

S P E C I F I C A T I O N

A U G U S T 28 , 2024

ISSUED FOR TENDER
in one volume

CITY OF MISSISSAUGA - MAVIS S. MECHANICAL & ROOF RENEWAL

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HAMANN ENGINEERING
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TITLE: Mavis South Mechanical and Roof Renewal
LOCATION: 3185 Mavis Rd, L5C 1T7
CITY/TOWN: Mississauga
PROVINCE: Ontario

JOB NO.: 22312

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3. Entry Door Security Report by Securitas Technology Canada Co. dated May 30, 2024.
4. Structural Engineer report for CMU rapir in Truck wash Bay.

1. GENERAL**1.1 Work Covered by Contract Documents**

1.1.1 Work of this Contract comprises of architectural/mechanical/electrical/structural work at roof, roof section "B1", "B2" and "A2" renewal & main Entrance accessibility modifications at 3185 Mavis Rd, Mississauga, ON.

1.1.2 Architectural Work to consist of the following, but not limited to:

- .1 Full replacement of three (3) roof areas (B1, B2, A2), new roof drains, RTU curbs etc.
- .2 Replace main entrance door/frames and glazing (exterior & interior) with new aluminum doors & frames; provide new ADO buttons,
- .3 Replace elevator cabin, elevator doors at Ground & Second Floors and related equipment (power unit, jack etc.).
- .4 Update light fixtures in Machine Room, Corridor, Foyer & Vestibule.
- .5 Increase/relocate door openings at Corridor, Machine Room, extend corridor into Men's locker room.
- .6 Construct a new BF ramp over existing slab and raise concrete floor at Machine room.
- .7 Removal of existing brick chimney to below roof deck level and make good wood roof deck and sub-structure.
- .8 Contractor to Complete the Project Summary and Warranty report (Schedule B) as a requirement for Substantial Completion.

1.1.3 Mechanical Work to consist of the following, but not limited to:

- .1 Replace Seven (7) HVAC rooftop units (HVAC-2, HVAC-5, HVAC-6, AC-4, AC-5, HVAC-7, HVAC-8) with new. Include all accessories, controls and integration to the BAS, any required structural modification and electrical to suit;
- .2 Replace Eight (8) Exhaust Fans with new, including ductwork modifications, controls, and electrical to suit;
- .3 Replace Existing gas fired domestic hot water heater with new, including new venting, plumbing and electrical to suit.
- .4 Contractor to Complete the Project Summary and Warranty report (Schedule B) as a requirement for Substantial Completion.

1.1.4 Electrical Work to consist of the following, but not limited to:

- .1 Elevator modernization
 - a. Replacement of existing elevator with new. Provide new lighting, power, and conduit infrastructure for data and telephone to the new elevator to suit. (Data & telephone work by others)
- .2 Main entrance renovation
 - a. Provide new lighting, power, and security rough-in at the main entrance and hallways.
- .3 Mechanical RTU and Exhaust fan and gas-fired water heater replacement
 - a. Replace the existing RTU, exhaust fans, and gas-fired water heater with new per mechanical drawing.
 - i. Where the new unit matches the existing one, re-use the existing feeder and reconnect to the new unit.

- ii. Where new units are larger than the existing ones, provide new conduit, wiring, and fused disconnect switch and connect to new equipment.

1.1.5 Structural Work to consist of the following, but not limited to:

.1 At Ground Floor

- a. Remove an existing slab on grade corridor ramp
- b. Replace with a new slab on grade ramp at a new location
- c. Increase a corridor entrance width each end and replace existing lintels with new
- d. Infill an existing corridor door opening and cut a new corridor door opening with new lintel
- e. Raise the existing slab elevation with concrete infill on rigid insulation in the existing Machine Room

.2 Existing Roof

- a. Upon removal for replacement of existing roof top units fill duct openings through the existing roof
- b. Structure and make good roofing.
- c. Provide timber roof framing reinforcing where indicated below the replacement units on timber roof construction
- d. Provide steel channel reinforcing where indicated below the replacement units on steel roof construction.

1.2 **Contract Method**

1.2.1 Construct Work under stipulated price contract.

1.3 **Work Sequence**

1.3.1 Coordinate all works in an efficient, effective and safe manner and ensure there are no interruptions of City operations. Coordinate sequential construction, completion, and turnover of areas as per Project Scope.

1.3.1.1 Phasing of work in office area:

- .1 Contractor to limit impact and downtime to office areas. Demolition or start up to occur only when equipment and supplies are available onsite.
- .2 To limit downtime, contractor to coordinate and phase interior installation work of:
 - a. Roof drains with roofing, and
 - b. Ductwork with delivery of rooftop units
- .3 Coordinate with City Project Manager timing of replacement of HVAC-9, EF-10 and interior work required at the second floor office area:
 - a. A maximum of 5 working days (1 week of downtime is permitted)
 - b. If required, Contractor to include after hours and weekend work to complete this phase of work.
 - c. Reinstatement of second floor washrooms can continue beyond 5 working day period.
 - d. Contractor to coordinate dates and duration of work with City Project Manager.

1.3.2 Within 5 business days of contract execution, the General Contractor shall submit a draft Project schedule clearly indicating work phases, timelines for work in office areas and anticipated shutdowns, to the Owner for review.

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- 1.3.3 Construction Schedule:
.1 Refer to CCDC 2.
- 1.3.4 Maintain fire egress routes at all times.
- 1.3.5 Co-ordinate Progress Schedule among all sub-contractors.
.1 Other trades or service providers retained by the Owner will be allowed to access the site during the construction period. These trades include the following, but not limited to: data & communications distribution. A complete list of trades and their work schedule will be provided to the successful Bidder to incorporate into their schedule.

1.4 Contractor Use of Premises

- 1.4.1 This remains an active works yard with year-round activities that includes road maintenance and winter plowing. Contractor shall coordinate and seek approval of all related site activities with the Owner, this includes:
- o Construction trailer set up and trade parking.
 - o Laydown area.
 - o Crane lifts.
- 1.4.2 Limit use of premises for the Work, for storage and for access, to allow:
.1 Owner's access around the area of Work.
.2 Consultants' access around the area of Work.
- 1.4.3 Co-ordinate use of premises under direction of the Owner.
- 1.4.4 Obtain and pay for use of additional storage or work areas needed for operations under this Contract.
- 1.4.5 Repair or replace portions of existing building space which have been altered during construction operations, as directed by the Consultant.
- 1.4.6 At completion of operations bring up the condition of existing building space to: equal to or better than that which existed before new work started.
- 1.4.7 Maintain fire access/control at all time. Unless construction process obstruct any of fire exits, General Contractor to post directional signage to closest access to exit. Contractor's vehicles and machinery's parked at the fire access route will be ticketed or towed at the Contractor's expense.

1.5 Owner's Furnished Items and G.C.'s Responsibilities

- 1.5.1 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 the Consultant notification of observed discrepancies or problems anticipated due to non-conformance with the Contract Documents.
 - .3 Receive and unload products at site.
 - .4 Inspect deliveries; 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 local authorities having jurisdiction.
 - .9 All existing building items and equipment noted to remain, must be replaced or repaired to existing or better condition, if damaged by the Contractor or subcontractor on site (under Contractor's control). The cost of such repairs and/or replacements must be covered by the Contractor.
 - .10 Clean up thoroughly the site and all areas affected by this work. Return the site to its original or better condition.

.11 Work in occupied office areas:

- Prior to any work being done, coordinate scheduling with the Owner for:
 - City's vendor to move and reinstall office furniture and equipment at City's cost.
 - Relocation of Office staff where required by City.
- Provide adequate health and safety delineation and/or hoarding in office spaces to undertake the work.
 - Additional designated substances survey testing as required through Cash Allowance
- Provide adequate protection in areas of work:
 - During demolition of second floor washroom, protect floor finishes, vanities, toilet partitions, washroom plumbing fixtures, and protect or remove and reinstall all wall hung accessories.
 - Provide floor protection in all carpeted office areas when undertaking work, tarp for dust control, and provide plywood protection when using lifts.
 - Provide floor to ceiling dust tight partition to completely close off the area of work.
 - Contractor is to clean and remove dust and debris at all areas of the work at the end of the work shift.
 - Completely remove barriers when the works are finished and remove and make good all finishes.
 - Maintain walking isles and access to existing exit stairs at all times.
 - During vestibule reconstruction, exit pathway from second floor exist stair to be maintained for emergency purposes only.
- For areas that require concrete and concrete block demolition, Contractor to minimize dusting:
 - Cover or wet down dry materials and exhaust dust under negative pressure to exterior.
 - Remove debris immediately after demolition.
- Fire Alarm and Sprinkler System
 - Contractor responsible to coordinate fire alarm bypass and reactivation.
 - Contractor responsible to coordinate Fire Watch as required under Cash Allowance.
 - Contractor to limit sprinkler and fire alarm downtime.

1.6 Existing Services

- 1.6.1 Notify the Owner and utility companies of intended interruption of services and obtain required permission.
- 1.6.2 Submit schedule to and obtain approval from the Owner for any shut-down or closure of active service or facility including power and communications services. Adhere to approved schedule and provide min 72hr notice to affected parties. Minimize duration of interruptions.
- 1.6.3 Where unknown services are encountered, immediately advise the Consultant and confirm findings in writing.
- 1.6.4 Protect, relocate or maintain existing active services. When inactive services are encountered, cap off in manner approved by authorities having jurisdiction.
- 1.6.5 Record locations of maintained, re-routed and abandoned service lines.

1.7 Documents Required

Maintain at the job site at all times, one copy of each document as follows:

- 1.7.1 Contract Drawings & Approved Permit Drawings printed in color.
- 1.7.2 Specifications.
- 1.7.3 Addenda.
- 1.7.4 Reviewed Shop Drawings.
- 1.7.5 List of Outstanding Shop Drawings.
- 1.7.6 Change Notices and Change Orders.
- 1.7.7 Other Modifications to Contract.
- 1.7.8 Field Test Reports.
- 1.7.9 Copy of Approved Work Schedule.
- 1.7.10 Health and Safety Plan and Other Safety Related Documents.
- 1.7.11 Other documents as specified.

2. PRODUCTS**2.1 Long Lead Items:**

- 2.1.1 The Contractor shall identify long lead items for early approval of shop drawings. These items may include the following, but not limited to:
 - .1 Flooring material
 - .2 Walls material

3. EXECUTION

N/A

END OF SECTION 01 11 00

1. GENERAL**1.1 References**

1.1.1 None.

1.2 Cash Allowances

1.2.1 Include in the Contract Price specified cash allowances.

1.2.2 Refer CCDC 2 and Supplemental Conditions GC 4.1 for Cash Allowance General Conditions.

1.2.3 Contract Price and not the cash allowance, includes the Contractor's overhead and profit for the Work in connection with each cash allowance.

1.2.4 Contract Price will be adjusted by written order to provide for excess or deficit to each cash allowance.

1.2.5 Where costs under a cash allowance exceed amount of allowance, Contractor will be compensated for excess incurred and substantiated plus allowance for overhead and profit as set out in the Contract Documents.

1.2.6 Include progress payments on accounts of the Work authorized under cash allowances in Consultant's monthly certificate for payment.

1.2.7 Prepare schedule jointly with the Consultant to show when items called for under cash allowances must be authorized by the Consultant for ordering purposes so that progress of the Work will not be delayed.

1.2.8 Scope of Work included in Cash Allowance are as follows:

.1 City of Mississauga Security Vendor of Record (Securitas) to provide:

- Cables for card readers and associated devices
- Access control devices, Card reader, PIR-TREX (reuse existing)
- CX12 relay for Door Card reader provided with new Door Operator

.2 Locksmith quotation (Royal Security Solutions Inc.)

.3 Amount to re-connect diffuser and repair ductwork if needed.

.4 City of Mississauga Fire Protection VOR (EPI Fire) to provide 24/7 fire watch during sprinkler head/piping temporary removal and reinstallation.

.5 New RTU Control work and connection to existing BAS. (Modern Niagara)

.6 Testing and Inspection

.7 Additional designated substances survey testing as required

2. PRODUCTS

N/A

3. EXECUTION

N/A

END OF SECTION

1. GENERAL**Summary**

- A. This Section includes administrative and procedural requirements for handling requests for equals and substitutions made after award of the Contract.
- B. In the event of Request for Substitution, the Contractor shall provide the following for the review and approval by the Architect within first 14 days of the start of Tender period: Catalog numbers and specific brands / lines or trade names used in materials, products, samples, equipment and systems. The Architect will review against requirements set in the Specifications to establish the standards of quality, utility and appearance required. Alternative products which are of equal quality and of equal required characteristics for the purpose intended may be proposed for use provided the Contractor complies with the following provisions:
 - .1 Division 01 Section 01 33 00 "Submittal Procedures" specifies requirements for submitting the Contractor's Construction Schedule and the Submittal Schedule.
 - .2 Division 01 Section 01 61 00 "Common Product Requirements" specifies requirements governing the Contractor's selection of products and product options.
- C. Equals and Substitutions will only be authorized by the Architect.

1.1 Related Requirements

- 1.1.1 Construction Drawings, Technical Specifications, Addenda, and general provisions of the Contract, including Contract General Conditions and Supplementary General Conditions and other Division 1 Specification Sections, apply to this Section.
- 1.1.2 Section 01 10 00 – Work Summary.

1.2 References

- 1.2.1 Canadian Construction Documents Committee (CCDC)
 - .1 CCDC 23-2005, A Guide to Calling Bids and Awarding Contracts.

1.3 Equals or Substitution Request Submittals:

- 1.3.1 The Owner and the Architect will consider requests for equals or substitutions if made within first 14 days of the start of Tender period. The information on all materials shall be consistent with the information herein.
- 1.3.2 After the contract award, the substitutions will only be considered for materials, products or systems specified that are no longer available. It will not be considered if the product was not purchased in a reasonable time after award. The Contractor shall submit all equal and substitutions requests in a form of a written document associated with all respective information for the Architect's review.
- 1.3.3 In order to enable the Owner and the Architect to determine that the proposed Equal or Substitution is or is not substantially equal to the first listed manufacturer or procedure, the Contractor is required to prepare and submit the required data for the first manufacturer listed or procedure listed in the specifications section with reference to the proposed Equal or Substitution.
 - .1 Identify the product, the fabrication and installation method to be replaced in each request. Include related Specification Section and Drawing numbers.
 - .2 A detailed comparison chart of significant qualities of the proposed substitution with those of the Work specified. Significant qualities may include elements, such as performance, weight, size, durability, and visual effect.
 - .3 Product Data, including Shop Drawings and descriptions of products and fabrication and installation procedures.
 - .4 Samples, where applicable or requested.
 - .5 A statement indicating the effect on the Contractor's Construction Schedule compared to the schedule without approval of the Equal or Substitution. Indicate the effect on overall Contract Time.

- .6 Cost information, broken down, including a proposal of the net change, if any in the Contract Sum.
- .7 The Contractor's certification that the proposed Equal or Substitution conforms to requirements in the Contract Documents in every respect and is appropriate for the applications indicated.
- .8 The Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of the failure of the Equal or Substitution to perform adequately.
- 1.3.4 The Contractor's submission which are not clearly identified as a request for an Equal or Substitution, will not be considered or accepted as a valid request for an Equal or Substitution, nor does it constitute an approval.
- 1.3.5 If the proposed request requires the Owner to incur additional responsibilities, including but not limited to, additional compensation to the Architect for redesign and evaluation services, increased cost of other construction by the Owner or similar considerations, then the Owner will have just cause to reject the request for Equal or Substitution, or additional compensations are to be buried by the Contractor.

1.4 **Architect's Action**

- 1.4.1 If necessary, the Architect will request additional information or documentation for evaluation within five (5) days of receipt of the original request for Equal or Substitution request. The Architect will notify the Owner of recommended acceptance or rejection of the proposed equal or substitution, within seven (7) days of receipt of the request, or five (5) days of receipt of additional information or documentation, whichever is later.
 - .1 Any request deemed an "Equal" and accepted by the Architect will result in written notification to the Contractor and will not be in the form of a change order for an "Equal".
 - .2 Any request deemed a "Substitution" and accepted by the Architect may result in written notification to the Contractor and may be in the form of a change order or written notification.

2. **PRODUCTS** N/A

3. **EXECUTION** N/A

END OF SECTION

1. GENERAL**1.1 Administrative**

- 1.1.1 Schedule and administer project meetings throughout the progress of the Work.
- 1.1.2 Prepare agenda for meetings.
- 1.1.3 Distribute written notice of each meeting four days in advance of meeting date to the Client and the Consultants (Architect and Engineers).
- 1.1.4 Provide physical space and make arrangements for meetings.
- 1.1.5 Preside at meetings.
- 1.1.6 Record the meeting minutes. Include significant proceedings and decisions. Identify actions by parties.
- 1.1.7 Reproduce and distribute copies of minutes within three days after meetings and transmit to meeting participants and affected parties not in attendance.
- 1.1.8 Representative of the Contractor, subcontractor and suppliers attending meetings must be qualified and authorized to act on behalf of the party each represents.

1.2 Pre-Construction Meeting

- 1.2.1 Within 7 days after award of the Contract, request a meeting of parties in the Contract to discuss and resolve administrative procedures and responsibilities.
- 1.2.2 Representatives of the Client, Consultants, Contractor, major subcontractors, field inspectors and supervisors will be in attendance.
- 1.2.3 Establish time and location of meeting and notify parties concerned minimum five days before meeting.
- 1.2.4 Agenda to include:
 - .1 Appointment of official representative of participants in the Work.
 - .2 Schedule of Work in accordance with the Contract Document.
 - .3 Schedule of submission of shop drawings, samples etc. Submit submittals in accordance with Section 01 33 00 – Submittal Procedures.
 - .4 Requirements for temporary facilities, site sign, offices, storage sheds, utilities, fences.
 - .5 Delivery schedule of specified equipment.
 - .6 Site security.
 - .7 Proposed changes, change orders, procedures, approvals required, mark-up percentages permitted, time extensions, overtime, administrative requirements.
 - .8 Client provided products.
 - .9 Record drawings.
 - .10 Maintenance manuals in accordance with Section 01 78 00 – Closeout Submittals.
 - .11 Take-over procedures, acceptance, warranties in accordance with Section 01 78 00 – Closeout Submittals.
 - .12 Monthly progress claims, administrative procedures, photographs, hold backs.
 - .13 Appointment of inspection and testing agencies or firms.

1.3 Progress Meetings

- 1.3.1 During the course of Work and two weeks prior to project completion, schedule progress meetings every two weeks.
- 1.3.2 Contractor, major subcontractors involved in the Work, Consultant and Client are to be in attendance.
- 1.3.3 Notify parties minimum four days prior to meetings.
- 1.3.4 Record minutes of meetings and circulate to attending parties and affected parties not in attendance within three days after meeting.
- 1.3.5 Agenda to include the following:
 - .1 Review, approval of minutes of previous meeting.
 - .2 Review of the 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.

2. **PRODUCT**
N/A

3. **EXECUTION**
N/A

END OF SECTION

1. GENERAL**1.1 Administrative**

- 1.1.1 Submit to the Consultant submittals listed for review. Submit promptly and in orderly sequence to not cause delay in the 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.
- 1.1.2 Do not proceed with the Work affected by submittal until review is complete.
- 1.1.3 Present shop drawings, product data, samples and mock-ups in SI Metric units.
- 1.1.4 Where items or information is not produced in SI Metric units converted values are acceptable.
- 1.1.5 Review submittals prior to submission to the Consultant. 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 the Work and Contract Documents. Submittals not stamped, signed, dated and identified as to specific project will be returned without being examined and considered rejected.
- 1.1.6 Notify the Consultant, in writing at time of submission, identifying deviations from requirements of the Contract Documents stating reasons for deviations.
- 1.1.7 Verify field measurements and ensure affected adjacent Work are co-ordinated.
- 1.1.8 Contractor's responsibility for errors and omissions in submission is not relieved by Consultant's review of submittals.
- 1.1.9 Contractor's responsibility for deviations in submission from requirements of the Contract Documents is not relieved by the Consultant review.
- 1.1.10 Keep one reviewed copy of each submission on site.

1.2 Shop Drawings and Product Data

- 1.2.1 The term "shop drawings" means drawings, diagrams, illustrations, schedules, performance charts, brochures and other data which are to be provided by the Contractor to illustrate details of a portion of the Work.
- 1.2.2 Submit drawings stamped and signed by professional engineer registered or licensed in the Province of Ontario, Canada.
- 1.2.3 Indicate materials, methods of construction and attachment or anchorage, erection diagrams, connections, explanatory notes and other information necessary for completion of the Work. Where articles or equipment attach or connect to other articles or equipment, indicate that such items have been co-ordinated, regardless of the Section under which adjacent items will be supplied and installed. Indicate cross references to design Drawings and Specifications.
- 1.2.4 Allow 10 days for the Consultant's review of each submission.
- 1.2.5 Adjustments made on the shop drawings by the Consultant are not intended to change Contract Price. If adjustments affect value of the Work, state such in writing to the Consultant prior to proceeding with the Work.
- 1.2.6 Make changes in shop drawings as the Consultant may require, consistent with the Contract Documents. When resubmitting, notify the Consultant in writing of revisions other than those requested.
- 1.2.7 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
- 1.2.8 Submissions include:
 - .1 Date and revision dates
 - .2 Project title and number
 - .3 Name and address of:
 - .1 Subcontractor.

