbestos Product Re-Assessment, Government of Canada Building, 441 University Avenue, Windsor, Ontario. Prepared by OH Solutions Inc. (Project Number 16-0712). Dated September 16, 2016.
- Designated Substances Assessment, Government of Canada Building, 441 University Avenue, Windsor, Ontario. Prepared by OH Solutions Inc. (Project Number 12-030). Dated December 20, 2012.
- Asbestos Materials Report, 5 Year Asbestos Reassessment, 441 University Avenue, Windsor, Ontario. Prepared by Pinchin Environmental Ltd. (Project Number S62931). Dated March 31, 2011.
- Asbestos Reassessment, 441 University Avenue, Windsor, Ontario. Prepared by Golder Associates Ltd. (Project Number 031-145099). Dated July 4, 2003.
- Non-Friable Asbestos Product Survey, 441 University Avenue, Windsor, Ontario. Prepared by Advanced Environmental Corp. (Project Number 06-3580). Dated November 5, 2006.
- Asbestos Reassessment, 441 University Avenue, Windsor, Ontario. Prepared by Cushman-Ball Environmental Ltd. (Project Number 20300.00). Dated November 3, 1998.

DST referenced the identifiable sampling and analytical results of the above-noted documentation, where applicable. As such, materials already identified as asbestos-containing or non-asbestos containing in previous documentation were not re-sampled by DST as part of this project specific survey. Furthermore, as part of the survey, the presence, quantity and condition of asbestos-containing materials (ACMs) were confirmed by DST. DST's field program also included the sampling of any additional ACMs and lead (in paint) and the identification of other Designated Substances not previously noted or where uncertainty existed. Where applicable, a sufficient number of bulk asbestos samples were collected in order to satisfy the current bulk sampling requirements of O.Reg. 278/05, as amended.

5.0 METHODOLOGY

The purpose of the survey program was to identify designated substances and hazardous materials that may be disturbed during future work operations. The survey did not include an

assessment of the roof. Destructive investigations were not performed to examine concealed conditions.

Materials suspected of containing designated substances and other hazardous materials were visually identified, based on the surveyor's knowledge of the historical composition of building products. Equipment that may contain halocarbons (e.g. air conditioning and refrigeration equipment) or PCBs (e.g. electrical transformers and fluorescent light ballasts) can often be identified by examining manufacturer's labels. For safety reasons, DST personnel do not remove the ballast shields from fluorescent light fixtures to examine the ballast codes unless the electrical circuit for the lighting has been tagged and locked out by a qualified electrician. According to the facility managers, the majority of the ballasts associated with fluorescent light fixtures had been replaced throughout the facility. Visual identification of materials suspected to contain asbestos or lead (in paint) was supported by the collection and analysis of a limited number of representative samples, where applicable. Materials suspected of containing designated substances other than asbestos or lead (in paint) were identified by appearance, age, and knowledge of historical applications.

In Ontario, a material is defined as an Asbestos-Containing Material (ACM) if the material has a minimum asbestos content of 0.5 per cent (%) by dry weight, as per *Ontario Regulation (O. Reg.) 278/05 Asbestos on Construction Projects and in Buildings and Repair Operations* enabled under the *Occupational Health and Safety Act (R.S.O. 1990, Chapter 0.1),* as amended. ACMs can be divided into two categories: friable and non-friable material. A friable ACM is a material that can be crumbled, powdered, or pulverized by hand pressure and can readily release fibres when disturbed. Common applications of friable ACMs are sprayed or trowelled surfacing materials (e.g. sprayed fireproofing and textured coatings) as well as mechanical and thermal insulation. Non-friable materials are materials that will generally release fibres only when cut or shaped. Common non-friable ACMs include vinyl floor products, caulking applications, asbestos textile products and asbestos cement products (transite). Some of these products may become friable with time or when disturbed.

Representative bulk samples of suspected ACMs were collected by DST during the site investigation. Samples were collected in order to meet the bulk sampling requirements stipulated in *O.Reg. 278/05, as amended*. Bulk samples were submitted to and analyzed by Paracel Laboratories Ltd. (Paracel). Paracel is an accredited laboratory through the Canadian Association for Laboratory Accreditation (CALA) and the National Voluntary Laboratory Accreditation Program (NVLAP). The bulk samples were analyzed using polarised light microscopy (PLM). This analytical method complies with the United States Environmental Protection Agency (U.S. EPA) Method 600/R-93/116 dated July, 1993, which is the regulatory approved protocol for bulk asbestos analysis in Ontario.

With regards to lead in paint, although the Ontario Ministry of Labour (MoL) has published a guideline for control of lead exposures on construction projects in Ontario, it does not include criteria for the classification of lead-paint. Instead, it uses presumed airborne lead concentrations for specific tasks as criteria for classifying work. However, in regulations set by the United States (U.S.) Department of Housing and Urban Development, lead-based paint is classified as any paint

application containing at least 1.0 milligrams of lead per square centimetre of surface area (1.0 mg/cm^2), or at least 0.5% lead content by weight [(5,000 parts per million (ppm)]. This criterion was widely, although not universally, used in Canada. In Canada, the Federal Canada Consumer Product Safety Act's *Surface Coating Materials Regulations SOR/2005-109* has lowered the allowable concentration of lead in paints for new consumer products to 0.009% lead content by weight (90 ppm). For the purposes of the survey and this report, paint applications having detectable concentrations of lead are considered to be lead-containing.

Selected photographs of representative conditions of existing asbestos-containing materials are included in Appendix A. Bulk asbestos analytical results are included in Appendix B. A floor plan showing sample locations is included as Appendix C. A room by room inventory of designated substances are presented in Appendix D.

During the survey access was not granted to Locations 1, 2, 10, 11, 12, 13, 14, 22, 23, 25, 38, 39, 40, 41, 42 and 126. The presence or absence of DSHM could not be confirmed. However, based on background documentation review, Asbestos-containing materials are suspected to be present within these areas.

6.0 FINDINGS

The following sections outline the complete findings of all accessible designated substances and hazardous building materials that were assessed within the building.

6.1. Asbestos

Table 1 presents the findings of bulk asbestos material samples collected as part of the survey (DST, December 2016).

Table 1: Summary of Bulk Samples Analyzed for Asbestos Content by Polarized Light Microscopy (PLM) – DST 2016

Sample I.D.	Sample Location	Sample Description	Asbestos Content and Type
01A	Location 85	Brown Vinyl Sheet Flooring	None Detected
01B			None Detected
01C			None Detected
01A	Location 85	Backing	None Detected
01C			None Detected
01A	Location 85	Mastic	None Detected
01B			None Detected
01C			None Detected
01B	Location 85	Paper	None Detected
01C			None Detected

Bold items represent materials that contain 0.5% or more asbestos, and are considered asbestos-containing materials, as per O.Reg 278/05, as amended.

Table 2 presents known asbestos-containing building materials, sampled previously and referenced as part of DST's background report review.

Table 2: Previously Identified Asbestos-Containing Materials		
Sample I.D.	**Sample Description**	**Asbestos Content and Type**
OHS-16-0712, Sample Set 06	Interior Plaster	1-3% Chrysotile Asbestos
OHS-16-0712, Sample Set 61	Exterior Plaster Soffit	2% Chrysotile Asbestos
OHS-16-0712, Sample Set 59	Vinyl Floor Tile – 12x12 White and Mastic	2-3% Chrysotile Asbestos
OHS-16-0712, Sample Set 58	Vinyl Floor Tile – 12x12 Tan	3% Chrysotile Asbestos
OHS-16-0712, Sample Set 54	Vinyl Floor Tile, 12x12 Tan	2% Chrysotile Asbestos
OHS-16-0712, Sample set 53	Vinyl Floor Tile – 12x12 Off-White Streaked	3% Chrysotile Asbestos
OHS-16-0712, Sample set 51	Aircell Insulation	62% Chrysotile Asbestos
OHS-16-0712, Sample Set 50	Parging Cement Pipe Insulation	33% Chrysotile Asbestos
OHS-16-0712-LH-441U-WC-1	Exterior Window Caulking	10% Chrysotile Asbestos
AEC-06-3580, Sample Set 2	Drywall Joint Compound	1.7% Chrysotile Asbestos

Bulk sampling and subsequent laboratory analysis and review of historical documentation have determined that the following materials contain regulated amounts of asbestos:

- Based on the random nature of asbestos identified in plaster materials throughout the Building and based on historical bulk sampling and visual observations, all plaster materials throughout the building shall be considered asbestos-containing. These include, but are not limited to, all plaster material layers associated with walls, ceilings and columns.
- Based on the random nature of asbestos identified in drywall joint compound throughout the Building and based on historical bulk sampling and visual observations, all drywall finishes with drywall joint compound throughout the building shall be considered asbestos-containing.
- Friable asbestos-containing pipe fitting and pipe straight insulation was observed in Locations 121, 122, 124, 125 and 129. Additional asbestos containing pipe fitting insulation are assumed present and concealed behind solid wall finishes.
- Non-friable asbestos-containing vinyl floor tiles and associated vinyl floor tile mastic were identified in Locations 16, 19, 21, 43, 44, 45, 50, 80, 81, 82, 83, 84, 85, 86, 87, 88, 103, 104, 119, 122 and 123.
- Non-friable asbestos-containing transite panels were identified on the exterior soffits of the building at the time of the survey.
- Non-friable asbestos-containing white caulking was identified on the exterior of the building at the time of the survey.