- .2 Supplier.
- .3 Manufacturer.
- .4 Contractor's stamp, signed by Contractor's authorized representative certifying approval of submissions, verification of field measurements and compliance with the 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.
- 1.2.9 After the Consultant's review, distribute copies.
- 1.2.10 Submit electronic copy of shop drawings for each requirement requested in the Specification Sections and as the Consultant may reasonably request.
- 1.2.11 Submit electronic copies of product data sheets or brochures for requirements requested in the Specification Sections and as requested by the Consultant where shop drawings will not be prepared due to standardized manufacture of product.
- 1.2.12 Submit electronic copies of test reports for requirements requested in the Specification Sections and as requested by the Consultant.
 - .1 Report signed by authorized official of testing laboratory that material, product or system identical to material, product or system to be provided has been tested in accord with specified requirements.
 - .2 Testing must have been within three years of date of the Contract award for project.
- 1.2.13 Submit electronic copies of certificates for requirements requested in the Specification Sections and as requested by the Consultant.
 - .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.
- 1.2.14 Submit electronic copies of manufacturer's instructions for requirements requested in the Specification Sections and as requested by the Consultant: Pre-printed material describing installation of product, system or material, including special notices and the Material Safety Data Sheets concerning impedances, hazards and safety precautions.
- 1.2.15 Submit electronic copies of the manufacturer's field reports for requirements requested in the Specification Sections and as requested by the Consultant.
- 1.2.16 Documentation of the testing and verification actions taken by manufacturer's representative to confirm compliance with manufacturer's standards or instructions.
- 1.2.17 If, upon review by the Consultant, no errors or omissions are discovered or if only minor corrections are made, copies will be returned and fabrication and installation of the 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 the Work may proceed.

1.3 Samples

- 1.3.1 Submit for review samples in duplicate as requested in the respective Specification Sections. Label samples with origin and intended use.

- 1.3.2 Deliver samples prepaid to the Consultant's business address.
- 1.3.3 Notify Consultant in writing at time of submission of deviations in samples from requirements of the Contract Documents.
- 1.3.4 Where colour, pattern or texture is criterion, submit full range of samples.
- 1.3.5 Adjustments made on samples by the Consultant are not intended to change the Contract Price. If adjustments affect value of the Work, state such in writing to the Consultant prior to proceeding with the Work.
- 1.3.6 Make changes in the samples which the Consultant may require, consistent with the Contract Documents.
- 1.3.7 Reviewed and accepted samples will become standard of workmanship and material against which installed work will be verified.

1.4 **Photographic Documentation**

- 1.4.1 Submit electronic copy of colour digital photography in “jpg” format, fine resolution monthly with progress draw statement and as directed by the Consultant.
- 1.4.2 Project identification: name and number of project and date of exposure indicated.
- 1.4.3 Number of viewpoints: minimum of two locations. Viewpoints and their location as determined by the Consultant.
- 1.4.4 Frequency of photographic documentation: weekly and as directed by the Consultant. Upon completion of framing and services before concealment of the Work, and as directed by the Consultant.

2. **PRODUCTS**

N/A

3. **EXECUTION**

N/A

END OF SECTION 01 33 00

1. GENERAL**1.1 References**

- 1.1.1 Canada Labour Code, Part 2, Canada Occupational Safety and Health Regulations
- 1.1.2 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).
- 1.1.3 Province of Ontario
 - .1 Occupational Health and Safety Act, R.S.O. 1990, Updated 2005.

1.2 Action and Informational Submittals

- 1.2.1 Make submittals in accordance with Section 01 33 00 - Submittal Procedures.
- 1.2.2 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 Current up-to-date Certificate of WSIB coverage
- 1.2.3 Submit 3 copies of Contractor's authorized representative's work site health and safety inspection reports to the Owner, Consultant, and authority having jurisdiction.
- 1.2.4 Submit copies of reports or directions issued by Federal, Provincial and Territorial health and safety inspectors.
- 1.2.5 Submit copies of incident and accident reports.
- 1.2.6 Submit WHMIS MSDS - Material Safety Data Sheets
- 1.2.7 Consultant will review Contractor's site-specific Health and Safety Plan and provide comments to Contractor within 7 days after receipt of plan. Revise plan as appropriate and resubmit plan to the Owner and Consultant within 4 days after receipt of comments from the Consultant.
- 1.2.8 Consultant'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.
- 1.2.9 Medical Surveillance: where prescribed by legislation, regulation or safety program, submit certification of medical surveillance for site personnel prior to commencement of Work, and submit additional certifications for any new site personnel to the Owner.
- 1.2.10 On-site Contingency and Emergency Response Plan: address standard operating procedures to be implemented during emergency situations.

1.3 Filing Of Notice

- 1.3.1 File Notice of Project with Ontario authorities prior to beginning of Work.

1.4 Safety Assessment

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

1.5 Meetings

- 1.5.1 Schedule and administer Health and Safety meeting with the Owner prior to commencement of Work.

1.6 General Requirements

- 1.6.1 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.
- 1.6.2 Owner may respond in writing, where deficiencies or concerns are noted and may request re-submission with correction of deficiencies or concerns.

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- 1.7 **Responsibility**
- 1.7.1 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.
- 1.7.2 Comply with and enforce compliance by employees with safety requirements of Contract Documents, applicable federal, provincial, territorial and local statutes, regulations, and ordinances, and with site-specific Health and Safety Plan.
- 1.8 **Compliance Requirements**
- 1.8.1 Comply with Ontario Health and Safety Act, R.S.O.
- 1.8.2 Comply with Occupational Health and Safety Regulations, 1996.
- 1.8.3 Comply with Canada Labour Code, Canada Occupational Safety and Health Regulations.
- 1.9 **Unforeseen Hazards**
- 1.9.1 When unforeseen or peculiar safety-related factor, hazard, or condition occur during performance of Work, follow procedures in place for Employee's Right to Refuse Work in accordance with Acts and Regulations of Ontario having jurisdiction and advise the Owner and Consultant verbally and in writing.
- 1.10 **Posting Of Documents**
- 1.10.1 Ensure applicable items, articles, notices and orders are posted in conspicuous location on site in accordance with Acts and Regulations of Ontario having jurisdiction, and in consultation with the Owner and Consultant.
- 1.11 **Correction Of Non-Compliance**
- 1.11.1 Immediately address health and safety non-compliance issues identified by authority having jurisdiction or by the Consultant.
- 1.11.2 Provide the Owner and Consultant with written report of action taken to correct non-compliance of health and safety issues identified.
- 1.11.3 Owner or Consultant may stop Work if non-compliance of health and safety regulations is not corrected.
- 1.12 **Powder Actuated Devices**
- 1.12.1 Use powder actuated devices only after receipt of written permission from the Owner and Consultant.
- 1.13 **Work Stoppage**
- 1.13.1 Give precedence to safety and health of public and site personnel and protection of environment over cost and schedule considerations for Work.
2. **PRODUCTS**
N/A
3. **EXECUTION**
N/A

END OF SECTION 01 35 29.06

1. GENERAL**1.1 References And Codes**

- 1.1.1 Perform Work in accordance with National Building Code of Canada (NBC), Ontario Building Code (OBC), Toronto Accessibility Guidelines and AODA including amendments up to tender closing date and other codes of provincial or local application provided that in case of conflict or discrepancy, more stringent requirements apply.
- 1.1.2 Meet or exceed requirements of:
 - .1 Contract documents.
 - .2 Specified standards, codes and referenced documents.

1.2 Hazardous Material Discovery

- 1.2.1 Asbestos: demolition of spray or trowel-applied asbestos is hazardous to health. Stop work immediately when material resembling spray or trowel-applied asbestos is encountered during demolition work. Notify Consultant immediately.
- 1.2.2 PCB: Polychlorinated Biphenyl: stop work immediately when material resembling Polychlorinated Biphenyl is encountered during demolition work. Notify Consultant immediately.
- 1.2.3 Mould: stop work immediately when material resembling mould is encountered during demolition work. Notify Consultant immediately.

1.3 Building Smoking Environment

- 1.3.1 Comply with smoking restrictions and municipal by-laws.

2. PRODUCTS

N/A

3. EXECUTION

N/A

END OF SECTION

1. GENERAL**1.1 References**

Canadian Construction Documents Committee (CCDC) – CCDC 2 - 2008, Stipulated Price Contract.

1.2 Inspection

1.2.1 Allow the Client and Consultant access to the Work. If part of the Work is in preparation at locations other than the place of Work, allow access to such work whenever it is in progress.

1.2.2 Give timely notice requesting inspection if the Work is designated for special tests, inspections or approvals by the Consultant instructions, or law of place of work.

1.2.3 If the 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.

1.2.4 The Consultant will order part of the Work to be examined if the Work is suspected to be not in accordance with the Contract Documents.

1.3 Independent Inspection Agencies

1.3.1 Independent inspection/testing agencies will be engaged by the Contractor for purpose of inspecting and/or testing portions of the Work. Cost of such services will be borne by Cash Allowances.

1.3.2 Allocated costs to Section 01 21 00 – Allowances.

1.3.3 Provide equipment required for executing inspection and testing by appointed agencies.

1.3.4 Employment of inspection/testing agencies does not relax responsibility to perform the Work in accordance with the Contract Documents.

1.3.5 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 the Consultant at no cost to Client. Pay costs for retesting and re-inspection.

1.4 Access to Work

1.4.1 Allow inspection/testing agencies access to the Work, off site manufacturing and fabrication plants.

1.4.2 Co-operate to provide reasonable facilities for such access.

1.5 Procedures

1.5.1 Notify the Consultant and the appropriate agency in advance of requirement for tests, in order that attendance arrangements can be made.

1.5.2 Submit samples and/or materials required for testing, as specifically requested in the Specifications. Submit with reasonable promptness and in orderly sequence to not cause delays in the Work.

1.5.3 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

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

1.6.2 Make good other contractor's work damaged by such removals or replacements promptly.

1.6.3 If in opinion of the Consultant it is not expedient to correct the defective Work or Work not performed in accordance with the Contract Documents, the Client will deduct from the Contract Price the difference in value between the Work performed and that called for by the Contract Documents, amount of which will be determined by the Consultant.

- 1.7 **Reports**
- 1.7.1 Submit four copies of the inspection and test reports to the Consultant.
- 1.7.2 Provide copies to subcontractor of the work being inspected or tested and manufacturer or fabricator of material being inspected or tested.
- 1.8 **Tests and Mix Designs**
- 1.8.1 Furnish test results and mix designs as requested.
- 1.8.2 Cost of tests and mix designs beyond those called for in the Contract Documents or beyond those required by law of place of work will be appraised by the Consultant and may be authorized as recoverable.
- 1.9 **Mock-Ups**
- 1.9.1 N/A
- 1.10 **Mill Tests**
- 1.10.1 N/A
- 1.11 **Equipment and Systems**
- 1.11.1 Submit adjustment and balancing reports for mechanical, electrical and building equipment systems.
- 1.11.2 Refer to Electrical and Mechanical for definitive requirements.
2. **PRODUCTS**
- N/A
3. **EXECUTION**
- N/A

END OF SECTION

1 GENERAL**1.1 Related Requirements**

- 1.1.1 Sections 01 33 00 Cast in Place Concrete
- 1.1.2 Sections 01 35 29.06 Health and Safety Requirements.
- 1.1.3 Sections 01 56 00 Temporary Barriers and Enclosures
- 1.1.4 The Work is to be performed in an occupied building. All existing services are to be maintained during construction. Major disruptions are to be scheduled in advance.

1.2 References

- 1.2.1 Canada Green Building Council (CaGBC)
 - .1 LEED Canada-NC Version 1.0-[2004], LEED (Leadership in Energy and Environmental Design): Green Building Rating System Reference Package For New Construction and Major Renovations (including Addendum [2007]).
 - .2 LEED Canada-CI Version 1.0-[2007], LEED (Leadership in Energy and Environmental Design): Green Building Rating System Reference Guide For Commercial Interiors.
- 1.2.2 U.S. Environmental Protection Agency (EPA) / Office of Water
 - .1 EPA 832R92005, Storm Water Management for Construction Activities: Developing Pollution Prevention Plans and Best Management Practices.

1.3 Action And Informational Submittals

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

1.4 Installation And Removal

- 1.4.1 Provide temporary utilities controls in order to execute work expeditiously.
- 1.4.2 Remove from site all such work after use.

1.5 Dewatering

- 1.5.1 Provide temporary gutter and trap facilities to keep secure all cleaning solutions and rinse water in sealed containers on site free from standing water.

1.6 Water Supply

- 1.6.1 Provide continuous supply of potable water for construction use.
- 1.6.2 Contractor will pay for utility charges at prevailing rates if performance of the work requires substantial quantities of water. Install water controls.

1.7 Temporary Heating And Ventilation

- 1.7.1 Provide temporary heating required during construction period, including attendance, maintenance and fuel.
- 1.7.2 Construction heaters used inside building must be vented to outside or be non-flameless type. Solid fuel salamanders are not permitted.
- 1.7.3 Provide temporary ventilation in enclosed areas as required to:
 - .1 Provide adequate ventilation to meet health regulations for safe working environment.
- 1.7.4 Maintain temperatures of minimum 15 degrees C in areas where construction is in progress.
- 1.7.5 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 spaces containing hazardous or volatile materials.
 - .5 Continue operation of ventilation and exhaust system for time after cessation of work process to assure removal of harmful contaminants.
- 1.7.6 Permanent heating system of building, to be used when available. Be responsible for damage to heating system if use is permitted.
- 1.7.7 Maintain strict supervision of operation of temporary heating and ventilating equipment to:
 - .1 Conform with applicable codes and standards.
 - .2 Enforce safe practices.

- .3 Prevent abuse of services.
- .4 Prevent damage to finishes.
- .5 Vent direct-fired combustion units to outside.
- 1.7.8 Be responsible for damage to Work due to failure in providing adequate heat and protection during construction.

1.10 **Fire Protection**

- 1.10.1 Provide and maintain temporary fire protection equipment during performance of Work required by governing codes, regulations and bylaws.
- 1.10.2 Burning rubbish and construction waste materials is not permitted on site.

2 **PRODUCTS**

2.1 **Not Used**

- 2.1.1 Not Used.

3 **EXECUTION**

N/A

END OF SECTION

1. GENERAL**1.1 References**

- 1.1.1 Canadian General Standards Board (CGSB):
 - .1 CGSB 1.59-97, Alkyd Exterior Gloss Enamel.
 - .2 CAN/CGSB 1.189-00, Exterior Alkyd Primer for Wood.
- 1.1.2 Canadian Standards Association (CSA International): CSA-O121-M1978(R2003), Douglas Fir Plywood.

1.2 Installation and Removal

- 1.2.1 Provide temporary controls in order to execute the Work expeditiously.
- 1.2.2 All equipment, material and tools should be kept separately from hoarding area for storage purpose when the work is not performing.
- 1.2.3 Remove from site all such work after use.

1.4 Guardrails and Barricades

- 1.4.1 Provide as required by governing authorities.

1.5 Dust Tight Screens

- 1.5.1 Provide dust tight screens or insulated partitions to localize dust generating activities and for protection of workers, finished areas of the Work and public.
- 1.5.2 Maintain and relocate protection until such work is complete.

1.6 Access to Site

- 1.6.1 Provide and maintain access roads, sidewalk crossings, ramps and construction runways as may be required for access to the Work.

1.7 Fire Routes

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

1.8 Protection for Off-Site and Public Property

- 1.8.1 Protect surrounding private and public property from damage during performance of the Work. Be responsible for damage incurred.

1.9 Protection of Base Building Finishes

- 1.9.1 Provide protection for finished and partially finished existing base building finishes and equipment during performance of the Work.
- 1.9.2 Provide necessary screens, covers and hoardings.
- 1.9.3 Be responsible for damage incurred due to lack of or improper protection.

2. PRODUCTS

N/A

3. EXECUTION

N/A

END OF SECTION 01 56 00

1. GENERAL**1.1 References**

- 1.1.1 Within text of each Specifications Section, reference may be made to reference standards.
- 1.1.2 Conform to these reference standards, in whole or in part as specifically requested in Specifications.
- 1.1.3 If there is question as to whether products or systems are in conformance with applicable standards, the Consultant reserves right to have such products or systems tested to prove or disprove conformance.
- 1.1.4 Cost for such testing will be born by the Client in event of conformance with the Contract Documents or by the Contractor in event of non-conformance.

1.2 Quality

- 1.2.1 Products, materials, equipment and articles incorporated in the Work shall be new, not damaged or defective and of best quality for purpose intended. If requested, furnish evidence as to type, source and quality of products provided.
- 1.2.2 Acquire, in cost effective manner, items containing highest percentage of recycled and recovered materials practicable consistent with maintaining satisfactory levels of competition. Make reasonable efforts to use recycled and recovered materials and in otherwise utilizing recycled and recovered materials in execution of the Work.
- 1.2.3 Defective products, whenever identified prior to completion of the 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 the Contractor's own expense and be responsible for delays and expenses caused by rejection.
- 1.2.4 Should disputes arise as to quality or fitness of products, decision rests strictly with the Consultant based upon requirements of the Contract Documents.
- 1.2.5 Unless otherwise indicated in the Specifications, maintain uniformity of manufacture for any particular or like item throughout building.
- 1.2.6 Permanent labels, trademarks and nameplates on products are not acceptable in prominent locations, except where required for operating instructions or when located in mechanical or electrical rooms.

1.3 Availability

- 1.3.1 Immediately upon signing the Contract, review product delivery requirements and anticipate foreseeable supply delays for items. If delays in supply of products are foreseeable, notify the Consultant of such, in order that substitutions or other remedial action may be authorized in ample time to prevent delay in performance of the Work.
- 1.3.2 In event of failure to notify the Consultant at commencement of the Work and should it subsequently appear that the Work may be delayed for such reason, the Consultant reserves right to substitute more readily available products of similar character, at no increase in the Contract Price or Contract Time.

1.4 Storage, Handling and Protection

- 1.4.1 Handle and store products in manner to prevent damage, adulteration, deterioration and soiling and in accordance with manufacturer's instructions when applicable.
- 1.4.2 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 the Work.
- 1.4.3 Store products subject to damage from weather in weatherproof enclosures.
- 1.4.4 Store cementitious products clear of earth or concrete floors and away from walls.
- 1.4.5 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.
- 1.4.6 Store sheet materials, lumber and products requiring protection on flat, solid supports and keep clear of ground. Slope top covering to shed moisture.
- 1.4.7 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.

1.4.8 Remove and replace damaged products at Contractor's own expense and to the satisfaction of the Consultant.

1.4.9 Touch-up damaged factory finished surfaces to the Consultant's satisfaction. Use touch-up materials to match original. Do not paint over name plates.

1.5 **Transportation**

1.5.1 Pay costs of transportation of products required in performance of the Work.

1.5.2 Transportation cost of products supplied by Client will be paid for by Client. Unload, handle and store such products.

1.6 **Manufacturer's Instructions**

1.6.1 Unless otherwise indicated in the 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.

1.6.2 Notify the Consultant in writing, of conflicts between Specifications and manufacturer's instructions, so that the Consultant will establish course of action.

1.6.3 Improper installation or erection of products, due to failure in complying with these requirements, authorizes the Consultant to require removal and re-installation at no increase in the Contract Price or Contract Time.

1.7 **Quality of Work**

1.7.1 Ensure the quality of work is of highest standard, executed by workers experienced and skilled in respective duties for which they are employed. Immediately notify the Consultant if required work is such as to make it impractical to produce required results.

1.7.2 Do not employ anyone unskilled in their required duties. The Consultant reserves the right to request dismissal from site, workers deemed incompetent or careless.

1.7.3 Decisions as to standard or fitness of quality of work in cases of dispute rest solely with the Consultant, whose decision is final.

1.8 **Co-ordination**

1.8.1 Ensure co-operation of workers in laying out the Work. Maintain efficient and continuous supervision.

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

1.9 **Concealment**

1.9.1 In finished areas conceal pipes, ducts and wiring in floors, walls and ceilings, except where indicated otherwise.

1.9.2 Before installation inform the Consultant if there is interference. Install as directed by the Consultant.

1.10 **Remedial Work**

1.10.1 Perform remedial work required to repair or replace parts or portions of the Work identified as defective or unacceptable. Coordinate adjacent affected work as required.

1.10.2 Perform remedial work by specialists familiar with materials affected. Perform in a manner to neither damage nor put at risk any portion of the Work.

1.11 **Location of Fixtures**

1.11.1 Consider location of fixtures, outlets and mechanical and electrical items indicated as approximate.

1.11.2 Inform the Consultant of conflicting installation. Install as directed.

1.12 **Fastenings**

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

- 1.12.2 Prevent electrolytic action between dissimilar metals and materials.
- 1.12.3 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.
- 1.12.4 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.
- 1.12.5 Keep exposed fastenings to a minimum, space evenly and install neatly.
- 1.12.6 Fastenings which cause spalling or cracking of material to which anchorage is made are not acceptable.

1.13 **Fastenings – Equipment**

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

1.14 **Protection of Work in Progress**

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

1.15 **Existing Utilities**

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

2. **PRODUCTS**

N/A

3. **EXECUTION**

N/A

END OF SECTION

1. GENERAL**1.1 Action and Informational Submittals**

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

1.1.2 Submit written request in advance of cutting or alteration which affects:

- .1 Structural integrity of elements of project.
- .2 Efficiency, maintenance, or safety of operational elements.
- .3 Visual qualities of sight-exposed elements.
- .4 Work of Owner or separate contractor.

1.1.3 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 Owner or separate contractor.
- .7 Written permission of affected separate contractor.
- .8 Date and time work will be executed.

1.2 Materials

1.2.1 Required for original installation.

1.2.2 Change in Materials: Submit request for substitution in accordance with Section 01 33 00 – Submittal Procedures.

1.3 Preparation

1.3.1 Inspect existing conditions, including elements subject to damage during work execution.

1.3.2 After uncovering, inspect conditions affecting performance of Work.

1.4 Execution

1.4.1 Distribute utilities to room spaces as indicated in Contract Drawings. Power and data connections will be responsibility of the Client.

1.4.2 Execute cutting, fitting, patching, and painting to complete Work.

1.4.3 Remove and replace defective and non-conforming Work.

1.4.4 Provide openings for necessary penetrations of mechanical and electrical Work. Fit Work sound-tight to all electrical and mechanical penetrations through sound walls.

1.4.5 Execute Work by methods to avoid damage to adjacent areas and base building where indicated to remain.

1.4.6 Limit the amount of exposed utilities as possible.

1.4.7 Removal and installation of the following items will be completed by CoM vendor of record

1. Card readers, Request for Exit PIR and concealed door contact
2. CX-12PLUS for interface with ADOs
3. Low voltage security cables from security panel

2. PRODUCTS

N/A

3. EXECUTION

N/A

END OF SECTION

1. GENERAL**Summary**

Work of this Section refers to cleaning of the site during & after construction. Document the existing condition of the space. All items noted to remain, if damaged by the Work of this Contract, must be repaired to its original or better condition at no additional cost to the Client.

1.1 References

1.1.1 Canadian Construction Documents Committee (CCDC) – CCDC 2008, Stipulated Price Contract.

1.2 Project Cleanliness

1.2.1 Maintain work in tidy condition, free from accumulation of waste products and debris, including that caused by subcontractors.

1.2.2 Remove waste materials from site at daily regularly scheduled times.

1.2.3 Do not burn waste materials on site.

1.2.4 Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris. Pay for any cost associating in obtaining such permits.

1.2.5 Provide on-site dump bin containers for collection of waste materials and debris.

1.2.6 Provide and use marked separate bins for recycling where possible.

1.2.7 Dispose of waste materials and debris off site.

1.2.8 Clean interior areas prior to start of finishing work and maintain areas free of dust and other contaminants during finishing operations.

1.2.9 Store volatile waste in covered metal containers and remove from premises at end of each working day.

1.2.10 Provide adequate ventilation during use of volatile or noxious substances. Use of building ventilation systems is not permitted for this purpose.

1.2.11 Use only cleaning materials recommended by manufacturer of surface to be cleaned and as recommended by cleaning material manufacturer.

1.2.12 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 Pre-occupancy Cleaning

1.3.1 When the Work is Substantially Performed remove surplus products, tools, construction machinery and equipment not required for performance of remaining work.

1.3.2 Remove waste products and debris other than that caused by others and leave work clean and suitable for occupancy.

1.3.3 Prior to final review remove surplus products, tools, construction machinery and equipment.

1.3.4 Remove waste products and debris.

1.3.5 Remove waste materials from site at daily regularly scheduled times. Do not burn waste materials on site.

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

1.3.7 Clean and polish glass, mirrors, hardware, and stainless steel, plastic laminate and mechanical and electrical fixtures. Replace broken, scratched or disfigured glass.

1.3.8 Remove stains, spots, marks and dirt from decorative work, electrical and mechanical fixtures, furniture fitments, walls, ceilings and floors.

1.3.9 Clean lighting reflectors, lenses and other lighting surfaces.

1.3.10 Vacuum clean and dust building interiors.

1.3.11 Wax, seal, shampoo or prepare floor finishes, as recommended by manufacturer.

1.3.12 Inspect finishes, fitments and equipment and ensure specified workmanship and operation.

1.3.13 Broom clean and wash all areas of existing building and exterior walks, steps and surfaces that have been affected by the work of this project.

- 1.3.14 Clean equipment and fixtures to sanitary condition; clean or replace filters of mechanical equipment.

1.4 **Final Cleaning**

- 1.4.1 Provide on-site dump bin containers for collection of waste materials and debris.
- 1.4.2 Provide and use marked separate bins for recycling where possible.
- 1.4.3 Dispose of waste materials and debris off site.
- 1.4.4 Leave existing building clean of dust, debris and waste materials.
- 1.4.5 Clean, polish, wax, seal and wash all existing building components to bring the space to its original or better condition.
- 1.4.6 Clean the site and ground cover from dust, dirt and waste.

2. **PRODUCTS**

N/A

3. **EXECUTION**

N/A

END OF SECTION 01 74 11

1. **GENERAL**

1.1 **Waste Management Goals**

- 1.1.1 Prior to start of Work conduct meeting with consultant to review and discuss PWGSC's Waste Management Plan and Goals.
- 1.1.2 Provide Consultant documentation certifying that waste management, recycling, reuse of recyclable and reusable materials have been extensively practiced.
- 1.1.3 Preserve environment and prevent pollution and environment damage.

1.2 **Storage, Handling And Protection**

- 1.2.1 Store, materials to be reused, recycled and salvaged in locations as directed by Consultant.
- 1.2.2 Unless specified otherwise, materials for removal do not become Contractor's property.
- 1.2.3 Separate non-salvageable materials from salvaged items. Transport and deliver non-salvageable items to licensed disposal facility.
- 1.2.4 Protect structural components not removed for demolition from movement or damage.
- 1.2.5 Prevent contamination of materials to be salvaged and recycled and handle materials in accordance with requirements for acceptance by designated facilities.
 - .1 On-site source separation is recommended.
 - .2 Remove co-mingled materials to off-site processing facility for separation.
 - .3 Provide waybills for separated materials.

1.3 **Disposal Of Wastes**

- 1.3.1 Do not burn rubbish or waste materials on or near the site.
- 1.3.2 Do not dispose of waste, volatile materials, mineral spirits, oil, paint thinner into waterways, storm, or sanitary sewers.
- 1.3.3 Keep records of construction waste including:
 - .1 Number and size of bins.
 - .2 Waste type of each bin.
 - .3 Total tonnage generated.
 - .4 Tonnage reused or recycled.
 - .5 Reused or recycled waste destination.
- 1.3.4 Remove materials from deconstruction as deconstruction/disassembly Work progresses.

1.4 **Use Of the Site And Facilities**

- 1.4.1 Execute work with least possible interference or disturbance to normal use of premises.
- 1.4.2 Maintain security measures established by existing facility and provide temporary security measures approved by the Consultant.
- 1.4.3 Maintain means of egress at all times.

1.5 **Scheduling**

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

2. **PRODUCTS**

N/A

3. **EXECUTION**

N/A

END OF SECTION

1. GENERAL**1.1 References**

- 1.1.1 Canadian Construction Documents Committee (CCDC)
.1 CCDC 2-2008, Stipulated Price Contract.

1.2 Administrative Requirements

- 1.2.1 Acceptance of Work Procedures:
.1 Contractor's Inspection:
Contractor: conduct inspection of Work, identify deficiencies and defects, and repair as required to conform to Contract Documents.
.1 Notify the Owner and Consultant in writing of satisfactory completion of Contractor's inspection and submit verification that corrections have been made.
.2 Request Consultant's inspection.
.2 Consultant's Inspection:
.1 Consultant and Contractor to inspect Work and identify defects and deficiencies.
.2 Contractor to correct Work as directed.
- 1.2.2 Completion Tasks: submit written certificates in English that tasks have been performed as follows:
.1 Work: completed and inspected for compliance with Contract Documents.
.2 Defects: corrected and deficiencies completed.
.3 Equipment and systems: tested, adjusted and balanced and fully operational.
.4 Certificates required by: Steel inspection, Fire Alarm Commissioner, ESA, HVAC Balancing.
.5 Operation of systems: demonstrated to Owner's personnel.
.6 Commissioning of mechanical, electrical and audio/visual systems: completed in accordance with 01 91 13 - General Commissioning (Cx) Requirements and copies of final Commissioning Report submitted to the Owner and Consultant.
.7 Work: complete and ready for final inspection.
- 1.2.3 Final Inspection:
.1 When completion tasks are done, request final inspection of Work by Consultant, and City Inspectors.
.2 When Work incomplete according to Owner and Consultant, complete outstanding items and request re-inspection.
- 1.2.4 Declaration of Substantial Performance: when Consultant considers deficiencies and defects corrected and requirements of Contract substantially performed, make application for Certificate of Substantial Performance.
- 1.2.5 Commencement of Lien: date of Substantial Performance to be the date for commencement of lien period unless required otherwise by lien statute of Place of Work.
- 1.2.6 Commencement of Warranty Periods: date of total performance as set out in CCDC 2 supplemental instructions to be date for commencement for warranty period.
- 1.2.7 Final Payment:
.1 When Consultant considers final deficiencies and defects corrected and requirements of Contract met, make application for final payment.
.2 Refer to CCDC 2: when Work deemed incomplete by Consultant, complete outstanding items and request re-inspection.
- 1.2.8 Payment of Holdback: after issuance of Certificate of Substantial Performance of Work, submit application for payment of holdback amount in accordance with contractual agreement.

1.3 Final Cleaning

- 1.3.1 Clean in accordance with Section 01 74 11 - Cleaning.

- 1.3.2 .1 Remove surplus materials, excess materials, rubbish, tools and equipment.
Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

2. **PRODUCTS**
N/A

3. **EXECUTION**
N/A

END OF SECTION 01 77 00

1. GENERAL**1.1 Administrative Requirements**

Pre-Warranty Meeting:

- 1.1.1 Convene meeting one week prior to Contract Completion with Contractor's Representative, Consultant and Owner's Representative, in accordance with Section 01 31 19 – Project Meetings to:
 - .1 Verify Project requirements.
 - .2 Review manufacturer's installation instructions and warranty requirements.
- 1.1.2 Owner and Consultant to establish communication procedures for:
 - .1 Notifying construction warranty defects.
 - .2 Determine priorities for type of defects.
 - .3 Determine reasonable response time.
- 1.1.3 Contact information for bonded and licensed company for warranty work action. Provide name, telephone number and address of company authorized for construction warranty work action.
- 1.1.4 Ensure contact is located within local service area of warranted construction, is continuously available and is responsive to inquiries for warranty work action.

1.2 Action and Informational Submittals

- 1.2.1 Provide submittals in accordance with Section 01 33 00 – Submittal Procedures.
- 1.2.2 Two weeks prior to Substantial Performance of the Work, submit to the Consultant, four final hard copies of Operating and Maintenance Manuals (in English) and one electronic PDF copy.
- 1.2.3 Provide spare parts, maintenance materials and special tools of same quality and manufacture as products provided in the Work.
- 1.2.4 Provide evidence, if requested, for type, source and quality of products supplied.
- 1.2.5 Provide 2 DVDs of video recorded demonstration and training session for staff as described in Section 01 79 00 Demonstration and Training.

1.3 Format

- 1.3.1 Organize data as instructional manual.
- 1.3.2 Binders: Vinyl, hard covered, three 'D' ring, loose leaf for letter size (8.5"x11") documents with spine and face pockets.
- 1.3.3 When multiple binders are used correlate data into related consistent groupings. Identify contents of each binder on spine.
- 1.3.4 Cover: Identify each binder with type or printed title "Project Record Documents"; list title of project, date of the submission and identify subject matter of contents.
- 1.3.5 Arrange content by systems, under section numbers and sequence of table of contents.
- 1.3.6 Provide tabbed fly leaf for each separate product and system, with typed description of product and major component parts of equipment.
- 1.3.7 Text: Manufacturer's printed data or typewritten data.
- 1.3.8 Drawings: Provide with reinforced punched binder tab:
 - Bind in with text; fold larger drawings to size of text pages.
- 1.3.9 Provide 1:1 scaled CAD files in dwg format on compact disc.
- 1.3.10 Provide As-Built CAD files drawings in dwg format on compact disc.

1.4 Contents – Project Record Documents

- 1.4.1 Table of Contents for each volume: Provide:
 - .1 Title of project
 - .2 Date of submission;
 - .3 Addresses and telephone numbers of Consultant, Engineers and Contractor with name of responsible parties
 - .4 Schedule of products and systems, indexed to content of volume
- 1.4.2 For each product or system: List names, addresses and telephone numbers of subcontractors and suppliers, including local source of supplies and replacement parts.

-
- 1.4.3 Product Data: Mark each sheet to identify specific products and component parts and data applicable to installation; delete inapplicable information.
- 1.4.4 Drawings: Supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams.
- 1.4.5 Typewritten Text: as required to supplement product data:
- .1 Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions specified in Section 01 45 00 – Quality Control.
- 1.5 **As-Built Documents and Samples**
- 1.5.1 Maintain at site for the Consultant and Owner, one record copy of:
- .1 Contract Drawings.
 - .2 Specifications.
 - .3 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.
- 1.5.2 Store record documents and samples in field office apart from documents used for construction: Provide files, racks and secure storage.
- 1.5.3 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.
- 1.5.4 Maintain record documents in clean, dry and legible condition. Do not use record documents for construction purposes.
- 1.5.5 Keep record documents and samples available for inspection by the Consultant.
- 1.6 **Recording Information on Project Record Documents**
- 1.6.1 Record information on set of black line opaque drawings and in copy of Project Manual, provided by the Consultant.
- 1.6.2 Use felt tip marking pens, maintaining separate colours for each major system, for recording information.
- 1.6.3 Record information concurrently with construction progress. Do not conceal the Work until required information is recorded.
- 1.6.4 Contract Drawings and shop drawings: Mark each item to record actual construction, including:
- .1 Measured locations of internal utilities and appurtenances, referenced to visible and accessible features of construction.
 - .2 Field changes of dimension and detail.
 - .3 Changes made by Change Orders.
 - .4 Details not on original Contract Drawings.
 - .5 References to related shop drawings and modifications.
- 1.6.5 Specifications: mark each item to record actual construction, including:
- .1 Manufacturer, trade name and catalogue number of each product actually installed, particularly optional items and substitute items.
 - .2 Changes made by Addenda and Change Orders.
- 1.6.6 Other Documents: Maintain manufacturer's certifications, inspection certifications and test records, required by individual Specifications Sections.
- 1.6.7 Provide digital photos for site records.
- 1.7 **Final Survey**
N/A.
- 1.8 **Equipment and Systems**
- 1.8.1 For each item of equipment and each system include description of unit or system and
-

-
- component parts:
- .1 Give function, normal operation characteristics and limiting conditions.
 - .2 Include performance curves, with engineering data and tests, and complete nomenclature and commercial number of replaceable parts.
- 1.8.2 Panel board circuit directories: provide electrical service characteristics, controls and communications.
- 1.8.3 Include installed colour coded wiring diagrams.
- 1.8.4 Operating Procedures: Include start-up, break-in and routine normal operating instructions and sequences:
- .1 Include regulation, control, stopping, shut-down and emergency instructions.
 - .2 Include summer, winter and any special operating instructions.
- 1.8.5 Maintenance Requirements: Include routine procedures and guide for trouble-shooting; disassembly, repair and reassembly instructions; and alignment, adjusting, balancing and checking instructions.
- 1.8.6 Provide servicing and lubrication schedule and list of lubricants required.
- 1.8.7 Include manufacturer's printed operation and maintenance instructions.
- 1.8.8 Include sequence of operation by controls manufacturer.
- 1.8.9 Provide original manufacturer's parts list, illustrations, assembly drawings and diagrams required for maintenance.
- 1.8.10 Provide installed control diagrams by controls manufacturer.
- 1.8.11 Provide Contractor's coordination drawings, with installed colour coded piping diagrams.
- 1.8.12 Provide charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.
- 1.8.13 Provide list of original manufacturer's spare parts, current prices and recommended quantities to be maintained in storage.
- 1.8.14 Include test and balancing reports as specified in Section 01 45 00 – Quality Control.
- 1.8.15 Additional requirements: As specified in individual Specification Sections.
- 1.9 **Materials and Finishes**
- 1.9.1 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.
- 1.9.2 Instructions for cleaning agents and methods, precautions against detrimental agents and methods and recommended schedule for cleaning and maintenance.
- 1.9.3 Additional requirements: As specified in individual Specifications Sections.
- 1.10 **Maintenance Materials**
- 1.10.1 Spare Parts:
- .1 Provide spare parts, in quantities specified in individual Specification Sections.
 - .2 Provide items of same manufacture and quality as items in the Work.
 - .3 Deliver to location as directed; place and store.
 - .4 Receive and catalogue items:
 - .1 Submit inventory listing to the Consultant.
 - .2 Include approved listings in the Maintenance Manual.
 - .5 Obtain receipt for delivered products and submit prior to final payment.
- 1.10.2 Extra Stock 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 the Work.
 - .3 Deliver to location as directed; place and store.
 - .4 Receive and catalogue items:
 - .1 Submit inventory listing to the Consultant.
 - .2 Include approved listings in the Maintenance Manual.
 - .5 Obtain receipt for delivered products and submit prior to final payment.
- 1.10.3 Special Tools:
-

- .1 Provide special tools, in quantities specified in individual Specification Section.
- .2 Provide items with tags identifying their associated function and equipment.
- .3 Deliver to location as directed; place and store.
- .4 Receive and catalogue items.
 - .1 Submit inventory listing to the Consultant.
 - .2 Include approved listings in the Maintenance Manual.

1.11 **Delivery, Storage and Handling**

- 1.11.1 Store spare parts, maintenance materials and special tools in manner to prevent damage or deterioration.
- 1.11.2 Store in original and undamaged condition with manufacturer's seal and labels intact.
- 1.11.3 Store components subject to damage from weather in weatherproof enclosures.
- 1.11.4 Store paints and freezable materials in a heated and ventilated room.
- 1.11.5 Remove and replace damaged products at Contractor's own expense and for review by the Consultant.

1.12 **Warranties and Bonds**

- 1.12.1 Develop warranty management plan to contain information relevant to warranties.
- 1.12.2 Submit warranty management plan, 30 days before planned pre-warranty conference to the Consultant for approval.
- 1.12.3 Warranty management plan to include required actions and documents to assure that Owner receives warranties to which it is entitled.
- 1.12.4 Provide plan in narrative form and contain sufficient detail to make it suitable for use by future maintenance and repair personnel.
- 1.12.5 Submit warranty information made available during construction phase, to the Consultant for approval prior to each monthly pay estimate.
- 1.12.6 Assemble approved information in binder, submit upon acceptance of Work and organize binder as follows:
 - .1 Separate each warranty or bond with index tab sheets keyed to table of contents listing.
 - .2 List subcontractor, supplier and manufacturer, with name, address and telephone number of responsible principal.
 - .3 Obtain warranties and bonds, executed in duplicate by subcontractors, suppliers and manufacturers, within 10 days after completion of applicable item of work.
 - .4 Verify that documents are in proper form, contain full information and are notarized.
 - .5 Co-execute submittals when required.
 - .6 Retain warranties and bonds until time specified for submittal.
- 1.12.7 Except for items put into use with Owner's permission, leave date of beginning of time of warranty until Date of Total Performance is determined.
- 1.12.8 Conduct joint twelve month and twenty three month warranty inspection, measured from time of acceptance by the Consultant.
- 1.12.9 Include information contained in warranty management plan as follows:
 - .1 Roles and responsibilities of personnel associated with warranty process, including points of contact and telephone numbers within the organizations of Contractors, subcontractors, manufacturers or suppliers involved.
 - .2 Listing and status of delivery of Certificates of Warranty for extended warranty items, to include HVAC balancing, transformers and commissioned systems such as alarm systems, audio-visual and lightning systems.
 - .3 Provide list for each warranted equipment, item, and feature of construction or system indicating:
 - .1 Name of item.
 - .2 Model and serial numbers.
 - .3 Location where installed.
 - .4 Name and phone numbers of manufacturers or suppliers.