The roof was not included as part of this survey. As such, the roof membrane and any other suspect materials present on the roof should be considered asbestos-containing until proven otherwise through laboratory analysis or other supporting documentation.

6.2. Lead

Based on the review of historical documentation yellow, mauve, green, yellow/white, orange, pink, beige, green and grey wall paints do contain detectable concentrations of lead. Due to the nature of lead in painted surfaces and based on sampling conducted from previous reports, white paint shall be considered lead-containing. The following locations were determined to contain poor condition lead-containing paint:

- Lead-containing Grey Floor Paint was observed to be in poor condition within the basement corridor, Location 125. A total of 0.5 m^2 of damaged paint was observed.
- Lead-containing Yellow Wall Paint was observed to be in poor condition within the former Environment Canada office in Location 45. A total of 0.5 m^2 of damaged paint was observed.

Based on previous sampling programs and reporting, no additional lead paint samples were collected by DST for lead content analysis.

Lead is also suspected to be present in the following materials:

- Solder on the joints of copper piping;
- Cast iron drain pipe joint caulking;
- Ceramic tile glazing; and
- Emergency light batteries.

6.3. Mercury

Mercury is suspected to be present in the following:

- Fluorescent light fixtures containing fluorescent light tubes were observed throughout the building. Fluorescent light tubes contain mercury in a vapour form and in the phosphor coating on the lamp tube.

6.4. Silica

Based on the historical composition of building materials, silica is expected to be present in:

- Concrete and cement materials;
- Drywall and associated materials;
- Vinyl floor tiles;
- Ceramic tiles, mortar, grout;
- Mastics;
- Vinyl Sheet Flooring;
- Plaster; and
- Ceiling tiles.

6.5. Mould

DST observed approximately one (1) square metre of mould impacted drywall with asbestos-containing drywall joint compound in Location 26, Storage Room on the Ground floor at the time of the survey.

6.6. Hazardous Materials

6.6.1. Halocarbons

DST identified a refrigeration unit in Location 105 during the survey. Refrigerators are suspected to contain halocarbons. No other halocarbons were observed on site during the site inspection.

6.6.2. Stored Chemicals

Stored chemicals used for janitorial purposes were confirmed (or assumed, as applicable) to be present at the facility during the survey. No other stored chemicals were observed on site during the site inspection.

6.7. Other Designated Substances and Hazardous Materials

The following Designated Substances and Hazardous Materials were neither observed, nor suspected of being present, in forms or quantities expected to have an impact on future work operations based on the understood project scope of work taking place at 441 University Avenue, Windsor, Ontario:

- Acrylonitrile;
- Arsenic;
- Coke Oven Emissions;
- Urea Formaldehyde Foam Insulation (UFFI);
- Fuel, Oil and/or Waste Oil Storage;
- Ethylene Oxide;
- Radioactive Materials;
- Hazardous film or residue within the ducts;
- PCBs;
- Isocyanates; and
- Vinyl Chloride.

7.0 CONCLUSIONS AND RECOMMENDATIONS

Based on the site investigation, review of previous reports, sampling and analysis, the following Designated Substances and Hazardous Materials are present in forms and quantities expected to have an impact on future work operations based on the understood project scope of work taking place at 441 University Avenue, Windsor, Ontario:

- Asbestos;
- Lead;
- Mercury;
- Silica;
- Halocarbons;

- Mould; and
- Stored Chemicals.

DST's recommendations for each material, which are based upon both regulatory compliance and best practice guidelines, are included in the following sections below.

7.1. Asbestos

The disturbance of ACMs on construction and demolition projects in the province of Ontario is governed by *O.Reg. 278/05*, as amended. This regulation classifies all asbestos disturbances as Low Risk (Type 1), Moderate Risk (Type 2), or High Risk (Type 3), each of which has defined precautionary measures. All asbestos materials are subject to specific handling and disposal precautions, and must be removed prior to demolition. The Ontario Ministry of Labour (MoL) must be notified of any project involving removal of more than a minor amount (e.g. typically 1 square metre) of friable asbestos material.

The transport and disposal of asbestos waste is governed by *O. Reg. 347/90 – General – Waste Management*, as amended. This regulation requires that asbestos waste be sealed in appropriately labelled, double containers resistant to puncture and tears. The waste must be disposed at a licensed waste disposal site.

The time weight average exposure limit (TWAEL) for airborne asbestos is prescribed by O.Reg. 490/09 Designated Substances, as amended. Work procedures and personal protective equipment must be used to ensure that workers are not exposed to airborne asbestos levels that exceed this TWAEL.

Identified friable ACMs (pipe insulation, plaster materials and drywall joint compound which become friable when removed or disturbed) require a minimum of Type 2 abatement procedures under O.Reg. 278/05, as amended, when disturbing/removing/repairing one (1) square metre or less of the material. Should demolition, disturbance, or repair be required of more than one (1) square metre of friable ACM, Type 3 abatement procedures are required. It should be noted that the removal of good condition pipe fitting insulation can be completed using Type 2 glovebag procedures, provided the glovebag seal can be maintained throughout the removal process.

Type 1 work procedures can be used for the removal of non-friable ACMs (e.g. vinyl floor tiles, vinyl floor tile mastic, caulking and transite sheeting), provided that the material can be wetted and removed using only non-powered hand tools. If the material cannot be wetted during the operation, Type 2 work procedures must be used (provided also that only non-powered hand tools are used). If these conditions cannot be met more stringent work procedures will be required.
The breaking, cutting, drilling, abrading, grinding, sanding, or vibrating of non-friable asbestos-containing materials, if the work is done by means of a power tool that is attached to a dust-collecting device equipped with HEPA filters, can be performed using Type 2 asbestos work procedures. The breaking, cutting, drilling, abrading, grinding, sanding, or vibrating of non-friable

asbestos-containing materials, if the work is done by means of a power tool that is not attached to a dust-collecting device equipped with HEPA filters, requires Type 3 asbestos work procedures.

The following recommendations apply to ACMs and suspected ACMs:

- Appropriate work procedures and precautionary measures must be used, as outlined in *O.Reg. 278/05*, as amended, when performing work that may disturb ACMs or suspected ACMs, including prior to building demolition.
- Disturbance and/or removal of ACMs must be appropriately recorded as part of the building's Asbestos Management Plan.
- If ACMs or suspected ACMs become damaged and worker exposure to the material is likely to occur, the damaged material must be repaired or removed following work procedures outlined in *O. Reg. 278/05,* as amended.
- Disposal of asbestos waste is controlled by the Ontario Environmental Protection Act, *Regulation 347/90, General – Waste Management,* as amended. This regulation requires that asbestos waste be sealed in double containers resistant to puncture and tears, and appropriately labelled. The waste must be disposed at a licensed waste disposal site. Proper notification must be issued to the site representative prior to transportation of waste. The transport of the waste to the disposal site is controlled by the federal *Transportation of Dangerous Goods Act, 1992* (TDGA).

DST made every attempt to look above false ceilings and into wall cavity hatches. In spite of these efforts, some ACMs may be concealed and not observed at the time of the survey. As such, should any previously unidentified suspect ACMs be encountered as part of future work, these materials are to be treated as ACMs and handled accordingly, unless sampling proves otherwise. Materials that have not been analyzed, but are visibly similar to other materials identified as asbestos-containing, must be considered asbestos-containing unless proven otherwise by laboratory analysis.

7.2. Lead

The Occupational Health and Safety Branch of the Ontario Ministry of Labour have published *Guideline: Lead on Construction Projects*. This document 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.

Lead-containing materials have been confirmed (or assumed, as applicable) to be present at the facility. Paint and surface coatings containing elevated concentrations of lead can pose a health risk to humans if ingested or inhaled. Such lead paints are also a risk to the environment with the potential to contaminate soil and groundwater. Paints with elevated lead content can also pose a health risk to workers while completing activities that involve disturbance of the paints.

The TWAEL for airborne lead is prescribed by Ontario Regulation 490/09 Designated Substances, as amended. Work procedures and personal protective equipment must be used to ensure that workers are not exposed to airborne lead levels that exceed this TWAEL.

The disposal of construction waste containing lead is governed by O. Reg. 347/90 - General – Waste Management, as amended. The transport of the waste to the disposal site is controlled by the federal TDGA. Materials with elevated concentrations of lead should be subject to toxicity characteristic leaching procedure (TCLP) testing to determine toxicity with respect to lead prior to disposal, in accordance with O.Reg 347/90, as amended.

Prior to future work, the following additional procedures should be performed with respect to other anticipated lead-containing materials:

- Copper piping solder can be cut a small distance (e.g. 50 mm) from the joints to avoid direct disturbance of the lead material;
- Cast iron drain pipes can be cut away from the joints to avoid direct disturbance of the lead caulking in the joints;
- Ceramic tiles and terrazzo can be removed using Type 1 work procedures and respiratory protection provided that only non-powered hand tools are used. If these conditions cannot be met, than more stringent (Type 2 or 3) work procedures are required; and
- Emergency light batteries and other batteries should be removed when decommissioned and disposed of as lead-containing waste.

7.3. Mercury

There are no regulations that specifically govern the disturbance of mercury on construction projects. However, the Occupational Health and Safety Division of the Ontario MoL has published *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. In the absence of specific legislation for mercury on construction projects, this guideline would serve as a reasonable, peer reviewed standard for work procedures.

When removal of the fluorescent light tubes is required, the tubes should be removed intact from the fixtures and appropriately stored. This prevents worker exposure to mercury vapour, particularly if the tubes were energized shortly before removal.

The TWAEL for mercury is prescribed by *O.Reg. 490/09 Designated Substances*, as amended. Work procedures and personal protective equipment must be used to ensure that workers are not exposed to airborne mercury levels that exceed this TWAEL.

Liquid mercury is classified as a hazardous waste under *O.Reg. 347/90, as amended*. The transport of the waste to a disposal site is controlled by *O.Reg. 347/90* and by the federal *TDGA.* It is now common practice to recycle fluorescent light tubes, and other items containing mercury, recovering the component materials, and avoiding the generation of hazardous waste.

7.4. Silica

The Occupational Health and Safety Branch of the Ontario MoL have published *Guideline: Silica on Construction Projects*. 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. This guideline should be followed during disturbance of silica-containing materials. As a general rule, it is preferable to use more stringent dust suppression techniques and

engineering controls as opposed to relying on respiratory protection to control worker exposure. Respiratory protection should only be relied on as a last resort when dust suppression techniques and engineering controls fail to control worker exposure.

The TWAEL for airborne silica is prescribed by *O.Reg. 490/09 Designated Substances*, as amended. Work procedures and personal protective equipment must be used to ensure that workers are not exposed to airborne silica levels that exceed this exposure limit.

7.5. Halocarbons

Halocarbon-containing materials have been confirmed (or assumed, as applicable) to be present at the facility. The handling, transport and disposal of halocarbons is governed by the following:

- Ozone-depleting Substances Regulations, 1998, as amended;
- *O.Reg. 463/10, Ozone Depleting Substances and Other Halocarbons;*
- *O.Reg. 238/01, Refrigerants; and*
- Federal Halocarbon Regulations, 2003 (FHR).

When suspected halocarbon-containing equipment is taken out of service, the halocarbon refrigerants must be captured and reclaimed by a licensed technician. The presence of halocarbon refrigerants within unit's no longer in service should be verified. If halocarbon refrigerants are found to be present, they must be captured and reclaimed by a licensed technician. Appropriate records of equipment decommissioning must be maintained in accordance with requirements of the FHR.

7.6. Mould

Mould impacted materials have been confirmed (or assumed, as applicable) to be present at the facility. Currently, there are no regulations pertaining to mould on construction projects. Most jurisdictions have issued alerts or bulletins concerning the hazard of mould in indoor environments. The Canadian Construction Association (CCA) published the following document as a response to concerns in the construction industry: CCA 82-2004, "Mould Guidelines for the Canadian Construction Industry", 2004. The Guideline recommends Level I, II and III mould abatement procedures for small (<1 m^2), medium (1 m^2 to 10 m^2) and large scale (>10 m^2) mould abatement operations that are to be determined by professionals based on the extent and density of mould on site.

Mould remediation, if required to support other work operations such as salvage, the removal of suspected mould impacted building materials should follow the above noted guideline. In the case of conflict between mould and other requirements (e.g. asbestos), the more stringent precautionary measures shall apply.

Disturbing building systems with standing water (e.g., compromised roofing systems, cooling towers, and sprinkler systems) should consider the potential presence of elevated bacteria levels within the water. Appropriate worker precautionary measures should be implemented where worker exposure to elevated bacteria levels may occur.

7.7. Stored Chemicals

Stored chemicals have been confirmed (or assumed, as applicable) to be present at the facility. The handling and use of chemicals should be undertaken by those with proper training (e.g. Workplace Hazardous Materials Information System, etc.) and adhere to any applicable guidelines and/or regulations including all available Material Safety Data Sheets (MSDS). The following general recommendations are made for best management practices where applicable at the facility:

- Ensure that all staff requiring WHMIS or other specialized training, receive the training and that it remains current. Ensure training records are maintained and keep hardcopies of certificates.
- Unlabeled or improperly labeled containers should be appropriately labeled as per the Workplace Hazardous Materials Information System (WHMIS).
- Material Safety Data Sheets (MSDS) must be reviewed and updated at least once in a three year period, and new MSDS must be added for all new products when the products are received.
- Ensure that spill kits contain appropriate spill clean-up materials and that these materials are organized and stored neatly in a clearly marked area. Inspect spill kits on a regular basis and maintain records of such inspections. Spills should be reported to the proper authority.

8.0 CLOSURE

A Limitations of Report section, which forms an integral part of this report, is attached.

We trust that the information contained herein meets your needs. Should you have any questions or comments, please do not hesitate to contact us.

DST CONSULTING ENGINEERS INC.

Pedram Nejatbakhsh, B.E.S.
Environmental Scientist
pnejatbakhsh@dstgroup.com

Brendan Harrigan, P.Eng.
Director of Government Client Group
bharrigan@dstgroup.com

LIMITATIONS OF REPORT

This report is intended for client use only. Any use of this document by a third party, or any reliance on or decisions made based on the findings described in this report, are the sole responsibility of such third parties, and DST Consulting Engineers Inc. accepts no responsibility for damages, suffered by any third party as a result of decisions made or actions conducted based on this report. No other warranties are implied or expressed.

The data, conclusions and recommendations which are presented in this report, and the quality thereof, are based on a scope of work authorized by the client. The sampling program included asbestos bulk sampling in select representative areas for laboratory analysis. There is a practical limitation on the number of samples that can be collected in a building. This requires the investigator to extrapolate observations and analytical results between sample locations. The uncertainty, and inherent risk, associated with this necessity increases with the distance between sampling locations. Note, however, that no scope of work, no matter how exhaustive, can guarantee to identify all contaminants. This report therefore cannot warranty that all building conditions are represented by those identified at specific locations.

Recommendations, when included, are made in good faith and are based on several successful experiences. DST is not in a position to evaluate the health risks associated with exposure to the mould referenced in this report. Since human reactions to mould exposure vary widely amongst individuals, and specific segments of the population are generally recognized to be more susceptible than others, an evaluation of health risks can only be made on an individual basis and even then, only by a licensed medical practitioner equipped with knowledge of the individual's medical history.

Any use of this report by the client and any other party is contingent upon their understanding and acceptance of the following condition:

"Mould is a naturally occurring substance and regardless of the results of an assessment or how completely it is removed, it could reoccur."