- .5 Names, addresses and telephone numbers of sources of spare parts.
- .6 Warranties and terms of warranty: include two years overall warranty of construction. Indicate items that have extended warranties and show separate warranty expiration dates.
- .7 Cross-reference to warranty certificates as applicable.
- .8 Starting point and duration of warranty period.
- .9 Summary of maintenance procedures required to continue warranty in force.
- .10 Cross-Reference to specific pertinent Operation and Maintenance Manuals.
- .11 Organization, names and phone numbers of persons to call for warranty service.
- .12 Typical response time and repair time expected for various warranted equipment.
- .4 Contractor's plans for attendance at twelve and twenty three month post-construction warranty inspections.
- .5 Procedure and status of tagging of equipment covered by extended warranties.
- .6 Post copies of instructions near selected pieces of equipment where operation is critical for warranty and/or safety reasons.
- 1.12.10 Respond in timely manner to oral or written notification of required construction warranty repair work.

1.13 **Warranty Tags**

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

2. **PRODUCTS**

N/A

3. **EXECUTION**

N/A

END OF SECTION 01 78 00

1. GENERAL**1.1 Administrative Requirements**

- 1.1.1 Demonstrate scheduled operation and maintenance of lighting control, audio-visual and HVAC equipment and systems to Owner's personnel two weeks prior to date of final inspection.
- 1.1.2 Owner: Provide list of personnel to receive instructions and co-ordinate their attendance at agreed-upon times.
- 1.1.3 Preparation:
 - .1 Verify conditions for demonstration and instructions comply with requirements.
 - .2 Verify designated personnel are present.
 - .3 Ensure equipment has been inspected and put into operation in accordance with the Section of that Work.
 - .4 Ensure testing, adjusting and balancing has been performed in accordance with Mechanical requirements and equipment and systems are fully operational.
- 1.1.4 Demonstration and Instructions:
 - 1. Video record entire demonstration and provide to Owner in DVD format (2 copies).
 - .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 Video the entire demonstration and provide the files on a CD to the owner.
 - .3 Instruct personnel in phases of operation and maintenance using operation and maintenance manuals as basis of instruction.
 - .4 Review contents of manual in detail to explain aspects of operation and maintenance.
 - .5 Prepare and insert additional data in operations and maintenance manuals when needed during instructions.

1.2 Action and Informational Submittals

- 1.2.1 Provide submittals in accordance with Section 01 33 00 – Submittal Procedures.
- 1.2.2 Submit schedule of time and date for demonstration of each item of equipment and each system two weeks prior to designated dates, for the Owner's approval.
- 1.2.3 Submit reports within one week after completion of demonstration, that demonstration and instructions have been satisfactorily completed.
- 1.2.4 Give time and date of each demonstration, with list of persons present.
- 1.2.5 Provide copies of completed Operation and Maintenance Manuals for use in demonstrations and instructions.

1.3 Quality Assurance

When specified in individual Sections requiring manufacturer to provide authorized representative to demonstrate operation of equipment and systems:

- 1.3.1 Instruct Owner's personnel.
- 1.3.2 Provide written report that demonstration and instructions have been completed.

2. PRODUCTS

N/A

3. EXECUTION

N/A

END OF SECTION

1. GENERAL**1.1 Summary****1.1.1 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.

1.1.2 Acronyms:

- .1 AFD - Alternate Forms of Delivery, service provider.
- .2 BMM - Building Management Manual.
- .3 Cx - Commissioning.

.5 O&M - Operation and Maintenance.

- .6 PI - Product Information.
- .7 PV - Performance Verification.
- .8 TAB - Testing, Adjusting and Balancing.

1.2 General

1.2.1 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.

1.2.2 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.

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

1.3 Non-Conformance To Performance Verification Requirements

1.3.1 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 Consultant, to ensure effective performance.

1.3.2 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.

1.4 Pre-Cx Review**1.4.1 Before Construction:**

- .1 Review contract documents, confirm by writing to Consultant.
 - .1 Adequacy of provisions for Cx.
 - .2 Aspects of design and installation pertinent to success of Cx.

1.4.2 During Construction:

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

1.4.3 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 Consultant.
- .7 Have Cx schedules up-to-date.
- .8 Ensure systems have been cleaned thoroughly.
- .9 Complete TAB procedures on systems, submit TAB reports to Consultant for review and approval.
- .10 Ensure "As-Built" system schematics are available.
- 1.4.4 Inform Consultant in writing of discrepancies and deficiencies on finished works.
- 1.5 **Conflicts**
 - 1.5.1 Report conflicts between requirements of this section and other sections to Consultant before start-up and obtain clarification.
 - 1.5.2 Failure to report conflict and obtain clarification will result in application of most stringent requirement.
- 1.6 **Action And Informational Submittals**
 - 1.6.1 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.
 - .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 Consultant for changes to submittals and obtain written approval at least 8 weeks prior to start of Cx.
 - .3 Submit proposed Cx procedures to Consultant where not specified and obtain written approval at least 2 weeks prior to start of Cx.
- 1.7 **Commissioning Documentation**
 - 1.7.1 Consultant to review and approve Cx documentation.
 - 1.7.2 Provide completed and approved Cx documentation to Consultant.
- 1.8 **Commissioning Schedule**
 - 1.8.1 Provide detailed Cx schedule as part of construction schedule in a form of a Gantt Chart, and indicate Critical Paths.
 - 1.8.2 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.
- 1.9 **Commissioning Meetings**
 - 1.9.1 Purpose: to resolve issues, monitor progress, identify deficiencies, relating to Cx.
 - 1.9.2 At 60% construction completion stage. Owner 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.
 - 1.9.3 Thereafter Cx meetings to be held until project completion and as required during equipment start-up and functional testing period.

- 1.9.4 Record and distribute minutes of the meeting.
- 1.9.5 Ensure subcontractors and relevant manufacturer representatives are present at 60% and subsequent Cx meetings and as required.

1.10 **Starting And Testing**

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

1.11 **Manufacturer's Involvement**

- 1.11.1 Obtain manufacturers installation, start-up and operations instructions prior to start-up of components, equipment and systems and review with Consultant.
 - .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.
- 1.11.2 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.
- 1.11.3 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.

1.12 **Procedures**

- 1.12.1 Verify that equipment and systems are complete, clean, and operating in normal and safe manner prior to conducting start-up, testing and Cx.
- 1.12.2 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-total performance verification: to include fine-tuning.
- 1.12.3 Correct deficiencies and obtain approval from Consultant after distinct phases have been completed and before commencing next phase.
- 1.12.4 Document require tests on approved PV forms.
- 1.12.5 Failure to follow accepted start-up procedures will result in re-evaluation of equipment by an independent testing agency selected by Consultant. 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 Consultant.
 - .2 Major equipment/systems: if evaluation report concludes that damage is minor, implement corrective measures approved by Consultant.
 - .3 If evaluation report concludes that major damage has occurred, Consultant 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.

1.13 **Start-Up Documentation**

- 1.13.1 Assemble start-up documentation and submit to Consultant for approval before commencement of commissioning.
- 1.13.2 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 Consultant to repeat start-up at any time.

1.14 **Operation And Maintenance Of Equipment And Systems**

- 1.14.1 After start-up, operate and maintain equipment and systems as directed by equipment/system manufacturer.
- 1.14.2 With assistance of manufacturer develop written maintenance program and submit Consultant for approval before implementation.
- 1.14.3 Operate and maintain systems for length of time required for commissioning to be completed.
- 1.14.4 After completion of commissioning, operate and maintain systems until issuance of certificate of interim acceptance.

1.15 **Test Results**

- 1.15.1 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.
- 1.15.2 Provide manpower and materials, assume costs for re-commissioning.

1.16 **Start Of Commissioning**

- 1.16.1 Notify Consultant at least 14 days prior to start of Cx.
- 1.16.2 Start Cx after elements of building affecting start-up and performance verification of systems have been completed.

1.17 **Instruments / Equipment**

- 1.17.1 Submit to Consultant 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.
- 1.17.2 Provide the following equipment as required:
 - .1 2-way radios.
 - .2 Ladders.
 - .3 Equipment as required to complete work.

1.18 **Commissioning Performance Verification**

- 1.18.1 Carry out Cx:
 - .1 Under actual operating conditions, over entire operating range, in all modes.
 - .2 On independent systems and interacting systems.
- 1.18.2 Cx procedures to be repeatable and reported results are to be verifiable.
- 1.18.3 Follow equipment manufacturer's operating instructions.
- 1.18.4 EMCS trending to be available as supporting documentation for performance verification.

1.19 **Witnessing Commissioning**

- 1.19.1 Consultant to witness activities and verify results.

1.20 Authorities Having Jurisdiction

- 1.20.1 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.
- 1.20.2 Obtain certificates of approval, acceptance and compliance with rules and regulation of authority having jurisdiction.
- 1.20.3 Provide copies to Consultant within 5 days of test and with Cx report.

1.21 Extent Of Verification

- 1.21.1 Conduct tests repeated during verification under same conditions as original tests, using same test equipment, instrumentation.
- 1.21.2 Review and repeat commissioning of systems if inconsistencies found in more than 20% of reported results.
- 1.21.3 Perform additional commissioning until results are acceptable to Consultant.

1.22 Repeat Verifications

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

1.23 Deficiencies, Faults, Defects

- 1.23.1 Correct deficiencies found during start-up and Cx to satisfaction of Consultant.
- 1.23.2 Report problems, faults or defects affecting Cx to Consultant in writing. Stop Cx until problems are rectified. Proceed with written approval from Consultant.

1.24 Completion Of Commissioning

- 1.24.1 Upon completion of Cx leave systems in normal operating mode.
- 1.24.2 Except for warranty and seasonal verification activities specified in Cx specifications, complete Cx prior to issuance of Interim Certificate of Completion.
- 1.24.3 Cx to be considered complete when contract Cx deliverables have been submitted and accepted by Consultant.

1.25 Activities Upon Completion Of Commissioning

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

1.26 Maintenance Materials, Spare Parts, Special Tools

- 1.26.1 Supply, deliver, and document maintenance materials, spare parts, and special tools as specified in contract.

1.27 Occupancy

- 1.27.1 Cooperate fully with Consultant during stages of acceptance and occupancy of facility.

1.28 Performance Verification Tolerances

- 1.28.1 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.
- 1.28.2 Instrument accuracy tolerances:
 - .1 To be of higher order of magnitude than equipment or system being tested.
- 1.28.3 Measurement tolerances during verification:
 - .1 Unless otherwise specified actual values to be within +/- 2 % of recorded values.

1.29 **Owner's Performance Testing**

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

2. **PRODUCT**
N/A

3. **EXECUTION**
N/A

END OF SECTION 01 91 13

1. GENERAL**Summary**

Work of this Section indicates selective demolition that need to be performed to accommodate new layouts. Refer to contract drawings. This section includes:

- Alteration project procedures.
- Disposal of materials.
- Identification of utilities.

1.1 Related Requirements

- 1.1.1 Section 01 11 00 - Summary of Work:
 - .1 Work sequence.
 - .2 Owner's continued occupancy.
 - .3 Alteration Project Procedures, re-installation of removed and stored products.
- 1.1.2 Section 01 33 00 – Submittal Procedures.
- 1.1.3 Section 01 35 29.06 – Health and Safety Requirements
- 1.1.4 Section 01 74 11 – Cleaning

1.2 References

- 1.2.1 Canadian Council of Ministers of the Environment (CCME)
 - .1 PN 1326-July 2005, Environmental Code of Practice for aboveground and underground tank systems containing petroleum products and allied petroleum products.
- 1.2.2 Canadian Standards Association (CSA International)
 - .1 CSA S350-M1980(R2003), Code of Practice for Safety in Demolition of Structures.

1.3 Action And Informational Submittals

- 1.3.1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- 1.3.2 Shop Drawings:
 - .1 Provide shop drawings for shoring in accordance with Section 01 33 00 - Submittal Procedures.
 - .2 Provide drawings stamped and signed by professional engineer registered or licensed in Province of Ontario, Canada.
- 1.3.3 Before proceeding with demolition of load bearing walls or any other structural & concrete walls, and where required by authority having jurisdiction submit for review by Consultant shoring and underpinning drawings prepared by qualified professional engineer registered or licensed in the Province of Ontario in Canada showing proposed method.
- 1.3.4 Prior to beginning of Work on site submit detailed Waste Reduction Workplan in accordance with Section 01 74 21 - Construction/Demolition Waste Management And Disposal and indicate:
 - .1 Descriptions of and anticipated quantities in percentages of materials to be salvaged reused, recycled and landfilled.
 - .2 Schedule of selective demolition.
 - .3 Number and location of dumpsters.
 - .4 Anticipated frequency of tippage.
 - .5 Name and address of haulers and waste facilities.

1.4 Delivery, Storage And Handling

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

1.5 Site Conditions

- 1.5.1 Should material resembling spray or trowel-applied asbestos or other designated

substance be encountered, stop work, take preventative measures, and notify Consultant immediately.

.1 Do not proceed until written instructions have been received from Owner and Consultant.

1.5.1 Notify Owner Representative before disrupting building access or services.

1.6 **Alteration Project Procedures**

1.6.1 Employ skilled and experienced installer to perform alteration work.

1.6.2 Close openings in exterior surfaces to protect existing work from weather and extremes of temperature and humidity.

1.6.3 Remove, cut, and patch Work in a manner to minimize damage and to provide means of restoring Products and finishes to original or specified condition.

1.6.4 Refinish existing visible surfaces to remain in renovated rooms and spaces, to renewed condition for each material, with a neat transition to adjacent finishes.

1.6.5 Where new Work abuts or aligns with existing, provide a smooth and even transition. Patch Work to match existing adjacent Work in texture and appearance.

1.6.6 When finished surfaces are cut so that a smooth transition with new Work is not possible, terminate existing surface along a straight line at a natural line of division and submit recommendation to Consultant for review.

1.6.7 Patch or replace portions of existing surfaces which are damaged, lifted, discoloured, or showing other imperfections.

1.6.8 Finish surfaces as specified in individual Product sections.

2. **PRODUCTS**

2.1 As specified in Product sections; match existing Products and work for patching and extending work.

3. **EXECUTION**

3.1 **Schedule**

3.1.1 Refer to Contract Drawings for detailed list of items to be removed. Items to be removed may include, but not limited to the following:

.1 Removal of all walls and framing. Removal of doors, frames, hardware and glazed partitions. Removal of floor and ceiling finishes. Removal of mechanical, plumbing, electrical and communication / tel / data cabling & equipment as indicated in engineer's drawings. Removal of millwork and shelving.

.2 Refer to Mechanical Contract Drawings for extent of mechanical HVAC and plumbing demolition.

.3 Refer to Electrical Contract Drawings for extent of electrical & audio/visual demolition.

3.2 **Examination**

3.2.1 Inspect building with Owner's Representative and verify extent and location of items designated for removal, disposal, alternative disposal, recycling, salvage and items to remain.

3.2.2 Notify and obtain approval of Facility Manager before starting demolition.

3.3 **Preparation**

3.3.1 Do Work in accordance with Section 01 35 29.06 - Health and Safety Requirements.

3.3.2 Protection:

.1 Keep noise, dust, and inconvenience to occupants to minimum.

.2 Protect building systems, services and equipment.

.3 Provide temporary dust screens, covers, railings, supports and other protection as required.

3.3.3 Existing abandoned electrical, telephone and communication service lines to be removed

and disposed off. Existing active electrical, telephone and communication service lines to be re-routed to run along public corridor ceiling.

3.3.5 Disconnect and cap designated services as shown in engineering drawings.

3.3.6 Demolition/Removal:

.1 Remove items as indicated in the Contract Drawings and Specifications.

3.3 **Demolition Salvage And Disposal**

3.3.1 Refer to demolition drawings and specifications for items to be salvaged for reuse.

3.3.2 Remove items to be reused, store as directed by Consultant, and re-install under appropriate section of specification.

3.3.3 Dispose of removed materials to appropriate recycling facilities except where specified otherwise, in accordance with authority having jurisdiction.

3.4 **Partial Demolition Of Structures**

3.4.1 N/A

3.5 **Stockpiling**

3.5.1 N/A

3.6 **Removal From Site**

36.1 N/A

3.7 **Cleaning And Restoration**

3.7.1 Keep site clean and organized throughout demolition procedure.

3.8 **Re-use and Salvaging of Materials**

3.8.1 Refer to Contract Drawings and Specifications for items to be salvaged for reuse / relocation if any.

END OF SECTION

1. GENERAL**1.1 Section Includes**

- 1.1.1 Concrete.
- 1.1.2 Concrete Form Bases.

1.2 Related Requirements

- 1.2.1 Division 03 - Concrete

1.3 References

- 1.3.1 American Society for Testing and Materials (ASTM)
 - .1 ASTM C260, Standard Specification for Air-Entraining Admixtures for Concrete.
 - .2 ASTM C309, Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
 - .3 ASTM C494/C494M, Standard Specification for Chemical Admixtures for Concrete.
 - .4 ASTM D412, Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers-Tension.
 - .5 ASTM D624, Standard Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomer.
 - .6 ASTM D1751, Standard Specification for Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
- 1.3.2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-51.34, Vapour Barrier, Polyethylene Sheet for Use in Building Construction.
- 1.3.3 Canadian Standards Association (CSA)
 - .1 CSA-A23.1/A23.2, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
 - .2 CAN/CSA-A23.2, Methods of Test for Concrete.
 - .3 CAN3-A266.4, Guidelines for the Use of Admixtures in concrete.
 - .4 CAN/CSA-A3000, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).
 - .5 CSA-A3001, Cementitious Materials for Use in Concrete.

1.4 Definitions

- 1.4.1 Cement: hydraulic cement or blended hydraulic cement (XXb - where b denotes blended).
 - .1 Type GU or GUb - General use cement.

1.5 Submittals

- 1.5.1 At least 4 weeks prior to commencing work, inform Owner's Representative of proposed source of aggregates and provide access for sampling.
- 1.5.2 Submit testing results and reports for review by Owner's Representative and do not proceed without written approval when deviations from mix design or parameters are found.
- 1.5.3 Certificates:
 - .1 Minimum 4 weeks prior to starting concrete work submit to Owner's Representative manufacturer's test data and certification by qualified independent inspection and testing laboratory that following materials will meet specified requirements:
 - .1 Portland cement.
 - .2 Blended hydraulic cement.
 - .3 Supplementary cementing materials.
 - .4 Grout.
 - .5 Admixtures.

- .6 Aggregates.
- .7 Water.
- .8 Waterstops.
- .9 Waterstop joints.
- .10 Joint filler.
- .2 Provide certification that mix proportions selected will produce concrete of quality, yield and strength as specified in concrete mixes, and will comply with CSA A23.1/A23.2.
- .3 Provide certification that plant, equipment, and materials to be used in concrete comply with requirements of CSA-A23.1/A23.2.

1.6 **Quality Assurance**

1.6.1 Minimum 4 weeks prior to starting concrete work, submit proposed quality control procedures for Owner's Representative approval for following items:

- .1 Falsework erection.
- .2 Hot weather concrete.
- .3 Cold weather concrete.
- .4 Curing.
- .5 Finishes.
- .6 Formwork removal.
- .7 Joints.

1.7 **Delivery, Storage, and Handling**

1.7.1 Concrete hauling time: maximum allowable time for concrete to be delivered to site of Work and discharged not to exceed 120 minutes after batching.

- .1 Modifications to maximum time limit must be agreed to Owner's Representative and concrete producer as described in CSA A23.1/A23.2.
- .2 Deviations to be submitted for review by Owner's Representative.

1.7.2 Concrete delivery: ensure continuous concrete delivery from plant meets CSA A23.1/A23.2.

1.7.3 Waste Management and Disposal:

- .1 Divert unused concrete materials from landfill to local facility approved by Owner's Representative.
- .2 Provide an appropriate area on the job site where concrete trucks can be safely washed.
- .3 Divert unused admixtures and additive materials (pigments, fibres) from landfill to official hazardous material collections site as approved by the Owner's Representative.
- .4 Unused admixtures and additive materials must not be disposed of into sewer systems, into lakes, streams, onto ground or in other location where it will pose health or environmental hazard.
- .5 Prevent admixtures and additive materials from entering drinking water supplies or streams. Using appropriate safety precautions, collect liquid or solidify liquid with inert, noncombustible material and remove for disposal. Dispose of waste in accordance with applicable local, provincial, and national regulations.