Regardless of the effectiveness of any remedial actions, mould growth may occur/reoccur anywhere within a building at any time, should conditions be favourable. It is therefore essential to maintain buildings, surfaces, appliances and furnishings under conditions which are not favourable to mould incubation and growth (warm, dry, and clean). The scope of services provided by DST for this assignment did not include a detailed evaluation of the thermal and moisture management characteristics of the exterior wall assembly, or a detailed building envelope investigation to ascertain every potential root cause of the water infiltration that created an environment favourable to mould proliferation. Similarly, DST has not been engaged to provide detailed designs for the reinstatement of building finishes or for improvements to the building envelope.

Note also that standards, guidelines and practices related to DST's scope of work may change with time. Those which were applied at the time of this program may be obsolete or unacceptable at a later date.

Any comments given in this report on potential remediation problems and possible methods are intended only for the guidance of the designer. The scope of work may not be sufficient to

determine all of the factors that may affect construction, clean-up methods and/or costs. Contractors bidding on this project or undertaking clean-ups should, therefore, make their own interpretation of the factual information presented and draw their own conclusions as to how the conditions may affect their work.

Any results from an analytical laboratory or other subcontractor reported herein have been carried out by others, and DST Consulting Engineers Inc. cannot warranty their accuracy. Similarly, DST cannot warranty the accuracy of information supplied by the client.

APPENDIX A

Select Photographs

Photo 1: View of the poor condition asbestos-containing plaster observed in Location 43 in the Stairwell of the basement.

Photo 2: View of the asbestos-containing plaster debris observed in Location 5 in the Fan Room of the ground floor.

Photo 3: View of the damaged lead-containing paint observed in Location 45 in the Environment Canada Office of the second floor.

Photo 4: View of the mould impacted drywall with asbestos-containing drywall joint compound observed in Location 26 in the Storage Room of the ground floor.

APPENDIX B

Laboratory Certificates of Analysis – Bulk Asbestos

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Certificate of Analysis

DST Consulting Engineers Inc. (Toronto)

2680 Matheson Boulevard East, Suite 102
Mississauga, ON L4W 0A5
Attn: Pedram Nejatbakhsh

Client PO:
Project: GV S0 28018
Custody:

Report Date: 19-Dec-2016
Order Date: 16-Dec-2016

Order #: 1651434

This Certificate of Analysis contains analytical data applicable to the following samples as submitted:

Paracel ID	Client ID
1651434-01	1A (VSF)
1651434-02	1B (VSF)
1651434-03	1C (VSF)
1651434-04	1A (backing)
1651434-05	1C (backing)
1651434-06	1A (mastic)
1651434-07	1B (mastic)
1651434-08	1C (mastic)
1651434-09	1B (paper)
1651434-10	1C (paper)

Approved By:

Emma Diaz
Senior Analyst

PARACEL LABORATORIES LTD.

Order #: 1651434

Certificate of Analysis

Client: DST Consulting Engineers Inc. (Toronto)

Client PO:

Report Date: 19-Dec-2016

Order Date: 16-Dec-2016

Project Description: GV S0 28018

Asbestos, PLM Visual Estimation **MDL - 0.5%**

Paracel I.D.	Sample Date	Layers Analyzed	Colour	Description	Asbestos Detected:	Material Identification	% Content
1651434-01	15-Dec-16	sample homogenized	Brown	Vinyl Sheet Flooring	No	Client ID: 1A (VSF) [AS-PRE]	
						Non-Fibers	100
1651434-02	15-Dec-16	sample homogenized	Brown	Vinyl Sheet Flooring	No	Client ID: 1B (VSF) [AS-PRE]	
						Non-Fibers	100
1651434-03	15-Dec-16	sample homogenized	Brown	Vinyl Sheet Flooring	No	Client ID: 1C (VSF) [AS-PRE]	
						Non-Fibers	100
1651434-04	13-Dec-16	sample homogenized	Beige	Backing	No	Client ID: 1A (backing) [AS-PRE]	
						Cellulose	95
						Non-Fibers	5
1651434-05	13-Dec-16	sample homogenized	Beige	Backing	No	Client ID: 1C (backing) [AS-PRE]	
						Cellulose	95
						Non-Fibers	5
1651434-06	13-Dec-16	sample homogenized	Black	Mastic	No	Client ID: 1A (mastic) [AS-PRE]	
						Non-Fibers	100
1651434-07	13-Dec-16	sample homogenized	Black	Mastic	No	Client ID: 1B (mastic) [AS-PRE]	
						Non-Fibers	100
1651434-08	13-Dec-16	sample homogenized	Black	Mastic	No	Client ID: 1C (mastic) [AS-PRE]	
						Non-Fibers	100
1651434-09	13-Dec-16	sample homogenized	Grey	Paper	No	Client ID: 1B (paper) [AS-PRE]	
						Cellulose	95
						Non-Fibers	5
1651434-10	13-Dec-16	sample homogenized	Grey	Paper	No	Client ID: 1C (paper) [AS-PRE]	
						Cellulose	95
						Non-Fibers	5

Analysis Summary Table

Analysis	Method Reference/Description	Lab Location	NVLAP Lab Code *	Analysis Date
Asbestos, PLM Visual Estimation	by EPA 600/R-93/116	1 - Mississauga	200863-0	19-Dec-16

** Reference to the NVLAP term does not permit the user of this report to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the Federal Government.*

Qualifier Notes

Sample Qualifiers :

AS-PRE: Due to the difficult nature of the bulk sample (interfering fibers/binders), additional NOB preparation was required prior to analysis

Work Order Revisions / Comments

None

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Chain of Custody
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Page 1 of 1

Client Name:	DST Consulting Engineers Inc.	Project Reference:	GVSO28018
Contact Name:	Pedram Nejatbakhsh/ Ben Hau	Quote #:	
Address:	2680 Matheson Boulevard East, Suite 102 Mississauga, Ontario L4W 0A5	PO #:	
Telephone:	416-427-1968	Email Address:	pnejatbakhsh@dstgroup.com bhau@dstgroup.com

TAT: ☐ Regular ☐ 3 Day ☑ 2 Day ☐ 1 Day ☐ Same Day

Date Required: Monday Dec 19

ASBESTOS ANALYSIS

Matrix: ☐ Air ☐ Other **Regulatory Guideline:** O.Reg.278/05

Required Analyses: ☐ PCM ☑ PLM ☐ PLM 400PC ☐ PLM 1000PC ☐ Chatfield ☐ TEM

Paracel Order Number: 1651434

	Sample ID	Matrix Description	Sampling Date	Air Volume (L)	Positive Stop? (Y/N)	Is the Sample Layered? (Y/N)	If layered, Describe Layer(s) to be Analyzed Separately* or Homogenize all **
1	1A	Brown Vinyl Sheet Flooring	December 13, 2016		Y	Y	All layers* VSF, backing, m
2	1B	Brown Vinyl Sheet Flooring	December 13, 2016		Y	Y	All layers* VSF, paper, m
3	1C	Brown Vinyl Sheet Flooring	December 13, 2016		Y	Y	All layers* VSF, paper, backing, mastic
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							

*** Each layer is charged as a separate analysis** **** Homogenize = Sample is combined to a uniform mixture**

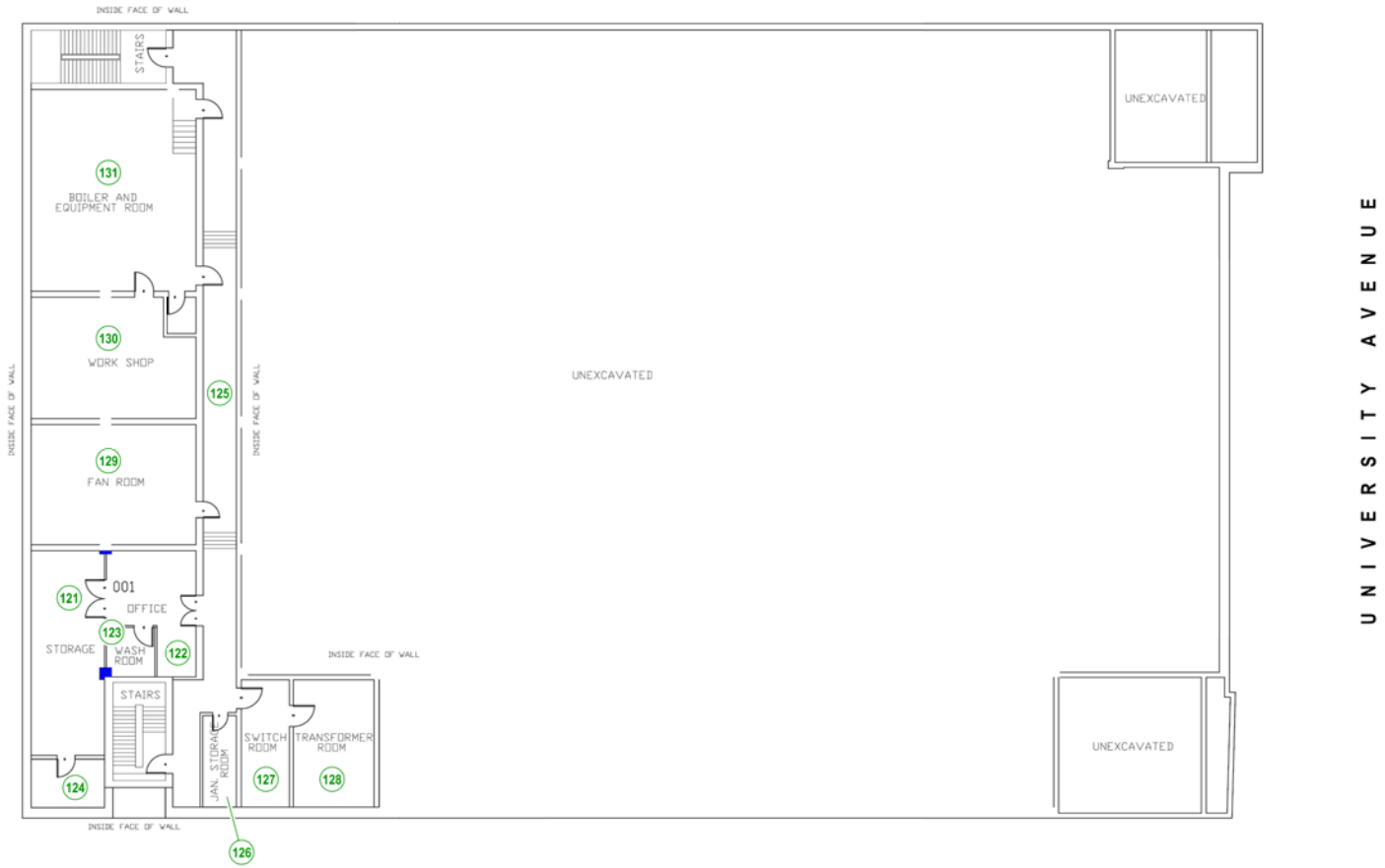
Comments: 2-3 layers

Method of Delivery: Rabbey

Relinquished By (Sign):	Received at Depot:	Received at Lab:	Verified By:
Relinquished By (Print): Pedram Nejatbakhsh			
Date/Time: December 15, 2016	Date/Time:	Date/Time: Dec 16/16 12:00	Date/Time: Dec 16/16 13:00

APPENDIX C

Site Plan



DST consulting engineers

Notes

1. This drawing shall be read in conjunction with the associated technical report.
2. Do not scale drawing.
3. All sample identifiers are prefixed with '28018-' which was excluded for drawing clarity.
4. Base drawings provided by client.

Legend

Location reference

Revision	Date	Issue	Approval
A	18-01-17	Final	B.H.

Client: PWGSC

Site: 441 University Avenue, Windsor, Ontario

Report Title: Hazardous Materials Survey

Drawing Title: Basement Level Sample Location Plan

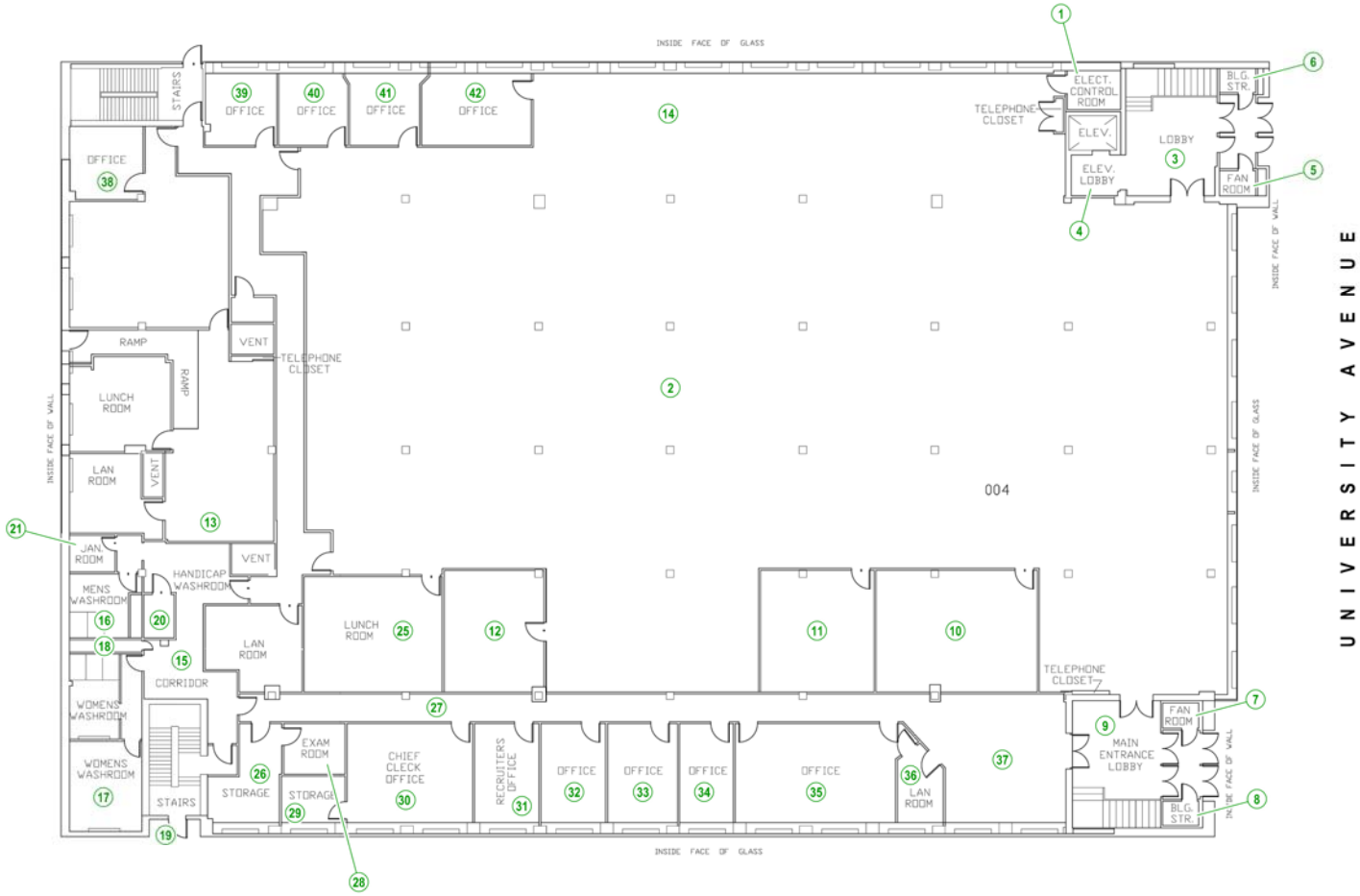
Designed By: P.N.	Scale: As shown
Drawn By: R.W.	Date: January 2017
Approved By: B.H.	Project No.: GV-SO-028018
Figure No.: 1	

Folder: L:\GV\GV\SO\GV\SO028018 PWGSC 441 University Windsor HazMat\AutoCAD\DWGs\2017 HazMat Survey Wednesday, January 18, 2017 @ 14:17 by Rob Wesson

Drawing: 1 basement.dwg

2150 Thurston Drive, Suite 203, Ottawa, Ontario K1G 5T9 Tel: (613) 748-1415 Fax: (613) 748-1356 Website: www.dstgroup.com

0 10 20 30 40 50 mm



Notes

1. This drawing shall be read in conjunction with the associated technical report.
2. Do not scale drawing.
3. All sample identifiers are prefixed with '28018-' which was excluded for drawing clarity.
4. Base drawings provided by client.