2. **PRODUCTS**

2.1 **Materials**

2.1.1 Portland cement: to CAN/CSA-A3001, Type GU.

- 2.1.2 Water: to CAN/CSA-A23.1.
 - 2.1.3 Aggregates: to CSA-A23.1.
 - 2.1.4 Coarse aggregates to be normal density to CSA-A23.1/A23.2.
 - 2.1.5 Admixtures:
 - .1 Air entraining admixture: to ASTM C260.
 - .2 Chemical admixtures: to ASTM C494, Owner's Representative to approve accelerating or set retarding admixtures during cold and hot weather placing.
 - 2.1.6 Non premixed dry pack grout: composition of non-metallic aggregate Portland cement with sufficient water for the mixture to retain its shape when made into a ball by hand and capable of developing compressive strength of 50 MPa at 28 days.
 - 2.1.7 Ribbed waterstops: extruded PVC of sizes indicated shop welded corner and intersecting pieces.
 - .1 Tensile strength: to ASTM D412, method A, Die "C".
 - .2 Elongation: to ASTM D412, method A, Die "C", minimum 275%.
 - .3 Tear resistance: to ASTM D624, method A, Die "B".
 - 2.1.8 Premoulded joint fillers:
 - .1 Bituminous impregnated fiber board: to ASTM D1751.
 - 2.1.9 Polyethylene film: minimum mm thickness to ASTM C171.
 - 2.1.10 Bonding adhesive: as approved by Owner's Representative.
- 2.2 **Mixes**
- 2.2.1 Proportion normal density concrete in accordance with CSA-A23.1/A23.2, Alternative 1 to give following quality and yield for all concrete.
 - .1 Cement:
 - .1 Type GU Portland cement.
 - .2 Minimum compressive strength at 28 days: for structural design.
 - .3 Minimum cement content: 300 kg/m³ of concrete.
 - .4 Class of exposure: N.
 - .5 Nominal size of coarse aggregate: 20 mm.
 - .6 Slump at time and point of discharge: 75 mm to 100 mm.
 - .7 Air content: 5% to 8%.
 - .8 Chemical admixtures: admixtures in accordance with ASTM C494.
- 2.3 **Concrete Bases**
- 2.3.1 Provide cast-in-place architectural concrete bases for lighting poles, bollards, receptacle pedestals and other applications as noted.
- 2.4 **Source Quality Control**
- 2.4.1 Have all concrete produced and delivered by a ready-mix plant that is a member of the Atlantic Provinces Ready Mixed Concrete Association (APRMCA) and holds a current "Certificate of Ready Mixed Concrete Production Facilities" issued by the Association. Submit a copy of this certificate to the Owner's Representative for approval.

3. **EXECUTION**

3.1 **Preparation**

- 3.1.1 Obtain Owner's Representative approval before placing concrete. Provide 24 h notice prior to placing of concrete.
- 3.1.2 Place concrete reinforcing in accordance with Division 03.
- 3.1.3 During concreting operations:
 - .1 Development of cold joints not allowed.
 - .2 Ensure concrete delivery and handling facilitates placing with minimum of rehandling, and without damage to existing structure or Work.

- 3.1.4 Pumping of concrete is permitted only after approval of equipment and mix.
- 3.1.5 Ensure reinforcement and inserts are not disturbed during concrete placement.
- 3.1.6 Prior to placing of concrete obtain Owner's Representative approval of proposed method for protection of concrete during placing and curing in adverse weather.
- 3.1.7 Protect previous Work from staining.
- 3.1.8 Clean and remove stains prior to application for concrete finishes.
- 3.1.9 Maintain accurate records of poured concrete items to indicate date, location of pour, quality, air temperature and test samples taken.
- 3.1.10 Do not place load upon new concrete until authorized by Owner's Representative.

3.2 **Construction**

- 3.2.1 Do cast-in-place concrete work in accordance with CSA-A23.1/A23.2.
- 3.2.2 Sleeves and inserts.
 - .1 No sleeves, ducts, pipes or other openings shall pass through joists, beams, column capitals or columns, except where indicated or approved by Owner's Representative.
 - .2 Where approved by Owner's Representative, set sleeves, ties, pipe hangers and other inserts and openings as indicated or specified elsewhere. Sleeves and openings greater than 100 x 100 mm not indicated, must be approved by Owner's Representative.
 - .3 Do not eliminate or displace reinforcement to accommodate hardware. If inserts cannot be located as specified, obtain approval of modifications from Owner's Representative before placing of concrete.
 - .4 Check locations and sizes of sleeves and openings shown on drawings.
 - .5 Set special inserts for strength testing as indicated and as required by nondestructive method of testing concrete.
- 3.2.3 Anchor bolts.
 - .1 Set anchor bolts to templates under supervision of appropriate trade prior to placing concrete.
 - .2 With approval of Owner's Representative, grout anchor bolts in preformed holes or holes drilled after concrete has set. Formed holes to be minimum 100 mm diameter. Drilled holes to be manufacturer's recommendations.
 - .3 Protect anchor bolt holes from water accumulations, snow and ice build-ups.
 - .4 Set bolts and fill holes with shrinkage compensating grout.
 - .5 Locate anchor bolts used in connection with expansion shoes, rollers and rockers with due regard to ambient temperature at time of erection.
- 3.2.4 Grout under base plates using procedures in accordance with manufacturer's recommendations which result in 100 % contact over grouted area.
- 3.2.5 Finishing.
 - .1 Finish concrete in accordance with CSA-A23.1/A23.2.
 - .2 Use procedures acceptable to Owner's Representative or those noted in CSAA23.1/A23.2, to remove excess bleed water. Ensure surface is not damaged.
 - .3 Wet cure using polyethylene sheets placed over sufficiently hardened concrete to prevent damage. Overlap adjacent edges 150 mm and tightly seal with sand on wood planks. Weigh sheets down to maintain close contact with concrete during the entire curing period.
 - .4 Where burlap is used for moist curing, place two prewetted layers on concrete surface and keep continuously wet during curing period.
 - .5 Finish concrete floor to meet requirements of CSA-A23.1/A23.2.
 - .6 Concrete floor to have finish hardness equal or greater than Mohs hardness in accordance with CSA-A23.1/A23.2.
 - .7 Provide swirl-trowelled finish for exterior walks, ramps, pads.
 - .8 Provide float finish for interior floor slabs.

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- .9 Rub exposed sharp edges of concrete with carborundum to produce 3 mm radius edges unless otherwise indicated.
- 3.2.6 Waterstops.
- .1 Install waterstops to provide continuous water seal.
 - .2 Do not distort or pierce waterstop in such a way as to hamper performance.
 - .3 Do not displace reinforcement when installing waterstops.
 - .4 Use equipment to manufacturer's requirements to field splice waterstops.
 - .5 Tie waterstops rigidly in place.
 - .6 Use only straight heat sealed butt joints in field.
 - .7 Use factory welded corners and intersections unless otherwise approved by Owner's Representative.
- 3.2.7 Joint fillers.
- .1 Furnish filler for each joint in single piece for depth and width required for joint, unless otherwise authorized by Owner's Representative.
 - .2 When more than one piece is required for a joint, fasten abutting ends and hold securely to shape by stapling or other positive fastening.
 - .3 Locate and form, isolation, construction and expansion joints as indicated. Install joint filler.
 - .4 Use 12 mm thick joint filler to separate slabs-on-grade from vertical surfaces and extend joint filler from bottom of slab to within 12 mm of finished slab surface unless indicated otherwise.
- 3.2.8 Dampproof membrane.
- .1 Install dampproof membrane under concrete slabs-on-grade inside building.
 - .2 Lap dampproof membrane minimum 150 mm at joints and seal.
 - .3 Seal punctures in dampproof membrane before placing concrete. Use patching material at least 150 mm larger than puncture and seal.
- 3.2.9 Concrete Bases
- .1 Reinforce bases with vertical steel reinforcing rods and horizontal steel reinforcing ties.
 - .2 Coordinate with installation of conduit at form bases for lighting poles, bollards, floodlights, signs, etc.
 - .3 Install specified below-grade fiber form, reinforcing steel, ducts, etc. to required grade.
 - .4 Place form on top of empty fiber form. Position vertical seams in desired direction.
 - .5 Pour specified concrete through open top of form into fiber form below. Avoid contact with inside surface of form. Bring concrete to top of form.
 - .6 Mechanically vibrate concrete with small vibrator & vigorously hand tap outside surface of form for best concrete surface finish results.
 - .7 Place and center anchor bolt assembly (or post, etc.) into concrete. Trowel-finish top surface of concrete.
- 3.3 **Tolerances**
- 3.3.1 Concrete slab tolerances in accordance with CSA-A23.1/A23.2, F-number Method, $F_F = 25$, $F_L = 20$.
- 3.4 **Field Quality Control**
- 3.4.1 Inspection and testing of concrete and concrete materials will be carried out by a Testing Laboratory designated by Owner in accordance with CSA-A23.1/A23.2, and Section 01 45 00.
- 3.4.2 Owner's Representative will take additional test cylinders during cold weather concreting. Cure cylinders on job site under same conditions as concrete which they represent.
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- 3.4.3 Non-destructive Methods for Testing Concrete shall be in accordance with CSAA23.1/A23.2.
- 3.4.4 Provide Certificate of Field Quality Inspection and Testing to Owner's Representative for inclusion in Commissioning Manual.
- 3.4.5 Inspection or testing by Owner's Representative will not augment or replace Contractor quality control nor relieve the Contractor of his contractual responsibility.

END OF SECTION

1. **GENERAL**
Summary

This Section includes supply and installation of unit masonry assemblies consisting of the following:

- Concrete masonry units (CMUs)
- Mortar, grout and concrete
- Masonry joint reinforcement
- Ties and anchors
- Miscellaneous masonry accessories

1.1 **Related Sections**

- 1.1.1 Section 07 21 13 – Blanket Insulation
- 1.1.2 Section 07 84 00 – Fire stopping
- 1.1.3 Section 07 92 00 – Joint Sealants
- 1.1.4 Section 09 22 16 – Non-Structural Metal Framing
- 1.1.5 Section 09 91 99 – Painting for Minor Works

1.2 **Reference Standards**

- 1.2.1 Canadian Standards Association (CSA):
 - 1.2.1.1 CSA A165 Series-04, CSA Standards on Concrete Masonry Units
 - 1.2.1.2 CSA A179-04, Mortar and Grout for Unit Masonry
 - 1.2.1.3 CSA A370-04, Connectors for Masonry
 - 1.2.1.4 CAN/CSA A371-04, Masonry Construction for Buildings
 - 1.2.1.5 CSA A3000-08, Cementitious Materials Compendium
 - 1.2.1.6 CSA G30.18-09, Carbon Steel Bars for Concrete Reinforcement
 - 1.2.1.7 CSA S304.1-04, Masonry Design for Buildings
- 1.2.2 American Society for Testing of Materials (ASTM):
 - 1.2.2.1 ASTM A496/A496M-07, Deformed Steel Wire for Concrete Reinforcement
 - 1.2.2.2 ASTM A563/A563M-07a, Standard Specification for Carbon and Alloy Steel Nuts
 - 1.2.2.3 ASTM A653/A653M-11, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
 - 1.2.2.4 ASTM A1011/A1011M-13, 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
 - 1.2.2.5 ASTM B633-07, Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel
 - 1.2.2.6 ASTM C5-03, Standard Specification for Quicklime for Structural Purposes
 - 1.2.2.7 ASTM C90-12, Standard Specification for Loadbearing Concrete Masonry Units
 - 1.2.2.8 ASTM C140/C140M-13a, Standard Test Methods for Sampling and Testing Concrete Masonry Units and Related Units
 - 1.2.2.9 ASTM C494/C494M-10, Standard Specification for Chemical Admixtures for Concrete
 - 1.2.2.10 ASTM D1056-07, Standard Specification for Flexible Cellular Materials-Sponge or Expanded Rubber
 - 1.2.2.11 ASTM E488-96 (2003), Standard Test Methods for Strength of Anchors in Concrete and Masonry Elements
 - 1.2.2.12 ASTM E514/E514M-11, Standard Test Method for Water Penetration and Leakage Through Masonry
- 1.2.3 Underwriters Laboratories of Canada (ULC):
 - 1.2.3.1 ULC List of Equipment and Materials for Fire Rated Construction

1.3 **Submittals**

- 1.3.1 Provide requested information in accordance with Section 01 00 06 – General Requirements: Submittals.
- 1.3.2 Action Submittals: Provide the following submittals before starting any work of this Section:
 - 1.3.2.1 Product Data: Submit product data for each type of product specified.
- 1.3.3 Informational Submittals: Provide the following submittals when requested by the Consultant:
 - 1.3.3.1 Submit ULC Assembly Listings and Materials cut sheets for fire rated assemblies as indicated in Section 07 05 53.
 - 1.3.3.2 Source Quality Control Submissions: Submit mix designs for each type of mortar and grout including descriptions of type and proportions of ingredients as follows:
 - 1.3.3.2.1 Include test reports for mortar mixes required in accordance with property specification in accordance with CSA A179.
 - 1.3.3.2.2 Include test reports for grout mixes required in accordance with compressive strength requirement in accordance with CSA A179.
 - 1.3.3.2.3 Include confirmation that mortar materials used have a lowered potential for development of efflorescence in accordance with modified testing for CSA A82.
 - 1.3.3.2.4 Submit mix designs for concrete in accordance with Section 03 31 00.
 - 1.3.3.3 Site Quality Control Submissions: Submit detailed description of methods, materials, and equipment used in accordance with cold or hot weather requirements; and proposed unit masonry cleaning techniques.

1.4 **Quality Assurance**

- 1.4.1 Regulatory Requirements: Provide fire resistance rated materials and construction identical to those of assemblies with fire resistance ratings determined by ULC Listings.

1.5 **Delivery, Storage, And Handling**

- 1.5.1 Delivery and Acceptance Requirements: Deliver pre-blended mortar mix in moisture resistant containers designed for lifting and emptying into dispensing silo; store dry mortar mix in delivery containers on elevated platforms, under cover, and in a dry location or in a metal dispensing silo with weatherproof cover.
- 1.5.2 Storage and Handling Requirements: Store masonry units on elevated platforms in a dry location and as follows:
 - 1.5.2.1 Stack materials on floors of building so that structural design loads are not exceeded; coordinate with Consultant.
 - 1.5.2.2 Cover tops and sides of stacks with waterproof sheeting securely tied to pallets if units are not stored in an enclosed location; do not install masonry units that become wet until they are dry.
 - 1.5.2.3 Store cementitious materials on elevated platforms, under cover, and in a dry location; do not use cementitious materials that have become wet or damp.
 - 1.5.2.4 Store aggregates where grading and other required characteristics can be maintained; store to prevent contamination by substances deleterious to performance and appearance.
 - 1.5.2.5 Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.6 **Site Conditions**

- 1.6.1 Protection of Masonry: Protect masonry and other work from marking and other damage and as follows:
 - 1.6.1.1 Cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work during construction until permanent flashings and membranes are completed.

- 1.6.1.2 Cover partially completed masonry when construction is not in progress to prevent wetting of inside wythes of construction and contribution to efflorescence.
- 1.6.1.3 Extend cover a minimum of 600 mm down both sides and hold cover securely in place.
- 1.6.1.4 Secure cover a minimum of 600 mm down face next to un-constructed wythe and hold cover in place where 1 wythe of multi-wythe masonry walls is completed in advance of other wythes.
- 1.6.1.5 Provide adequate bracing for masonry during construction and until permanent lateral supports are in place.
- 1.6.1.6 Do not apply uniform floor or roof loads for a minimum of 12 hours and concentrated loads for a minimum of 3 days after building masonry walls or columns.
- 1.6.2 Stain Prevention:
 - 1.6.2.1 Use non-staining coverings.
 - 1.6.2.2 Protect completed work from mortar droppings.
 - 1.6.2.3 Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted; immediately remove grout, mortar, and soil that come in contact with such masonry.
 - 1.6.2.4 Protect base of walls from rain splashed mud and from mortar splatter by spreading coverings on ground and over wall surface.
 - 1.6.2.5 Protect sills, ledges, and projections from mortar droppings.
 - 1.6.2.6 Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
 - 1.6.2.7 Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.
 - 1.6.2.8 Protect adjacent surfaces and Work from damage during cleaning of masonry.
- 1.6.3 Membrane and Membrane Flashing Requirements:
 - 1.6.3.1 Apply membrane air/vapour retarder to substrate surfaces that are dry and within the manufacturer's temperature threshold range.
 - 1.6.3.2 Apply membranes to concrete masonry units (strike masonry joints flush) that are smooth, clean, and dry and in good condition:
 - 1.6.3.2.1 Remove moisture, grease, machine oil or other foreign material.
 - 1.6.3.2.2 Verify that concrete and mortar is cured for minimum 7 days, and dry before application.

2 **PRODUCTS**

2.1 **Concrete Masonry Units**

- 2.1.1 Standard Concrete Masonry Units: Manufactured in accordance with CAN/CSA A165.1, and as follows:
 - 2.1.1.1 Classification: H/15/D/M.
 - 2.1.1.2 Size: Modular metric to sizes indicated on Drawings.
 - 2.1.1.3 Special shapes:
 - 2.1.1.3.1 Provide purpose made shapes for lintels and bond beams.
- 2.1.2 Fire Resistant Concrete Masonry Units: Manufactured in accordance with CAN/CSA A165.1 as modified below:
 - 2.1.2.1 Classification: H/15/D/M except as modified by fire resistance requirements specified below.
 - 2.1.2.2 Concrete Composition: Type L230S Concrete.
 - 2.1.2.3 Fire Resistant Characteristics: Aggregate Type and Equivalent Thickness as required to provide fire resistance indicated, determined in accordance with Appendix D of the National Building Code, subsections D-1.4 and D-1.6.
 - 2.1.2.4 Fire Rating: 1 Hour as indicated on Wall Assembly Types listed on Drawing A2.1.
 - 2.1.2.5 Size: Modular metric to sizes indicated on Drawings.
 - 2.1.2.6 Special shapes: Manufactured to same composition as listed above and as

follows:

- 2.1.2.6.1 Provide square units for exposed corners.
- 2.1.2.6.2 Provide purpose made shapes for lintels and bond beams.
- 2.1.2.6.3 Provide additional shapes as indicated.

2.2 **Mortar And Grout Materials**

- 2.2.1 Cementitious Materials: In accordance with CSA A179, and as follows:
 - 2.2.1.1 Cement Type: Normal Portland Cement in accordance with CSA A3001, Type GU.
 - 2.2.1.2 Masonry Cement: In accordance with CSA A3001.
 - 2.2.1.3 Hydrated Lime: In accordance with ASTM C207; Type S or SA
- 2.2.2 Aggregates: In accordance with CSA A179 and as follows:
 - 2.2.2.1 Mortar Aggregates:
 - 2.2.2.1.1 Use same brands of materials and source of aggregate for entire project.
 - 2.2.2.1.2 Use washed aggregate consisting of natural sand or crushed stone for mortar that is exposed to view.
 - 2.2.2.1.3 Use aggregate graded with 100% passing the No. 16 (1.18 mm) sieve for joints less than 6 mm thick.
 - 2.2.2.2 Grout Aggregates: In accordance with CSA A23.1 or ASTM C331.
- 2.2.3 Cold Weather Admixture:
 - 2.2.3.1 Non-chloride, non-corrosive, accelerating admixture in accordance with CSA A179 and ASTM C494/C494M, Type C, and recommended by manufacturer for use in masonry mortar of composition indicated.
 - 2.2.3.2 Acceptable Materials:
 - 2.2.3.2.1 Grace Construction Products, Morset.
 - 2.2.3.2.2 Degussa ChemRex, Trimix-NCA.
- 2.2.4 Water: Potable in accordance with CSA A179.
- 2.2.5 Grout: In accordance with CSA A179, Table 3.

2.3 **Galvanizing**

- 2.3.1 The following galvanizing requirements apply to steel anchors, ties, reinforcing and accessories where requirements are not otherwise specifically listed:
 - 2.3.1.1 Ties and Reinforcing:
 - 2.3.1.1.1 Mill Galvanized (Interior Use): In accordance with ASTM A116, Class 3.
 - 2.3.1.1.2 Hot Dip Galvanized (Exterior, including inner wythe of exterior wall construction and High Humidity Use): In accordance with ASTM A153, Class B-2.
 - 2.3.1.2 Hot Dip Hardware and Bolts: In accordance with ASTM A153, Class B- 2 regardless of location.
 - 2.3.1.3 Hot Dip Sheet Steel: In accordance with ASTM A653/A653M, Coating Designation Z600, regardless of location.
 - 2.3.1.4 Structural Shapes and Pipes: In accordance with ASTM A123/A123M, Grade 85, regardless of location.

2.4 **Reinforcement**

- 2.4.1 Reinforcing Bars: Deformed bars, all Grade 400, in accordance with CSA A371 and CSA G30.18.
- 2.4.2 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:
 - 2.4.2.1 Interior Walls: Hot dip galvanized, carbon steel.
 - 2.4.2.2 Exterior Walls: Hot dip galvanized, carbon steel.
 - 2.4.2.3 Wire Size for Side Rods: W1.7 or 3.8 mm diameter.

- 2.4.2.4 Wire Size for Cross Rods: W1.7 or 3.8 mm diameter.
- 2.4.2.5 Spacing of Cross Rods, Tabs, and Cross Ties: At a maximum of 400 mm O/C.
- 2.4.2.6 Lengths: A minimum of 3000 mm, with prefabricated corner and tee units.
- 2.4.3 Connectors: In accordance with to CSA A370 and CSA S304 with hot dip galvanized finish.
- 2.5 **Ties And Anchors**
- 2.5.1 Ties and anchors specified in this section shall be designed in accordance with CSA A370 for non-conventional masonry connectors as follows:
- 2.5.1.1 Deflection: Maximum 2 mm, including free play, when acted upon by a lateral load of 0.45 kN, in all possible positions of adjustment.
- 2.5.1.2 Positive restraint at position of maximum adjustment.
- 2.5.1.3 Free play of multi-component ties maximum 1.2 mm when assembled in all possible configurations.
- 2.5.1.4 Anchors shall allow vertical adjustment but resist tension and compression forces perpendicular to plane of wall.
- 2.5.2 Lateral Partition Supports (Top of Wall Anchors):
- 2.5.2.1 Angle Support: Fabricated from 2.657 mm core metal thickness angled steel plate having 75 mm long legs fastened to deck structure to allow vertical movement of masonry assembly; hot dip galvanized; coordinate with Section 07 84 00 for firestopping insulation and smoke seals.
- 2.5.3 Toggle Bolts: Tumble wing type, class and style as required for supported construction.
- 2.6 **Miscellaneous Masonry Accessories**
- 2.6.1 Firestopping: As specified under Section 07 84 00.
- 2.6.2 Sealants: As specified under Section 07 92 00, and as follows:
- 2.6.2.1 Vertical Sealant: Colour to match block.
- 2.6.2.2 Horizontal Sealant: Colour to match mortar.
- 2.6.3 Joint Filler:
- 2.6.3.1 Compressible Filler: Pre-moulded filler strips in accordance with ASTM D1056, Grade 2A1; compressible up to 35%; of width and thickness indicated; formulated from neoprene, urethane or PVC.
- 2.6.4 Bond Breaker Strips: #15 asphalt saturated, organic roofing felt in accordance with CSA A123.3.
- 2.6.5 Reinforcing Bar Positioners:
- 2.6.5.1 Wire units designed to fit into mortar bed joints spanning masonry unit cells with loops for holding reinforcing bars in centre of cells.
- 2.6.5.2 Fabricate wire units are formed from 3.6 mm diameter steel wire, hot-dip galvanized after fabrication.
- 2.6.5.3 Acceptable Materials:
- 2.6.5.3.1 Dayton Superior Corporation, Dur-O-Wal D/A 810, D/A 812 or D/A 817
- 2.6.5.3.2 Heckmann Building Products Inc., No. 376 Rebar Positioner
- 2.6.5.3.3 Hohmann and Barnard, Inc., #RB or #RB-Twin Rebar Positioner
- 2.6.6 Air and Vapour Retarder Membranes: Provide only acceptable materials listed in Section 07 27 13 and that form the basis of the contract; coordinate through wall flashings listed in this section with products that form the basis of the contract.
- 2.6.7 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.
- 2.6.8 Metal Flashing: Provide metal flashing materials in accordance with Section 07 62 00.
- 2.7 **Mortar And Grout Mixes**
- 2.7.1 Do not use admixtures, including air entraining agents, accelerators, retarders, water

repellent agents, antifreeze compounds, or other admixtures; unless approved in writing by the Consultant, and as follows:

2.7.1.1 Do not use calcium chloride in mortar or grout.

2.7.1.2 Limit cementitious materials in mortar to portland cement, mortar cement, and lime.

2.7.1.3 Add cold weather admixture (if used) at same rate for all mortar that will be exposed to view, regardless of weather conditions, to ensure that mortar colour is consistent.

2.7.2 Trowel Ready (Wet Premix) Mortar for Unit Masonry:

2.7.2.1 Batch and mix materials in accordance with CSA A179 Property Specification, at an acceptable batch plant; hand mixing will only be permitted when accepted in writing by Consultant for small site mixed quantities.

2.7.2.2 Provide the following types of mortar for applications stated unless another type is specifically indicated on Drawings or needed to provide required compressive strength of masonry:

2.7.2.2.1 Parging Mortar: Type S.

2.7.2.2.2 Mortar for exterior masonry above grade, as follows:

- Loadbearing: Type S.
- Non-loadbearing: Type N.

2.7.2.2.3 Mortar for Interior Masonry, and as follows:

- Loadbearing: Type S.
- Non-loadbearing: Type N.

3 **EXECUTION**

3.1 **Examination**

3.1.1 Examine conditions for compliance with requirements for installation tolerances and other conditions affecting performance of work.

3.1.1.1 Prepare written report listing conditions detrimental to performance of work and submit to the Consultant.

3.1.1.2 Verify that reinforcing dowels are properly placed.

3.1.2 Examine rough-in and built-in construction for piping systems to verify actual locations of piping connections before installation of unit masonry.

3.1.3 Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 **Installation**

3.2.1 Thickness: Build cavity and other masonry construction to full thickness shown on Drawings; build single wythe walls to actual widths of masonry units, using units of widths indicated on Drawings.

3.2.2 Build chases and recesses to accommodate items specified in this and other Sections; leave openings for equipment to be installed before completing masonry; complete masonry to match the construction immediately adjacent to opening after installing equipment.

3.2.3 Use full size units without cutting except as follows:

3.2.3.1 Cut units with motor driven saws if cutting is required to provide a continuous pattern or to fit adjoining construction.

3.2.3.2 Provide clean, sharp, un-chipped edges.

3.2.3.3 Allow units to dry before laying unless wetting of units is specified.

3.2.3.4 Install cut units with cut surfaces and cut edges concealed where possible; obtain Consultant's acceptance where cut edges must be exposed.

3.2.4 Select and arrange units for exposed unit masonry to produce a uniform blend of colours and textures; mix units by drawing units diagonally down multiple rows from at least three different pallets as masonry units are placed.

3.2.5 Installation Tolerances: Install masonry to tolerances listed in CSA A371.

3.3 **Laying Masonry Walls**

- 3.3.1 Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement type joints, returns, and offsets; avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.
- 3.3.2 Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in running bond; do not use units with less than 100 mm horizontal face dimensions at corners or jambs; lay masonry in running bond where not otherwise indicated.
- 3.3.3 Lay concealed masonry with all units in a wythe in running bond or bonded by lapping a minimum of 100 mm, and as follows:
 - 3.3.3.1 Bond and interlock each course of each wythe at corners.
 - 3.3.3.2 Do not use units with less than nominal 100 mm horizontal face dimensions at corners or jambs.
- 3.3.4 Built-In Work:
 - 3.3.4.1 Build in items specified in this and other Sections as construction progresses.
 - 3.3.4.2 Fill in solidly with masonry around built-in items.
 - 3.3.4.3 Fill space between steel frames and masonry solidly with mortar.
 - 3.3.4.4 Place a layer of metal lath, wire mesh, or plastic mesh in the joint below and rod mortar or grout into core where built-in items are to be embedded in cores of hollow masonry units.
 - 3.3.4.5 Protect built-in items from damage arising from work of this Section.
- 3.3.5 Grouting and Concrete Core Fills:
 - 3.3.5.1 Fill cores in hollow concrete masonry units with concrete 600 mm under bearing plates, beams, lintels, posts, and similar items, unless otherwise noted on Drawings.
 - 3.3.5.2 Use concrete where indicated, and also for vertical core filling, lintel beams, bond beams and other filled cores where reinforcing steel is indicated.
 - 3.3.5.3 Use fine grout where the space being grouted is 50 mm or less in its least dimensions; use concrete in all other applications that call for grout.
 - 3.3.5.4 Use square end concrete masonry units wherever a full or half concrete masonry unit will receive concrete fill.
 - 3.3.5.5 Use full mortar bedding of cross webs for cores that are filled.
 - 3.3.5.6 Fill cores in lifts of 1200 mm maximum; provide cleanout openings for lifts in excess of 1200 mm where Consultant has accepted larger lifts.
 - 3.3.5.7 Consolidate core fill during placement by vibration or puddling.
 - 3.3.5.8 Secure vertical reinforcement in position at top and bottom of core, and a maximum 1200 mm spacing, refer to Drawings for location of vertical reinforcement.
 - 3.3.5.9 Fill voids solid with mortar so that ties and anchors are set in full mortar bed where masonry walls abut steel or concrete columns.

3.4 **Mortar Bedding And Jointing**

- 3.4.1 Lay hollow concrete masonry units as follows:
 - 3.4.1.1 Face shells fully bedded in mortar and with head joints of depth equal to bed joints.
 - 3.4.1.2 Webs fully bedded in mortar in all courses of piers, columns, and pilasters.
 - 3.4.1.3 Webs fully bedded in mortar in grouted masonry, including starting course on footings.
 - 3.4.1.4 Entire units, including areas under cells, fully bedded in mortar at starting course on footings where cells are not grouted.
- 3.4.2 Tool exposed joints when mortar is thumbprint hard, using a profiled jointer tool, and as follows:
 - 3.4.2.1 Concave Profile: All exposed joints where paint or similar thin finish coating is specified.

3.5 Masonry Joint Reinforcement

- 3.5.1 Install entire length of longitudinal side rods in mortar with a minimum cover of 16 mm on exterior side of walls and 13 mm in other locations.
- 3.5.2 Lap reinforcement a minimum of 150 mm, and as follows:
 - 3.5.2.1 Space reinforcement at a maximum of 400 mm O/C.
 - 3.5.2.2 Install reinforcement at a maximum of 200 mm above and below wall openings and extending 300 mm beyond openings.
- 3.5.3 Interrupt joint reinforcement at control and expansion joints.
- 3.5.4 Provide continuity at wall intersections by using prefabricated T-shaped units.
- 3.5.5 Provide continuity at corners by using prefabricated L-shaped units.

3.6 Anchoring Masonry To Structural Members

- 3.6.1 Anchor masonry to structural members where masonry abuts or faces structural members as follows:
 - 3.6.1.1 Provide a minimum of 13 mm wide open space between masonry and structural member.
 - 3.6.1.2 Keep open space free of mortar and other rigid materials.
 - 3.6.1.3 Anchor masonry to structural members with anchors embedded in masonry joints and attached to structure.
 - 3.6.1.4 Space anchors at a maximum of 600 mm vertically on-centre and 900 mm horizontally on-centre.

3.7 Control And Expansion Joints

- 3.7.1 Install control and expansion joint materials in unit masonry as masonry progresses; do not allow materials to span control and expansion joints without provision to allow for in-plane wall or partition movement.
- 3.7.2 Form control joints in concrete masonry consisting of a complete vertical break free from mortar using one of the following methods:
 - 3.7.2.1 Break joint reinforcement at control joints, but extend bond beam reinforcing 400 mm into wall across control joint and wrap with 0.15 mm polyethylene bond breaker.
 - 3.7.2.2 Fit bond breaker strips into hollow contour in ends of concrete masonry units on one side of control joint; fill resultant core with grout and rake out joints in exposed faces for application of sealant.
 - 3.7.2.3 Install preformed control joint gaskets designed to fit standard sash block.
 - 3.7.2.4 Install interlocking units designed for control joints; install bond breaker strips at joint; keep head joints free and clear of mortar or rake out joint for application of sealant.
 - 3.7.2.5 Install temporary foam plastic filler in head joints and remove filler when unit masonry is complete for application of sealant.
 - 3.7.2.6 Refer to Drawings for control and expansion joint locations, and vertical reinforcing requirements; confirm location with Consultant before installation; confirm with Consultant where not shown on Drawings.
- 3.7.3 Install a minimum 10 mm high horizontal, pressure relieving joints by inserting a compressible filler, sealant and backer rod specified in Section 07 92 00 Joint Sealants; locate horizontal, pressure relieving joints beneath shelf angles supporting masonry.

3.8 Steel Lintels

- 3.8.1 Install steel lintels where required; coordinate with Section 05 50 00 Metal Fabrications for sizes and spans.
- 3.8.2 Provide minimum 200 mm bearing at each jamb.

3.9 Reinforced Unit Masonry Installation

- 3.9.1 Temporary Formwork and Shores:
 - 3.9.1.1 Construct formwork and shores as needed to support reinforced masonry elements during construction.

- 3.9.1.2 Construct formwork to provide shape, line, and dimensions of completed masonry as indicated.
 - 3.9.1.3 Make forms sufficiently tight to prevent leakage of mortar and grout.
 - 3.9.1.4 Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.
 - 3.9.1.5 Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and other temporary loads that may be placed on them during construction.
 - 3.9.2 Place reinforcement in accordance with CSA A371.
 - 3.9.3 Do not place grout until entire height of masonry to be grouted has attained enough strength to resist grout pressure.
 - 3.9.4 Comply with requirements stated in CSA A371 for cleanouts and for grout placement, including minimum grout space and maximum pour height.
 - 3.9.5 Limit height of vertical grout pours to a maximum of 1500 mm.
- 3.10 **Ties To The Structure**
- 3.10.1 Install welded anchors with adjustable wire ties, at 400 mm O/C; vertically for columns, horizontally for beams, where masonry walls abut or pass steel structural members.
 - 3.10.2 Fill masonry unit solidly with grout or Type S mortar where an anchor crosses a void or passes into the cell of a hollow unit.
 - 3.10.3 Tie unit masonry walls and partitions to concrete columns and beams; fill end space and first block core with concrete and reinforce.
 - 3.10.4 Ties to the structure:
 - 3.10.4.1 Tie walls to undersides of structure by placing continuous 2.657 mm metal angles on both sides of the wall, secured to the structure above only, to provide lateral restraint without limiting vertical movement.
 - 3.10.4.2 Secure lateral support angles at 400 mm maximum centres and within 100 mm of each end.
 - 3.10.4.3 Connect lateral support angles for a factored load of 5 kN/m applied at the tip of the vertical leg.
 - 3.10.4.4 Mount anchor heads flush.
 - 3.10.4.5 Provide dowels for horizontal block lock per Structural Specifications and Drawings.
- 3.11 **Site Quality Control**
- 3.11.1 Site quality control inspections and testing to be performed by third-party testing agency as approved by the Owner.
 - 3.11.2 Contractor will engage qualified independent inspectors to perform inspections and prepare reports; allow inspectors access to scaffolding and work areas, as needed to perform inspections; place grout only after inspectors have verified compliance of grout spaces and grades, sizes, and locations of reinforcement.
- 3.12 **Repairing And Cleaning**
- 3.12.1 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.
 - 3.12.2 After mortar is thoroughly set and cured, clean exposed masonry as follows:
 - 3.12.2.1 Remove large mortar particles by hand with wooden paddles and non-metallic scrape hoes or chisels.
 - 3.12.2.2 Brush efflorescence off of surfaces using a stiff bristled brush to the greatest extent possible.
 - 3.12.2.3 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:
 - 3.12.2.3.1 Local weather forecast and trends can be viewed at

<http://www.weatheroffice.ec.gc.ca/>.

3.12.2.3.2 Wet cleaning can cause additional efflorescence bloom if not allowed to dry sufficiently.

3.12.2.4 Attempt cleaning with plain water and stiff bristled brushes before proceeding to chemical or acidic cleaning methods.

3.12.2.5 Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes.

3.12.2.6 Obtain Consultant's approval of sample cleaning before proceeding with cleaning of masonry.

3.12.2.7 Protect adjacent non-masonry surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.

3.12.2.8 Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.

3.12.2.9 Clean concrete masonry by cleaning method indicated in NCMA TEK 8-2A and 8-3A applicable to type of stain on exposed surfaces.

3.13 **Masonry Waste Disposal**

3.13.1 Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill, as described above, and other masonry waste, and legally dispose of off Owner's property.

END OF SECTION

1 GENERAL

1.1 Related Documents

Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 Summary

1.2.1 This Section includes the following:

1. Aluminum handrails and railings for ramp at Corridor (Elevator Lobby).

1.3 Performance Requirements

1.3.1 General: In engineering handrails and railings to withstand structural loads indicated, determine allowable design working stresses of materials based on the following:

1. Aluminum: AA 30, "Specification for Aluminum Structures."
2. Cold-Formed Structural Steel: AISI SG-673, Part I, "Specification for the Design of Cold-Formed Steel Structural Members."
3. For fully tempered glass in glass-supported handrails and railings, use a safety factor of 3 applied to the applicable modulus of rupture listed in "Mechanical Properties" in AAMA Aluminum Curtain Wall Series No. 12, "Structural Properties of Glass."

1.3.2 Structural Performance of Handrails. Provide handrails capable of withstanding the following structural loads without exceeding allowable design working stress of materials for handrails, anchors, and connections:

1. Handrails: Capable of withstanding the following loads applied as indicated:
 - a. Concentrated load of 200 lbf applied at any point and in any direction
 - b. Uniform load of 50 lbf/ft. applied in any direction.
 - c. Concentrated and uniform loads above need not be assumed to act concurrently.

1.3.3 Thermal Movements: Provide handrails and railings that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, over stressing of components, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

1.3.4 Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

1.4 Submittals

1.4.1 Product Data: For manufacturers product lines of handrails and railings assembled from standard components.

1. Include Product Data for grout, anchoring cement, and paint products.

1.4.2 Shop Drawings: Show fabrication and installation of handrails and railings. Include plans, elevations, sections, details, and attachments to other work.

1.4.3 Samples for Initial Selection: Manufacturer's color charts showing the full range of colors available for products with factory-applied color finishes.

1.4.4 Samples for Initial selection: Short sections of railing or flat sheet metal Samples showing available mechanical finishes.

1.4.5 Samples for Verification: For each type of exposed finish required, prepared on components indicated below and of same thickness and metal indicated for the Work. If finishes involve normal color and texture variations, include sample sets showing the full range of variations expected.

1. 35-mm diam pipe section of each handrails
2. Fittings and brackets.
3. Assembled Samples of railings, made from full-size components, including top rail, post, handrail, and infill. Show method of finishing members at intersections. Samples need not be full height.

1.4.6 Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

1.4.7 Product Test Reports: Indicating products comply with requirements, based on comprehensive testing of current products.

1.5 Quality Assurance

1.5.1 Source Limitations: Obtain each type of railing through one source form a single manufacturer.

1.6 Storage

1.6.1 Store handrails and railings in a dry, well-ventilated, weather tight place.

1.7 Project Conditions

1.7.1 Field Measurements: Verify handrail and railing dimensions by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the work.

1.7.2 Established Dimensions: Where field measurements cannot be made without delaying the work, establish dimensions and proceed with fabricating handrails and railings without field measurements. Coordinate construction to ensure that actual dimensions correspond to established dimensions.

1.8 Coordination

1.8.1 Coordinate installation of anchorage for handrails and railings. 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.

2 **PRODUCTS**

2.1 **Manufacturers**

2.1.1 Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include the following:

1. Aluminum Handrails and Railings:
 - a. C.R. Laurence Co., Inc.
2503 E. Vernon Ave.
Los Angeles, CA. 90058
Toll Free: (800) 421-6144
Toll Free Fax: (800) 262-3299
International Phone: (323) 588-1281
International Fax: (323) 584-5289
www.crlaurence.com
email: techsales@crlaurence.com

2.2 **Metals**

2.2.1 General: Provide metal free from pitting, seam marks, roller marks, stains, discolorations, and other imperfections where exposed to view on finished units.

2.2.2 Aluminum: Alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with not less than strength and durability properties of alloy and temper designated below for each aluminum form required.

1. Extruded Bar and Tube: ASTM B 221 (ASTM B 221M), alloy 6063-T5/T52.
2. Extruded Structural Pipe and Tube: ASTM B 429, alloy 6063-T6.
3. Drawn Seamless Tube: ASTM B 210 (ASTM B 210M), alloy 6063-T832.
4. Plate and Sheet: ASTM B 209 (ASTM B 209M), alloy 6061-T6.
5. Die and Hand Forgings: ASTM B 247 (ASTM B 247M), alloy 6061-T6.
6. Castings: ASTM B 26/B 26M, alloy A356-T6.

2.2.3 Brackets, Flanges, and Anchors: Cast or formed metal of same type of material and finish as supported rails, unless otherwise indicated.

1. Provide cast brackets with flange tapped for concealed anchorage to threaded hanger bolt.
2. Provide formed or cast brackets with predrilled hole for exposed bolt anchorage.
3. Provide formed steel brackets with predrilled hole for bolted anchorage and with snap-on cover that matches rail finish and conceals bracket base and bolt head.
4. Provide brackets with interlocking pieces that conceal anchorage. Locate screws on bottom of bracket.