Legend

◯ Location reference

Revision	Date	Issue	Approval
A	18-01-17	Final	B.H.

Client: PWGSC

Site: 441 University Avenue, Windsor, Ontario

Report Title: Hazardous Materials Survey

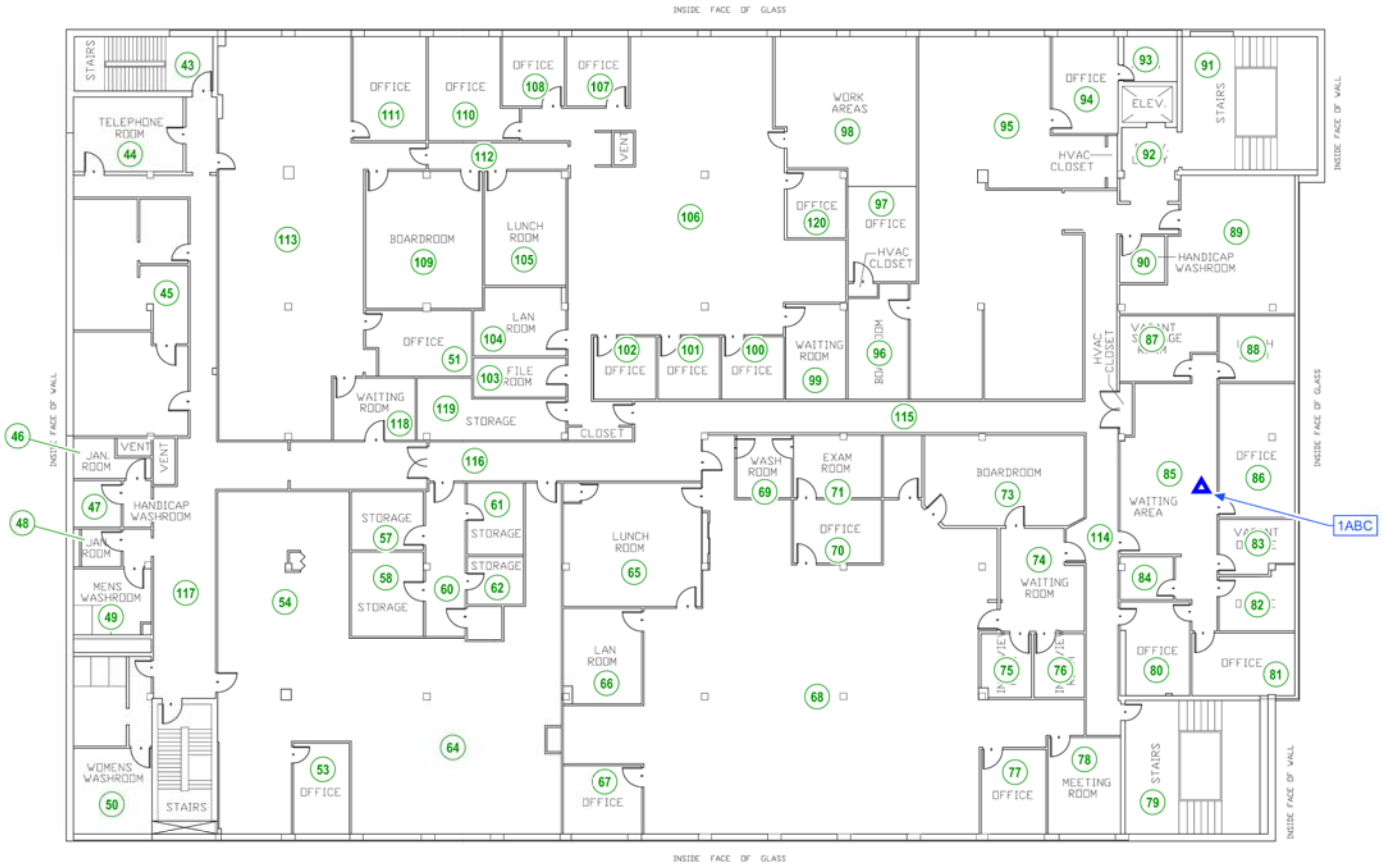
Drawing Title: First Floor Level Sample Location Plan

Designed By: P.N.	Scale: As shown
Drawn By: R.W.	Date: January 2017
Approved By: B.H.	Project No.: GV-SO-028018

Figure No. 2 T

2150 Thurston Drive, Suite 203, Ottawa, Ontario K1G 5T9 Tel: (613) 748-1415 Fax: (613) 748-1356 Website: www.dstgroup.com

Drawing: 2 1st floor.dwg Folder: L:\GV\GV\SO\GV\SO028018 PWGSC 441 University Windsor HazMat\AutoCAD\DWGs\2017 HazMat Survey Wednesday, January 18, 2017 @ 15:12 by Rob Wesson



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Notes

1. This drawing shall be read in conjunction with the associated technical report.
2. Do not scale drawing.
3. All sample identifiers are prefixed with '28018-' which was excluded for drawing clarity.
4. Base drawings provided by client.

Legend

Approximate asbestos sample location, as applicable

Location reference

Revision	Date	Issue	Approval
A	18-01-17	Final	B.H.

Client: PWGSC

Site: 441 University Avenue, Windsor, Ontario

Report Title: Hazardous Materials Survey

Drawing Title: Second Floor Level Sample Location Plan

Designed By: P.N.	Scale: As shown
Drawn By: R.W.	Date: January 2017
Approved By: B.H.	Project No.: GV-SO-028018
Figure No.: 3	

Folder: L:\GV\GV\SO\GVSO028018 PWGSC 441 University Windsor HazMat\AutoCAD\DWGs\2017 HazMat Survey Wednesday, January 18, 2017 @ 15:12 by Rob Wesson

Drawing: 3 2nd floor.dwg

2150 Thurston Drive, Suite 203, Ottawa, Ontario K1G 5T9 Tel: (613) 748-1415 Fax: (613) 748-1356 Website: www.dstgroup.com

0 10 20 30 40 50 mm

APPENDIX D

Room by Room Inventory

Location Number	Floor	Room Description	Material Description	Accessibility (A/B/C/D)	Friability (F/NF)	Quantity (m^2/LM)	Condition (G/F/P)	Comments
1	Ground	Electrical Control Room	Drywall Joint Compound	A	NF	10 m^2	Unknown	[1]Room inaccessible by DST personnel
			Vinyl Floor Tiles	A	NF	5 m^2	Unknown	
2	Ground	Human Resource Development Room	Drywall Joint Compound	A	NF	500 m^2	Unknown	[1]Room inaccessible by DST personnel
3	Ground	Lobby	Plaster	A	NF	100 m^2	G	
			Drywall Joint Compound	A	NF	20 m^2	G	
4	Ground	Elevator Lobby	Plaster	A	NF	40 m^2	G	
			Drywall Joint Compound	A	NF	20 m^2	G	
5	Ground	Fan Room	Plaster	A	NF	16 m^2	G	
			Plaster	A	NF	0.5 m^2	Debris	
6	Ground	Building Storage	Plaster	A	NF	16 m^2	G	
7	Ground	Fan Room	Plaster	A	NF	16 m^2	G	
8	Ground	Building Storage	Plaster	A	NF	16 m^2	G	
9	Ground	Main Entrance Lobby	Plaster	A	NF	120 m^2	G	
			Drywall Joint Compound	A	NF	25 m^2	G	
10	Ground	Meeting/Training Room	Drywall Joint Compound	A	NF	90 m^2	Unknown	[1]Room inaccessible by DST personnel
11	Ground	St. Clair College 003 Board Room	Drywall Joint Compound	A	NF	80 m^2	Unknown	[1]Room inaccessible by DST personnel
12	Ground	Board Room	Drywall Joint Compound	A	NF	80 m^2	Unknown	[1]Room inaccessible by DST personnel
13	Ground	Storage Room	Drywall Joint Compound	A	NF	100 m^2	Unknown	[1]Room inaccessible by DST personnel