2.3 **Fasteners**

2.3.1 Fasteners for Anchoring Handrails and Railings to other Construction: Select fasteners of type, grade and class required to produce connections suitable for anchoring handrails to other types of construction indicated and capable of withstanding design loads.

2.3.2 Fasteners for Interconnecting Handrail and Railing Components: Use fasteners fabricated from same basic metal as fastened metal, unless other wise indicated. Do not use metal that are corrosive or incompatible with material joined.

1. Provide concealed fasteners for interconnecting railing components and for attaching them to other Work, unless exposed fasteners are unavoidable or are standard fastening method for handrail and railing indicated.
2. Provide Phillips flat-head machine screws for exposed fasteners, unless otherwise indicated.

2.3.3 Cast-in-Place and Post installed Anchors: Anchors of type indicated below, fabricated from corrosion-resistant materials with capability to sustain, without failure, a load equal to six times the load imposed when installed in concrete, as determined by testing per ASTM E 488 conducted by qualified independent testing agency.

1. Cast-in-place anchors.
2. Chemical anchors.
3. Expansion anchors.

2.5 Grout And Anchoring Cement

2.5.1 Nonshrink, Nonmetallic Grout: Premixed, factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.

2.5.2 Interior Anchoring Cement: Factory-packaged, nonshrink, nonstaining, hydraulic-controlled expansion cement formulation for missing with water at Project site to create pourable anchoring, patching, and grouting compound. Use for interior applications only.

2.6 Fabrication

2.6.1 Assemble handrails and railing in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation. Use connections that maintain structural value of joined pieces.

2.6.2 Form changes in direction of railing members as follows:

1. As detailed.

2.6.2 Mechanical Connections: Fabricate handrails and railings by connecting members with railing manufacturer's standard concealed mechanical fasteners and fittings, unless other wise indicated. Fabricate members and fittings to produce flush, smooth, rigid, hairline joints.

2.6.3 Brackets, Flanges, Fittings, and Anchors: Provide manufacturer's standard wall brackets, flanges, miscellaneous fittings, and anchors to connect handrail and railing members to other construction.

2.6.4 Provide inserts and other anchorage devices to connect handrails to concrete or masonry. Fabricate anchorage device capable of withstanding loads imposed by handrails and railings. Coordinate anchorage devices with supporting structure.

2.6.5 Shear and punch metals cleanly and accurately. Remove burrs from exposed cut edges.

2.6.6 Cut, reinforce, drill, and tap components, as indicated, to receive finish hardware, screws, and similar items.

2.6.7 Close exposed ends of railing members with prefabricated end fittings.

2.6.8 Provide wall returns at ends of wall-mounted handrails, unless other wise indicated. Close ends of returns, unless clearance between end of railing and wall is ¼ inch (6 mm) or less.

2.7 Finishes, General

2.8.1 Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

2.8.2 Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.8 Aluminum Finishes

2.9.1 Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

2.9.2 High Performance Organic Coating Finish: AA-C12C42R1x (Chemical Finish: cleaned with inhibited chemicals, Chemical Finish: acid chromate-fluoride-phosphate conversion coating; Powder Coating: as specified below). Prepare, pretreat, and apply coating to exposed metal surfaces to comply with manufacturer's written instructions.

1. Tiger Drylac, Series 39, Polyester Powder Coating, 3 mil. Average film thickness complying with AAMA 2604-98.

a. Color and Gloss: As selected by Architect from manufacturer's full range of choices for color and gloss, including custom colors. Selections might include up to four different selections for color.

3 EXECUTION

3.1 Examination

3.1.1 Examine substrates, where reinforced to receive anchors, to verify that locations of concealed reinforcements have been clearly marked for Installer. Locate reinforcements and mark locations if not already done.

3.2 Installation, General

3.2.1 Fit exposed connections together to form tight, hairline joints.

3.2.2 Cutting, Fitting, and Placement: Perform Cutting, drilling, and fitting required for installing handrails and railings. Set handrails and railing accurately in location, alignment, and elevation, measured from established lines and levels and free from rack.

1. Do not weld, cut, or abrade surfaces of railing components that have been coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
2. Align rails so variations from level for horizontal members and from parallel with rake of steps and ramps for sloping members do not exceed ¼ inch in 12 feet (5 mm in 3 m).

3.2.3 Corrosion Protection: Coat concealed surfaces of aluminum and copper alloys that will be in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.

3.2.4 Adjust handrails and railings before anchoring to ensure alignment at abutting joints. Space posts at interval indicated, but not less than that required by structural loads.

3.2.5 Fastening to In-Place Construction: Use anchorage devices and fasteners where necessary for securing handrails and railing and for properly transferring loads to in-place construction.

3.3 **Connections**

3.3.1 Nonwelded Connections: Use mechanical joints for permanently connecting railing components. Use wood blocks and padding to prevent damage to railing members and fittings.

3.4 **Installing**

3.4.1 Handrails: Install assembly to comply with railing manufacturer's written instructions.

1. Erect handrails under direct supervision of manufacturer's authorized technical personnel.

3.5 **Cleaning**

3.5.1 Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with same material.

3.6 **Protection**

3.6.1 Protect finishes of handrails and railings from damage during construction period with temporary protective coverings approved by railing manufacturer. Remove protective coverings at the time of Substantial Completion.

3.6.2 Restore finishes damaged during installation and construction period so no evidence remains of correction work. Return items that cannot be refinished in field to shop; make required alterations and refinish entire unit, or provide new units.

END OF SECTION

1. GENERAL**Summary**

This section consists of miscellaneous metal fabrications such as steel lintels and lighting grids.

1.1 Related Section

- 1.1.1 Section 01 33 00 – Submittal Procedures
- 1.1.2 Section 01 74 11 – Cleaning
- 1.1.3 Section 07 21 29 – Blanket Insulation
- 1.1.4 Section 07 92 00 - Joint Sealants

1.2 References

- 1.2.1 ASTM International:
 - .1 ASTM A 53/A 53M-07, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.
 - .2 ASTM A 269-08, Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service.
 - .3 ASTM A 307-07b, Standard Specification for Carbon Steel Bolts and Studs, 60,000PSI Tensile Strength.
- 1.2.2 CSA International:
 - .1 CSA G40.20/G40.21-04 (R2009), General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
 - .2 CAN/CSA G164-M92 (R2003), Hot Dip Galvanizing of Irregularly Shaped Articles.
 - .3 CSA S16-09, Design of Steel Structures.
 - .4 CSA W48-06, Filler Metals and Allied Materials for Metal Arc Welding (Developed in co-operation with the Canadian Welding Bureau).
 - .5 CSA W59-M03 (R2008), Welded Steel Construction (Metal Arc Welding) Metric.
- 1.2.3 Health Canada / Workplace Hazardous Materials Information System (WHMIS):
 - .1 Material Safety Data Sheets (MSDS).

1.3 Action and Informational Submittals

- 1.3.1 Submit in accordance with Section 01 33 00 – Submittal Procedures.
- 1.3.2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for sections, plates, pipe, tubing, bolts and include product characteristics, performance criteria, physical size, finish and limitations.
 - .2 Submit two copies of WHMIS MSDS. For finishes, coatings, primers and paints applied on site: indicate VOC concentration in g/L.
- 1.3.3 Shop Drawings:
 - .1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Ontario, Canada.
 - .2 Indicate materials, core thicknesses, finishes, connections, joints, method of anchorage, number of anchors, supports, reinforcement, details and accessories.
 - .3 Low-Emitting Materials: Submit listing of paints and coatings used in building, comply with VOC and chemical component limits or restrictions requirements.

1.4 Quality Assurance

- 1.4.1 Test Reports: submit certified test reports showing compliance with specified performance characteristics and physical properties.
- 1.4.2 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

- 1.5.1 Deliver, store and handle materials in accordance with Section 01 61 00 – Common Product Requirements and with manufacturer's written instructions.
- 1.5.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labeled with manufacturer's name and address.
- 1.5.3 Storage and Handling Requirements:
 - .1 Store materials off ground in dry location and in accordance with manufacturer's recommendations.
 - .2 Replace defective or damaged materials with new.

2. PRODUCTS**2.1 Materials**

- 2.1.1 Steel sections and plates: to CAN/CSA-G40.21, Grade 350W.
- 2.1.2 Steel pipe: to ASTM A53 standard weight galvanized finish.
- 2.1.3 Bolts and anchor bolts: to ASTM A307.
- 2.1.4 Shop coat primer to CGSB 85-GP-10M.

2.2 Fabrication

- 2.2.1 Fabricate work square, true, straight and accurate to required size, with joints closely fitted and properly secured.
- 2.2.2 Use self-tapping shake-proof round headed screws on items requiring assembly by screws or as indicated.
- 2.2.3 Where possible, fit and shop assemble work, ready for erection.
- 2.2.4 Provide bolted 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.

2.3 Finishes

- 2.3.1 Shop coat primer: to CAN/CGSB-1.40.
- 2.3.2 Primer: VOC limit 250 g/L maximum to GS-11CCD-047a.
- 2.3.3 Apply one shop coat of primer to metal items.
- 2.3.4 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.

2.4 Isolation Coating

- 2.4.1 Isolate aluminum from following components, by means of bituminous paint:
 - .1 Dissimilar metals except stainless steel, zinc, or white bronze of small area.
 - .2 Concrete, mortar, masonry and wood.

2.5 “L” Steel Angles and Steel Plates

- 2.5.1 Steel angles at corridor extension:
 - .1 Prime painted, steel plate where indicated in contract drawings. Weld steel angles to each steel plate. Fasten steel plate to wood blocking with 3 ¼” long lag bolts.
- 2.5.2 Prime paint for interior.
 - .1 Primer: maximum VOC limit 50 g/L when applied onsite.

2.6 Channel Frames

- 2.6.1 Fabricate frames from steel, sizes of channel and opening as indicated in structural drawings.
- 2.6.2 Weld channels together to form continuous frame for jambs and head of openings, sizes

as indicated.

- 2.6.3 Galvanized finish for exterior, prime paint for interior.
.1 Primer: maximum VOC limit 50 g/L when applied onsite.

3. **EXECUTION**

3.1 **Examination**

Verification of Conditions: Verify conditions of substrates previously installed under other Sections or Contracts are acceptable for metal fabrications installation in accordance with manufacturer's written instructions.

- 3.1.1 Inform the Consultant of unacceptable conditions immediately upon discovery.
3.2.2 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from the Consultant.

3.2 **Erection**

- 3.2.1 Do welding work in accordance with CSA W59 unless specified otherwise.
3.2.2 Erect metalwork square, plumb, straight and true, accurately fitted, with tight joints and intersections.
3.2.3 Provide suitable means of anchorage acceptable to the Consultant such as dowels, anchor clips, bar anchors, expansion bolts and shields and toggles.
3.2.4 Exposed fastening devices to match finish, be finished flush and be compatible with material through which they pass.
3.2.5 Supply components for work by other trades in accordance with shop drawings and schedule.
3.2.6 Make field connections and field weld connection in accordance to the Contract Documents.
3.2.7 Deliver items over for casting into concrete and building into masonry together with setting templates to appropriate location and construction personnel.
3.2.8 Touch-up rivets, field welds, bolts and burnt or scratched surfaces with primer after completion of primer.
3.2.9 Touch-up galvanized surfaces with zinc rich primer where burned by field welding.
3.2.10 Install railing system rigid and secure, installed by mechanics experienced in erection of architectural metal. All screws and fittings shall be drawn up tightly. Rails shall be set plumb and aligned.
3.2.11 Do not cut components or abrade component finishes. Field touch-up of finishes is not acceptable. Return components with damaged finishes to shop for required alterations, followed by complete refinishing or provide new components.
3.2.12 Secure mounting brackets to building structure in a positive manner using manufacturer recommended reinforcement and anchorage methods for substrate conditions. Locate brackets and hardware at spacing required to support structural loads.

3.3 **Corner Guards**

- 3.3.2 Provide sufficient blocking in wall for wall mounted lighting grid supports.

3.4 **Cleaning**

- 3.4.1 Progress Cleaning: clean in accordance with Section 01 74 11 – Cleaning. Leave work area clean at end of each day.
3.4.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 – Cleaning.

3.5 **Protection**

- 3.5.1 Protect installed products and components from damage during construction.
- 3.5.2 Repair damage to adjacent materials caused by metal fabrications installation.

END OF SECTION

1. GENERAL**Summary**

Work of this Section consists of plywood for electrical panel backboard, blocking for wall mounted equipment and handrails and plywood board at parapet walls where necessary.

1.1 Related Section

1.1.1 01 74 11 Cleaning

1.2 References

1.2.1 Canadian Standards Association (CSA International):

- .1 CSA B111-1974 (R2003), Wire Nails, Spikes and Staples.
- .2 CAN/CSA-G164-M92 (R2003), Hot Dip Galvanizing of Irregularly Shaped Articles.
- .3 CSA O121-M1978 (R2003), Douglas Fir Plywood.
- .4 CSA O141-05, Softwood Lumber.
- .5 CSA O151-04, Canadian Softwood Plywood.
- .6 CSA O153-M1980 (R2003), Poplar Plywood.
- .7 CAN/CSA-O325.0-92 (R2003), Construction Sheathing.

1.2.2 Health Canada/WHMIS: MSDS.

1.2.3 National Lumber Grades Authority (NLGA): Standard Grading Rules for Canadian Lumber 2005.

1.2.4 Underwriters Laboratories of Canada (ULC):

- .1 CAN4-S104-80 (R1985), Standard Method for Fire Tests of Door Assemblies.
- .2 CAN/ULC-S105-09, Standard Specification for Fire Door Frames.

1.3 Action and Informational Submittals

1.3.1 Submittal Submissions: in accordance with Section 01 33 00 – Submittal Procedures.

1.4 Quality Assurance

1.4.1 Lumber identification: by grade stamp of an agency certified by Canadian Lumber Standards Accreditation Board.

1.4.2 Plywood identification: by grade mark in accordance with applicable CSA standards.

1.4.3 Plywood, OSB and wood based composite panel construction sheathing identification: by grademark in accordance with applicable CSA standards.

1.5 Delivery, Storage and Handling

1.5.1 Storage and Handling Requirements:

- .1 Store materials off ground in dry location and in accordance with manufacturer's recommendations.
- .2 Replace defective or damaged materials with new.

2. PRODUCTS**2.1 Performance Requirements**

2.1.1 Lumber Grades: Provide lumber products that are all sides finished (S4S) in nominal dimensions required for the project; grade-marked by accredited agencies of the Canadian Lumber Standards Accreditation Board and conform to Standard Grading Rules published by the National Lumber Grades Authority.

2.1.2 Panel Grades: Provide panel products that are grade-marked by agencies recognized by CSA O325 and National Institute of Standards and Technology, Voluntary Product Standard PS 2-04 Performance Standard for Wood-Based Structural-Use Panels as modified by other listed CSA panel standards.

- 2.1.3 Moisture Content: Provide lumber and panel products installed in contact with gypsum board and similar moisture sensitive materials must have a maximum moisture content of 8% or less, tested immediately prior to installation of those products.
- 2.1.4 Volatile Organic Compound Emissions: Use adhesives in composite lumber and panel products that have no added urea-formaldehyde and that are not volatile at normal occupied building temperature conditions.

2.2 **Lumber Materials**

All materials to be straight, new, dry and clean, properly sized and chapped to correct dimensions from nominal sizes specified or indicated.

- 2.2.1 Lumber: unless specified otherwise, softwood, S4S, moisture content 19% or less in accordance with following standards:
 - .1 CAN/CSA-O141.
 - .2 NLGA Standard Grading Rules for Canadian Lumber.
 - .3 CAN/CSA-Z809 or FSC or SFI certified.
- 2.2.2 Furring, blocking, nailing strips, grounds, rough bucks, cants, curbs, fascia backing and sleepers for walls, casework, and counters where required:
 - .1 S2S is acceptable for furring, nailing strips and rough bucks.
 - .2 Dimension size: "Standard" light framing or better grade.
- 2.2.3 Lumber for exterior sheathing:
 - .1 Type 3: 13mm (1/2") Pressure-Treated softwood, S4S. Plywood, OSB and wood based composite panels: to CAN/CSA-O325.
 - .1 Urea-formaldehyde free.
 - .2 In accordance with following Standards:
 - .1 to CAN/CSA-O325 , or
 - .3 Dimension size: 1219x2438mm (4'x8') sheets cut to suit application.
 - .5 Fastening:
 - .1 anchor to metal studs or wall using galvanized fasteners and toggle bolts.
- 2.2.4. Lumber for wood fence, gates and gazebo:
 - .1 Pressure-Treated wood to CSA O322-[02], for posts, rails, rafters
 - .2 Cedar to CAN/CSA-O141 for fence boards

2.3 **Panel Materials:**

All materials to be straight, new, dry and clean, properly sized and chapped to correct dimensions from nominal sizes specified or indicated.

- .1 Douglas fir plywood (DFP): to CSA O121, standard construction.
 - .1 Urea-formaldehyde free.
- .2 Canadian softwood plywood (CSP): to CSA O151, standard construction.
 - .1 Urea-formaldehyde free.
- .3 Plywood, OSB and wood based composite panels: to CAN/CSA-O325.
 - .1 Urea-formaldehyde free.
- 2.3.1 Lumber for electrical panel backboard:
 - .1 Type 3: 19mm (3/4") Fire-Rated Pressure-Treated softwood, S4S.
 - .2 In accordance with following Standards:
 - .1 CAN4-S104 and CAN/ULC-S105, or
 - .2 NLGA Standard Grading Rules for Canadian Lumber, or
 - .3 Canadian softwood plywood (CSP): to CSA/ULC-S105, standard construction, urea-formaldehyde free.
 - .3 Dimension size: 1219x2438mm (4'x8') sheets cut to suit application.
 - .4 Finish: Painted to later selection by Architect.

- .5 Fastening:
 - .1 anchor to metal studs or wall using toggle bolts.
- 2.3.2 Lumber for roof sheathing
 - .1 Grade B: 16mm (5/8") T&G for Gazebo to CSA O121 (DFP) or CSA O151-04 (CSP) exterior grade
 - .2 Grade C: 13 mm (1/2") for Roof Sheathing to CSA O121 (DFP) or CSA O151-04 (CSP) exterior grade
- 2.4 **Accessories**
 - 2.4.1 Nails, spikes and staples: to CSA B111.
 - 2.4.2 Bolts: 12.5mm diameter unless indicated otherwise, complete with nuts and washers.
 - 2.4.3 Proprietary fasteners: toggle bolts, expansion shields and lag bolts, screws and lead or inorganic fibre plugs, recommended for purpose by manufacturer.
 - 2.4.4 Metal 'U' clamps.
 - 2.4.5 Adhesives: Gun grade, cartridge loaded adhesives meeting requirements of GS- 36 for Commercial Adhesive as follows:
 - 1. General Purpose Adhesive: Meeting requirements of CSA O112 having maximum VOC content of 70 g/L
 - 2.4.6 Sealant: Non-hardening butyl sealant as specified in Section 07 92 00.
- 2.5 **Finishes**
 - 2.5.1 Galvanizing: to CAN/CSA-G164 ASTM A 653/A 653M, use galvanized fasteners for all exterior work, fire-retardant treated lumber and pressure treated lumber.
 - 2.5.2 Painted; unless otherwise indicated. Color to later selection by Architect.
Primers and Paints: in accordance with manufacturer's recommendations for surface conditions:
 - .1 Primer: VOC limit 100 g/L maximum to GS-11, SCAQMD Rule 1113.
 - .2 Paint: VOC limit 50g/L maximum to GS-11, SCAQMD Rule 1113.
 - .3 Coating: VOC limit 100 g/L maximum to GS-11 SCAQMD Rule 1113.
- 2.6 **Wood Preservative**
 - 2.6.1 Surface-applied wood preservative: clear or copper naphthenate or five per cent pentachlorophenol solution, water repellent preservative.
 - 2.6.2 Structures built with wood treated with pentachlorophenol and inorganic arsenicals must not be used for storing food nor should the wood come in contact with drinking water.
- 3. **EXECUTION**
 - 3.1 **Preparation**
 - 3.1.1 Treat surfaces of material with wood preservative, before installation.
 - 3.1.2 Apply preservative by dipping or by brush to completely saturate and maintain wet film on surface for minimum three minute soak on lumber and one minute soak on plywood.
 - 3.1.3 Re-treat surfaces exposed by cutting, trimming or boring with liberal brush application of preservative before installation.
 - 3.2 **Installation**
 - 3.2.1 Comply with requirements of National Building Code (NBC), supplemented by the following paragraphs.
 - 3.2.2 Install furring and blocking as required to space-out and support casework, cantilevered countertops, ceiling canopies, cabinets, wall mounted equipment and accessories, wall

and ceiling finishes, facings and other work as required.