Location Number	Floor	Room Description	Material Description	Accessibility (A/B/C/D)	Friability (F/NF)	Quantity (m^2/LM)	Condition (G/F/P)	Comments
14	Ground	Human Resource Development Canada	Drywall Joint Compound	A	NF	520 m^2	Unknown	[1]Room inaccessible by DST personnel
15	Ground	Vestibule	Plaster	A	NF	50 m^2	G	
			Drywall Joint Compound	A	NF	150 m^2	G	
16	Ground	Men's Washroom	Plaster	A	NF	40 m^2	G	
			Drywall Joint Compound	A	NF	90 m^2	G	
			Vinyl Floor Tile	A	NF	16 m^2	G	
17	Ground	Women's Washroom	Plaster	A	NF	98 m^2	G	
			Drywall Joint Compound	A	NF	55 m^2	G	
18	Ground	Pipe Shaft	Drywall Joint Compound	B	NF	20 m^2	G	
19	Basement, Ground and Second	Stairwell	Plaster	A	NF	110 m^2	G	
19		Stairwell	Vinyl Floor Tile	A	NF	10 m^2	G	
			Parging Cement	B	F	4 Fittings	G	
20	Ground	Handicap Washroom	Drywall Joint Compound	A	NF	62 m^2	G	
21	Ground	Janitor Room	Plaster	A	NF	100 m^2	G	
			Drywall Joint Compound	A	NF	20 m^2	G	
			Vinyl Floor Tile	A	NF	4 m^2	G	
22	Ground	LAN Room	Drywall Joint Compound	A	NF	20 m^2	Unknown	[1]Room inaccessible by DST personnel
23	Ground	Storage	Drywall Joint Compound	A	NF	30 m^2	Unknown	[1]Room inaccessible by DST personnel
24	Ground	LAN Room	Drywall Joint Compound	A	NF	78 m^2	G	
25	Ground	Lunch Room	Drywall Joint Compound	A	NF	60 m^2	Unknown	[1]Room inaccessible by DST personnel
26	Ground	Storage Room	Plaster	A	NF	40 m^2	G	
26	Ground	Storage Room	Drywall Joint Compound	A	NF	65 m^2	G	

Location Number	Floor	Room Description	Material Description	Accessibility (A/B/C/D)	Friability (F/NF)	Quantity (m^2/LM)	Condition (G/F/P)	Comments
			Drywall Joint Compound	A	NF	1 m^2	P	Ceiling
27	Ground	Corridor	Drywall Joint Compound	A	NF	500 m^2	G	
28	Ground	Exam Room	Drywall Joint Compound	A	NF	108 m^2	G	
29	Ground	Storage Room	Drywall Joint Compound	A	NF	108 m^2	G	
30	Ground	Chief Clerk Office	Plaster	A	NF	48 m^2	G	
			Drywall Joint Compound	A	NF	158 m^2	G	
31	Ground	Recruiters Office	Plaster	A	NF	25 m^2	G	
			Drywall Joint Compound	A	NF	105 m^2	G	
32	Ground	Office	Plaster	A	NF	25 m^2	G	
			Drywall Joint Compound	A	NF	105 m^2	G	
33	Ground	Office	Plaster	A	NF	28 m^2	G	
			Drywall Joint Compound	A	NF	110 m^2	G	
34	Ground	Office	Plaster	A	NF	22 m^2	G	
			Drywall Joint Compound	A	NF	100 m^2	G	
35	Ground	Exam Room	Plaster	A	NF	75 m^2	G	
			Drywall Joint Compound	A	NF	135 m^2	G	
36	Ground	LAN Room	Plaster	A	NF	15 m^2	G	
			Drywall Joint Compound	A	NF	55 m^2	G	
37	Ground	Vestibule	Plaster	A	NF	150 m^2	G	
37	Ground	Vestibule	Drywall Joint Compound	A	NF	85 m^2	G	
38	Ground	Office	Drywall Joint Compound	A	NF	100 m^2	Unknown	[1]Room inaccessible by DST personnel
39	Ground	Human Resource Development Canada	Drywall Joint Compound	A	NF	400 m^2	Unknown	[1]Room inaccessible by DST personnel
40	Ground	Human Resource Development Canada	Drywall Joint Compound	A	NF	350 m^2	Unknown	[1]Room inaccessible by DST personnel

Location Number	Floor	Room Description	Material Description	Accessibility (A/B/C/D)	Friability (F/NF)	Quantity (m^2/LM)	Condition (G/F/P)	Comments
41	Ground	Human Resource Development Canada	Drywall Joint Compound	A	NF	300 m^2	Unknown	[1]Room inaccessible by DST personnel
42	Ground	Human Resource Development Canada	Drywall Joint Compound	A	NF	300 m^2	Unknown	[1]Room inaccessible by DST personnel
43	Basement, Ground and Second	Stairwell	Plaster	A	NF	110 m^2	G	
			Plaster	A	NF	1.5 m^2	P	Basement Closet
			Plaster	A	NF	1 m^2	F	2nd Floor
			Vinyl Floor Tile	A	NF	10 m^2	G	
			Parging Cement	B	F	4 Fittings	G	
44	Second	Telephone Room	Plaster	A	NF	65 m^2	G	
			Plaster	A	NF	10 m^2	P	
			Drywall Joint Compound	A	NF	75 m^2	G	
			Vinyl Floor Tile	A	NF	25 m^2	G	
45	Second	Environment Canada	Plaster	A	NF	38 m^2	G	
			Plaster	A	NF	0.5 m^2	P	
			Drywall	A	NF	20 m^2	G	
			Vinyl Floor Tile	A	NF	20 m^2	G	
46	Second	Janitor's Room	Plaster	A	NF	20 m^2	G	
			Drywall Joint Compound	A	NF	75 m^2	G	
47	Second	Handicap Washroom	Plaster	A	NF	22 m^2	G	
			Drywall Joint Compound	A	NF	90 m^2	G	
48	Second	Janitor's Room	Plaster	A	NF	20 m^2	G	
			Drywall Joint Compound	A	NF	65 m^2	G	
49	Second	Men's Washroom	Plaster	A	NF	85 m^2	G	
			Drywall Joint Compound	A	NF	85 m^2	G	
50	Second	Women's Washroom	Plaster	A	NF	130 m^2	G	
50	Second		Drywall Joint Compound	A	NF	65 m^2	G	
50	Second		Vinyl Floor Tile	A	NF	32 m^2	G	
51	Second	Office	Drywall Joint Compound	A	NF	140 m^2	G	

Location Number	Floor	Room Description	Material Description	Accessibility (A/B/C/D)	Friability (F/NF)	Quantity (m^2/LM)	Condition (G/F/P)	Comments
52	Second	BLJC	Drywall Joint Compound	A	NF	135 m^2	G	
53	Second	Office	Plaster	A	NF	16 m^2	G	
			Drywall Joint Compound	A	NF	74 m^2	G	
54	Second	Vacant	Drywall Joint Compound	A	NF	160 m^2	G	
55	Second	Vacant	Drywall Joint Compound	A	NF	100 m^2	G	
56	Second	Vacant	Drywall Joint Compound	A	NF	60 m^2	G	
57	Second	Office	Drywall Joint Compound	A	NF	75 m^2	G	
58	Second	Interview Room	Drywall Joint Compound	A	NF	90 m^2	G	
59	Second	Exam	Drywall Joint Compound	A	NF	84 m^2	G	
60	Second	Health Canada 008	Drywall Joint Compound	A	NF	120 m^2	G	
61	Second	Quiet Room	Drywall Joint Compound	A	NF	80 m^2	G	
62	Second	Storage Room	Drywall Joint Compound	A	NF	45 m^2	G	
63	Second	Washroom	Drywall Joint Compound	A	NF	40 m^2	G	
64	Second	Corp of the City of Windsor	Plaster	A	NF	85 m^2	G	
			Drywall Joint Compound	A	NF	450 m^2	G	
65	Second	Lunch Room	Drywall Joint Compound	A	NF	250 m^2	G	
66	Second	LAN Room	Drywall Joint Compound	A	NF	110 m^2	G	
67	Second	Office	Plaster	A	NF	35 m^2	G	
			Drywall Joint Compound	A	NF	100 m^2	G	
68	Second	National Defence 006	Drywall Joint Compound	A	NF	600 m^2	G	
69	Second	Washroom	Drywall Joint Compound	A	NF	90 m^2	G	
70	Second	Office	Drywall Joint Compound	A	NF	110 m^2	G	
71	Second	Exam Room	Drywall Joint Compound	A	NF	110 m^2	G	
72	Second	Vacant	Drywall Joint Compound	A	NF	55 m^2	G	
73	Second	Boardroom	Drywall Joint Compound	A	NF	220 m^2	G	
74	Second	Waiting Room	Drywall Joint Compound	A	NF	185 m^2	G	
75	Second	Interview Room	Drywall Joint Compound	A	NF	95 m^2	G	
76	Second	Interview Room	Drywall Joint Compound	A	NF	95 m^2	G	
77	Second	Office	Drywall Joint Compound	A	NF	120 m^2	G	
			Plaster	A	NF	45 m^2	G	

Location Number	Floor	Room Description	Material Description	Accessibility (A/B/C/D)	Friability (F/NF)	Quantity (m^2/LM)	Condition (G/F/P)	Comments
78	Second	Meeting Room	Drywall Joint Compound	A	NF	140 m^2	G	
			Plaster	A	NF	65 m^2	G	
79	Second	Stairwell	Plaster	A	NF	140 m^2	G	
80	Second	Office	Plaster	A	NF	60 m^2	G	
			Drywall Joint Compound	A	NF	60 m^2	G	
			Vinyl Floor Tile	A	NF	12 m^2	G	
81	Second	Office	Plaster	A	NF	60 m^2	G	
			Drywall Joint Compound	A	NF	60 m^2	G	
			Vinyl Floor Tile	A	NF	12 m^2	G	
82	Second	Office	Plaster	A	NF	20 m^2	G	
			Drywall Joint Compound	A	NF	75 m^2	G	
			Vinyl Floor Tile	A	NF	10 m^2	G	
83	Second	Office	Plaster	A	NF	20 m^2	G	
			Drywall Joint Compound	A	NF	60 m^2	G	
			Vinyl Floor Tile	A	NF	10 m^2	G	
84	Second	Washroom	Drywall Joint Compound	A	NF	65 m^2	G	
			Vinyl Floor Tile	A	NF	6 m^2	G	
85	Second	DND Waiting Area	Drywall Joint Compound	A	NF	230 m^2	G	
			Vinyl Floor Tile	A	NF	40 m^2	G	
86	Second	Office	Plaster	A	NF	45 m^2	G	
			Drywall Joint Compound	A	NF	130 m^2	G	
			Vinyl Floor Tile	A	NF	20 m^2	G	
87	Second	Storage Room	Drywall Joint Compound	A	NF	140 m^2	G	
			Vinyl Floor Tile	A	NF	12 m^2	G	
88	Second	Lunch Room	Plaster	A	NF	25 m^2	G	
			Drywall Joint Compound	A	NF	75 m^2	G	
88	Second	Lunch Room	Vinyl Floor Tile	A	NF	13 m^2	G	
89	Second	Vacant 009	Plaster	A	NF	125 m^2	G	
89	Second	Vacant 009	Drywall Joint Compound	A	NF	135 m^2	G	
90	Second	Handicap Washroom	Drywall Joint Compound	A	NF	65 m^2	G	

Location Number	Floor	Room Description	Material Description	Accessibility (A/B/C/D)	Friability (F/NF)	Quantity (m^2/LM)	Condition (G/F/P)	Comments
91	Second	Stairs	Plaster	A	NF	140 m^2	G	
92	Second	Elevator Lobby	Plaster	A	NF	85 m^2	G	
			Drywall Joint Compound	A	NF	40 m^2	G	
93	Second	LAN Room	Plaster	A	NF	76 m^2	G	
94	Second	Office	Plaster	A	NF	80 m^2	G	
			Drywall Joint Compound	A	NF	80 m^2	G	
95	Second	Windsor Employment Resource Centre	Plaster	A	NF	40 m^2	G	
	Second		Drywall Joint Compound	A	NF	375 m^2	G	
96	Second	Boardroom	Drywall Joint Compound	A	NF	110 m^2	G	
97	Second	Office	Drywall Joint Compound	A	NF	110 m^2	G	
98	Second	Work Areas	Plaster	A	NF	48 m^2	G	
			Drywall Joint Compound	A	NF	140 m^2	G	
99	Second	Waiting Room	Drywall Joint Compound	A	NF	110 m^2	G	
100	Second	Office	Drywall Joint Compound	A	NF	100 m^2	G	
101	Second	Office	Drywall Joint Compound	A	NF	100 m^2	G	
102	Second	Office	Drywall Joint Compound	A	NF	100 m^2	G	
103	Second	File Room	Drywall Joint Compound	A	NF	90 m^2	G	
			Vinyl Floor Tile	A	NF	8 m^2	G	
104	Second	LAN Room	Drywall Joint Compound	A	NF	125 m^2	G	
			Vinyl Floor Tile	A	NF	14 m^2	G	
105	Second	Lunch Room	Drywall Joint Compound	A	NF	145 m^2	G	
106	Second	Revenue Canada 001	Plaster	A	NF	55 m^2	G	
			Drywall Joint Compound	A	NF	450 m^2	G	
107	Second	Office	Plaster	A	NF	25 m^2	G	
			Drywall Joint Compound	A	NF	75 m^2	G	
108	Second	Office	Plaster	A	NF	25 m^2	G	
108	Second	Office	Drywall Joint Compound	A	NF	75 m^2	G	
109	Second	Boardroom	Drywall Joint Compound	A	NF	180 m^2	G	
110	Second	Office	Plaster	A	NF	25 m^2	G	
			Drywall Joint Compound	A	NF	110 m^2	G	

Location Number	Floor	Room Description	Material Description	Accessibility (A/B/C/D)	Friability (F/NF)	Quantity (m^2/LM)	Condition (G/F/P)	Comments
111	Second	Office	Plaster	A	NF	25 m^2	G	
			Drywall Joint Compound	A	NF	105 m^2	G	
112	Second	Corridor	Drywall Joint Compound	A	NF	115 m^2	G	
113	Second	Former Revenue Canada Office	Plaster	A	NF	56 m^2	G	
			Plaster	A	NF	0.5 m^2	F	Electrical Panel and Windows
			Drywall Joint Compound	A	NF	20 m^2	G	
114	Second	Corridor	Plaster	A	NF	15 m^2	G	
			Drywall Joint Compound	A	NF	285 m^2	G	
115	Second	Corridor	Drywall Joint Compound	A	NF	420 m^2	G	
116	Second	Corridor	Drywall Joint Compound	A	NF	420 m^2	G	
117	Second	Corridor	Plaster	A	NF	15 m^2	G	
			Drywall Joint Compound	A	NF	285 m^2	G	
118	Second	Waiting Room	Drywall Joint Compound	A	NF	110 m^2	G	
119	Second	Storage Room	Drywall Joint Compound	A	NF	120 m^2	G	
			Vinyl Floor Tile	A	NF	18 m^2	G	
120	Second	Office	Drywall Joint Compound	A	NF	95 m^2	G	
121	Basement	Storage Room	Parging Cement	B	F	16 Fittings	G	
			Aircell	B	F	50 LM	G	
			Drywall Joint Compound	B	NF	35 m^2	G	
122	Basement	BLJC 001 Office	Drywall Joint Compound	B	NF	45 m^2	G	
			Vinyl Floor Tile	A	NF	38 m^2	G	
123	Basement	Washroom	Drywall Joint Compound	B	NF	60 m^2	G	
124	Basement	Storage Room	Parging Cement	B	F	4 Fittings	G	
125	Basement	Corridor	Parging Cement	B	F	8 Fittings	G	
130	Basement	Work Shop	Parging Cement	B	F	12 Fittings	G	
131	Basement	Boiler and Equipment Room	Plaster	B	NF	10 m^2	G	Washroom Ceiling
	Exterior	Building Exterior	Transite Soffit	B/C	NF	80 m^2	G	
	Exterior	Building Exterior	White Caulking	B/C	NF	40 LM	G	

[1]Data for ACMs made accessible to DST personnel are based solely on historical data, as available.

Accessibility
A – Access to all building occupants
B – Accessible to maintenance and operations without a ladder.
C – Accessible to maintenance and operations staff with a ladder. Also rarely entered locked areas.
D – Not normally accessible or without demolition.

Friability
F – Friable
NF – Non-Friable

Quantity
m^2 – Squared Metres
LM – Lineal Metres

Condition
G – Good
F – Fair
P – Poor

Notes
1 – DST was unable to access the location due to accessibility issues. Quantities are based on historical data, and was not verified at the time of site visit.