- 3.2.3 Align and plumb faces of furring and blocking to tolerance of 1:600.
- 3.2.4 Install rough bucks, Nailers and linings to rough openings as required to provide backing for frames and other work.
- 3.2.5 Use caution when working with particle board. Use dust collectors and high-quality respirator masks.
- 3.2.6 Provide nailing of framing to OBC Table 9.23.3.4
- 3.2.7 Counter sink bolts where necessary to provide clearance for other work.
- 3.2.8 Provide furring and blocking as required to space out and support casework, cabinets, wall and ceiling finishes, facings, and other work as required.

END OF SECTION

1. GENERAL

1.1. General Requirements

- 1.1.1. The General Conditions, the Supplementary Conditions, the Instructions to Bidders and Division 1 General Requirements shall be read in conjunction with and govern this section.
- 1.1.2. The Specification shall be read as a whole by all parties concerned. Each Section may contain more or less than the complete work of any trade. The Contractor is solely responsible to make clear to the Subcontractors the extent of their work.

1.2. Summary

- 1.2.1. This Section includes requirements for supply and installation of the following, as required for complete and proper installation:
 - .1 Fluid Applied Bituminous Dampproofing Membrane

1.3. Related Sections

- 1.3.1. Section 03 30 00 Cast-in-Place Concrete

1.4. References

- 1.4.1. Specification American Society for Testing and Materials (ASTM):
 - .1 ASTM D4479/D4479M, Standard Specification for Asphalt Roof Coatings – Asbestos Free
 - .2 ASTM E96, Standard Test Methods for Water Vapor Transmission of Materials
- 1.4.2. Canadian General Standards Board (CGSB):
 - .1 CAN/CGSB 37.2, Emulsified Asphalt, Mineral-Colloid Type, Unfilled, for Dampproofing and Waterproofing, and for Roof Coatings
 - .2 CAN/CGSB 37.16, Filled Cutback Asphalt for Dampproofing and Waterproofing
 - .3 CGSB 37-GP-6M, Asphalt, Cutback, Unfilled for Dampproofing

1.5. Administrative Requirements

- 1.5.1. Coordination: Coordinate the Work of this Section with the installation of exterior substrate; Sequence work so that installation of fluid applied bituminous dampproofing membrane coincides with installation of substrate preparation without causing delay to the Work.

1.6. Submittals

- 1.6.1. Provide requested information in accordance with Section 01 33 00 Submittals Procedures.
- 1.6.2. Action Submittals: Provide the following submittals before starting any work of this Section:
 - .1 Product Data: Submit manufacturer's data sheets covering the care and recommended maintenance procedures for incorporation into maintenance manuals.
 - .2 Certifications:
 - .1 Submit copies of manufacturers' current ISO 9001 certification. Fluid applied bituminous dampproofing membrane, adhesives and associated auxiliary materials shall be included.
 - .3 Submit references clearly indicating that the fluid applied bituminous dampproofing membrane manufacturer has successfully completed projects on an annual basis of similar scope and nature for a minimum of fifteen (15) years.
 - .4 Submit manufacturers' complete set of standard details for the fluid applied bituminous dampproofing membrane showing a continuous plane of water tightness below grade.
 - .5 Provide material checklist complete with application rates and minimum thickness of adhesives and primers.

1.7. Quality Assurance

- 1.7.1. Qualifications: Provide proof of qualifications when requested by consultant:
- .1 Submit in writing, a document stating that the applicator of the fluid applied bituminous dampproofing membrane specified in this section is recognized by the manufacturer as suitable for the execution of the Work.
 - .2 Perform Work in accordance with the manufacturer's written instructions of the fluid applied bituminous dampproofing membrane and this specification.
 - .3 Maintain one copy of manufacturer's written instructions on site.
 - .4 At the beginning of the Work and at all times during the execution of the Work, allow access to Work site by the fluid applied bituminous dampproofing membrane manufacturers' representative.
 - .5 Components used in this section shall be sourced from one manufacturer; including fluid applied bituminous dampproofing membrane, sealants, primers, mastics and adhesives.

1.8. Delivery, Storage and Handling

- 1.8.1. Delivery: At the time of delivery, visually inspect all materials for damage. Note any damaged to materials on the receiving ticket and immediately report to the shipping company and the material manufacturer.
- .1 Remove damaged materials from the site immediately.
- 1.8.2. Storage:
- .1 Store materials as recommended by manufacturer and conforming to applicable safety regulatory agencies. Refer to all applicable data including but not limited to MSDS sheets, Product Data sheets, product labels, and specific instructions for personal protection.
 - .2 Store materials off the ground and cover with a weather proof flame resistant sheeting or tarpaulin.
- 1.8.3. Handling: Material shall be handled in accordance with sound material handling practices and in accordance with manufacturer's written instructions.

1.9. Coordination

- 1.9.1. Ensure continuity of the water seal throughout the scope of this section.
- 1.9.2. Ambient Conditions:
- .1 Install materials outlined in this Section after completion of work by other Sections is complete; to provide adequate dry, clean, level, and plumb surfaces for installation and adhesion.
 - .2 Apply when ambient air and substrate temperatures are above temperature range indicated by fluid applied bituminous dampproofing membrane manufacturer, during time of install, and for a minimum of forty-eight (48) hours after installation, unless otherwise indicated.
 - .3 Ensure surfaces are sound, dry, clean and free of oil, grease, dirt, excess mortar or other contaminants.
 - .4 Ensure surfaces are dry prior to and a minimum of sixteen (16) hours after time of install.
 - .5 Do not permit traffic of any kind over unprotected bituminous dampproofing membranes. Apply protection course as soon as possible in accordance with manufacturers written instructions.

1.10. Alternatives

- 1.10.1. Submit requests for alternates in accordance with Section 01 23 10 Alternatives.
- 1.10.2. Submit requests for alternates to this specification a minimum of ten (10) working days prior to bid date. Include a list of twenty-five (25) projects executed over the past five (5) years.

- 1.10.3. Acceptable alternates will be confirmed by addendum. Substitute materials not approved in writing prior to tender closing shall not be permitted for use on this project.

1.11. Warranty

- 1.11.1. Contractor Warranty: Warrant that the fluid applied dampproofing membrane and membrane flashings will stay in place and remain leak proof for two (2) years.
- 1.11.2. Manufacturer's Warranty: Fluid applied dampproofing membrane manufacturer must warranty the membrane and membrane flashings for leak coverage as a result of faulty materials for a period of five (5) years from the date of substantial completion.

2. PRODUCTS

2.1. Material Manufacturer

- 2.1.1. Components and auxiliary materials must be obtained as a single-source from the assembly manufacturer to ensure total system compatibility and integrity.
- 2.1.2. Materials and accessories specified herein are manufactured by:
Henry Company
15 Wallsend Drive,
Scarborough, Ontario, Canada, M1E 3X6
(800) 387 9598
www.henry.com

2.2. Materials

- 2.2.1. Fluid Applied Bituminous Dampproofing Membrane
- .1 Liquid applied, dampproofing emulsion composed of vacuum-reduced asphalt dispersed in a mineral colloid emulsifier, in compliance with CAN/CGSB 37.2. for warm weather applications.
- .1 Colour: Black
- .2 Solids by Volume: 57%
- .3 Application Temperature: 5 deg C (40 deg F) minimum.
- .4 Maximum VOC: 0 g/L
- .5 Water Vapour Permeance (ASTM E96): 8 ng/Pa.m².s., (0.14 perms)
- .6 Basis of Design Product: 700-01 Dampproofing and Waterproofing Asphalt Emulsion by Henry Company.
- .2 Liquid applied medium consistency, solvent type waterproofing and dampproofing compound of selected asphalts and fibres permitting application in thick films; in compliance with CAN/CGSB 37.16-M89. For cold weather applications
- .1 Colour: Black
- .2 Solids by Volume: 54%
- .3 Application Temperature: Ambient (Thickens at low temperature).
- .4 Water Vapour Permeance (ASTM E96): 2.9 ng/Pa.m².s., (0.05 perms)
- .5 Basis of Design Product: 710-11 Dampproofing and Waterproofing Asphalt Coating by Henry Company.
- 2.2.2. Asphalt Primer
- .1 Light bodied asphalt based material for priming surfaces for cold-applied dampproofing coatings, in compliance with CGSB 37-GP-9M.
- .1 Colour: Black
- .2 Solids by Volume: 37%
- .3 Basis of Design Product: 910-01 Penetrating Asphalt Primer by Henry Company.
- 2.2.3. Insulation Adhesive
-

- .1 Insulation, Drainage Board and Protection Board Adhesive: Synthetic rubber base compound having the following characteristics:
 - .1 Colour: Cream.
 - .2 Compatible with sheet applied waterproofing membrane, substrate and insulation materials.
 - .3 Long term flexibility: Pass CGSB 71-GP-24M.
 - .4 Chemical resistance: Alkalis, mild acid and salt solutions.
 - .5 Application Temperature: between -12 deg C and 40 deg C.
 - .6 Basis of Design Products: 230-21 Insulation Adhesive by Henry Company.

3. **EXECUTION**

3.1. **Examination**

- 3.1.1. Verification of Conditions:
 - .1 Examine substrates to receive work and surrounding adjacent surfaces for conditions affecting installation.
 - .2 Strike masonry joints flush. Concrete surfaces shall be smooth and without large voids, honeycombing, spalled areas or sharp protrusions.
 - .3 Notify Consultant in writing of any discrepancies. Commencement of the work or any parts thereof shall mean acceptance of the prepared substrate.
- 3.1.2. Notify Contractor in writing of any conditions that are not acceptable.
- 3.1.3. The installing contractor shall examine and determine that surfaces and conditions are ready to accept the Work of this section in accordance with published literature. Commencement of Work or any parts thereof shall mean installers acceptance of the substrate.

3.2. **Preparation**

- 3.2.1. All surfaces must be sound, clean and free of oil, grease, dirt, excess mortar or other contaminants.
- 3.2.2. Provide adequate protection of materials and work of this section from damage by weather, backfilling operations and other causes.
- 3.2.3. Protect adjacent surfaces and Work of other trades from damage resulting from Work of this section. Make good such damage at no additional cost to the Owner.
 - .1 Provide sound handling and installation procedures to prevent and protect against overspray of materials specified in this Section.

3.3. **Installation**

- 3.3.1. Fluid Applied Dampproofing and Waterproofing Membrane Application:
 - .1 Preparation: Dry surfaces should be dampened with water prior to application.
 - .2 Dampproofing Application: Apply dampproofing coating at a rate of 1.5 l/m² (3.6 gal/100ft²) and let dry.
- 3.3.2. Fluid Applied Dampproofing Membrane Application in cold conditions:
 - .1 Primer: Apply penetrating asphalt primer at a rate of approximately 2 to 8m² (895 to 330ft²).and allow to cure.
 - .2 Dampproofing Application: Apply dampproofing coating at approximately 1.5 l/m² (3.6 gal/100ft²). Allow to dry thoroughly before applying board products and/or backfilling.
- 3.3.3. Insulation Installation:
 - .1 Co-ordinate with Section 07 21 00 Thermal Insulation for insulating materials.
 - .2 Adhesive (Optional):
 - .1 Apply the insulation adhesive in a serpentine pattern to fluid applied dampproofing membrane.

- .2 Immediately embed insulation into the adhesive and press firmly into place to ensure full contact. Apply additional adhesive if allowed to skin over.
- .3 Fully butter all joints of insulation panels with adhesive during installation, except at expansion joints.
- .4 Stagger the end joints of the insulation.
- .5 Cut the insulation to fit closely to all protrusions and obstructions.
- .3 Insulation Clips:
 - .1 Mechanically fasten insulation clips to the fluid applied dampproofing membrane with adhesive recommended by insulation clip manufacturer.
 - .2 Apply number of insulation clips as recommended by insulation manufacturer, in locations indicated in their written documentation.

3.4. Field Quality Control

- 3.4.1. Final Observation and Verification:
 - .1 Final inspection of fluid applied dampproofing membrane shall be carried out by the Owner's representative, and the contractor.
 - .2 Contact Manufacturer for warranty issuance requirements.
- 3.4.2. Fluid applied dampproofing membrane is not designed for permanent UV exposure. Apply protection board as soon as possible after installation of fluid applied dampproofing membrane. Refer to manufacturer published literature for product limitations.

3.5. Cleaning and Protection

- 3.5.1. Progress Cleaning: Leave work area clean at the end of each work day, ensuring safe movement of passing pedestrians.
- 3.5.2. Waste Management: Co-ordinate recycling of waste materials and packaging at appropriate facility, diverting waste from landfill. Certified installer shall be responsible for ensuring waste management efforts are practiced.

END OF SECTION

1. GENERAL**Summary**

This Section includes requirements for supply and installation of the following:

- Exterior Rigid Insulation for Roofing
- Raised floor at Machine Room

1.1 Related Section

- 1.1.1 Section 01 33 00 – Submittal Procedures
- 1.1.2 Section 04 04 99 – Masonry for Minor Works
- 1.1.3 Section 07 25 13 – Air and Vapour Membranes
- 1.1.4 Section 07 62 00 – Sheet Metal Flashing and Trim

1.2 Submittals

- 1.2.1 Provide required information in accordance with Section 01 33 00 – Submittal Procedures.

1.3 Quality Assurance

- 1.3.1 Regulatory Requirements: Provide insulation products that meet or contain less than the regulated limits for Ozone Depletion Potential compounds listed in the Montreal Protocol adopted by the United Nations Environmental Program.

1.4 Delivery, Storage, And Handling

- 1.4.1 Storage and Handling Requirements: Protect insulation materials from physical damage and from deterioration by moisture, soiling, and other sources. Store inside and in a dry location; follow manufacturer's written instructions for handling, storing, and protecting during installation; protect plastic insulation as follows:
 - 1. Do not expose to sunlight, except to extent necessary for period of installation and concealment.
 - 2. Protect against ignition at all times. Do not deliver plastic insulating materials to Project site before installation time.
 - 3. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

2 PRODUCTS**2.1 Manufacturers**

- 2.1.1 Basis-of-Design Materials: Products named in this Section were used as the basis-of-design for the project; additional manufacturers offering similar products may be incorporated into the work of this Section provided they meet the performance requirements established by the named products and provided:

Acceptable Materials Manufacturers:

- 1. Dow Canada
- 2. Owens-Corning Canada

2.2 Materials

- 2.2.1 Roof Insulation: a closed cell polyisocyanurate foam core between polymers coated glass fibers facers; Min R-value not less than 5.5 per 25mm; square edges, board size 610 mm x 2440 mm x thickness required to achieve insulation value indicated on Drawings; minimum compressive strength 210 kPa at 10% deformation in accordance with ASTM D1621, water absorption (% by volume) maximum 0.7% in accordance with ASTM D2842:

- 1. Acceptable Materials:
 - a) Dow Styrofoam SM
 - b) Owens-Corning Foamular C-300
 - c) Sopra ISO by Soprema

- 2.2.2 Raised floor: Moisture-resistant, durable and lightweight extruded polystyrene foam board with shiplap edges that is designed specifically to be installed over concrete slab.
1. Acceptable Materials:
 - a) Dow Styrofoam Brand Ultra SL
 - b) Owens-Corning Foamular CodeBord

2.3 Accessories

2.3.1 Insulation Adhesive:

1. Two-component, polyurethane insulation adhesive: used to adhere layers of insulation boards of polystyrene, of polyisocyanurate and for cover boards, gypsum or cement boards and for the attachment of bituminous vapour-barrier:
 - a) DUOTACK by Soprema
 - b) Basis-of-Design Materials: Bakor, 230-21 Rigid Insulation Adhesive; substitutions will be considered for this material.

2.3.2 Exterior Rigid Insulation:

1. Membrane Air and Vapour Barrier: Refer to Section 07 25 13 for membrane type.
2. Gaskets to Adjacent Substrates: Standard type suitable for use with system, permanently resilient; ultraviolet and ozone resistant; colour to match adjacent colour
3. Sealants to Adjacent Substrates: Refer to Section 07 92 00 – Joint Sealants, non-staining, non-shrinking and non-sagging type compatible with substrate materials; colour as selected by Consultant.
4. Perimeter Insulation Fasteners: Concrete faced insulation manufacturer's standard concealed fasteners with groove mounting plate and fastening spline.

3 EXECUTION

3.1 Examination

- 3.1.1 Examine substrates and conditions for compliance with requirements for Sections in which substrates and related work are specified and other conditions affecting performance.
- 3.1.2 Verify that all surfaces which are to receive rigid insulation are clean, free of deleterious matter and are sufficiently level to allow the proper installation of insulation.
- 3.1.3 Verify that all flashings provided under other Sections are installed and that they divert moisture to exterior of insulated systems.

3.2 Preparation

- 3.2.1 Clean substrates of substances harmful to insulations; remove projections that interfere with insulation attachment.
- 3.2.2 Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 Installation

- 3.3.1 Install insulation and accessories in accordance with manufacturer's written instructions applicable to products and application indicated and as follows:
 1. Use insulation that is undamaged, dry, and unsoiled and that has not been left exposed at any time to ice and snow
 2. Maintain continuous thermal insulation, vapour barrier and air tightness for building spaces and elements, and as follows:
 - a) Saw cut and trim insulation neatly to fit spaces; fill voids with foamed-in-place insulation compatible with installed insulation, refer to Section 07 25 19
 - b) Butt edges and ends tight
 - c) Fit insulation tight against mechanical, electrical and other items

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- d) protruding through the plane of insulation
 - e) Use insulation free of broken or chipped edges
 - f) Apply single layer of insulation to produce thickness indicated, unless multiple layers are otherwise specifically shown or required to make up total thickness
 - g) 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
 - g) Mechanically fasten insulation boards 50 mm in from edges at 300 mm centres.
- 3. Leave insulation joints unbonded over line of expansion and control joints; bond a continuous 150 mm wide strip of primary vapour membrane over expansion and control joints using compatible adhesive
 - 4. Protect insulation from damage until it is covered; replace any broken, sunburned, crushed or dented insulation immediately prior to covering; coordinate with backfilling operations
- 3.3.2 Raised Floor Insulation:
- 1. Lay boards on level compacted fill.
 - 2. Protect top surface of horizontal insulation from damage during concrete work by applying protection board.
- 3.4 **Protection**
- 3.4.1 Protect installed board insulation from damage due to harmful weather exposures, physical abuse, and other causes.
 - 3.4.2 Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION

1 GENERAL**1.1 Related Requirements**

- 1.1.1. Section 04 04 99 Masonry for minor works.
- 1.1.2. Section 06 08 99 Rough Carpentry for Minor Works.

1.2 References**1.2.1 Definitions:**

- .1 Aesthetic joint: joint for appearance of installation ease. Also known as aesthetic reveals, grooves and reglets used to provide starting and stopping points during application of finish coat.
- .2 Back wrapping: at edges (termination) of EIFS where the reinforcing mesh and base coat extend from the back side of the insulation around the termination edge and onto the front of the insulation.
- .3 Base coat: layer consists of polymer modified, typically mixed with Portland cement and applied to face of insulation board and reinforced with one or more layers of mesh to function as a weather barrier.
- .4 Lamina: base coat, reinforcing mesh and finish.

1.2.2 Reference Standards:

- .1 ASTM International
 - .1 ASTM B 117-[09], Standard Practice for Operating Salt Spray (Fog) Apparatus.
 - .2 ASTM C 144-[11], Standard Specification for Aggregate for Masonry Mortar.
 - .3 ASTM C 297/C 297M-[04(2010)], Standard Test Method for Flatwise Tensile Strength of Sandwich Construction.
 - .4 ASTM C 1002-[07], Standard Specification for Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs.
 - .5 ASTM D 968-[05(2010)], Standard Test Methods for Abrasion Resistance of Organic Coatings by the Falling Abrasive.
 - .6 ASTM D 2247-[11], Standard Practice for Testing Water Resistance of Coatings in 100% Relative Humidity.
 - .7 ASTM E 72-[10], Standard Test Methods of Conducting Strength Tests of Panels for Building Construction.
 - .8 ASTM E 96/E 96M-[10], Standard Test Methods for Water Vapor Transmission of Materials.
 - .9 ASTM E 2098-[00(2006)], Standard Test Method for Determining Tensile Breaking Strength of Glass Fiber Reinforcing Mesh for Use in Class PB Exterior Insulation and Finish Systems (EIFS), after Exposure to a Sodium Hydroxide Solution.
 - .10 ASTM E 2134-[01(2006)], Standard Test Method for Evaluating the Tensile-Adhesion Performance of an Exterior Insulation and Finish System (EIFS).
 - .11 ASTM E 2321-[03], Standard Practice for Use of Test Methods E 96 for Determining the Water Vapor Transmission (WVT) of Exterior Insulation and Finish Systems (EIFS).
 - .12 ASTM E 2430-[05], Standard Specification For Expanded Polystyrene (EPS) Thermal Insulation Boards For Use In Exterior Insulation and Finish Systems (EIFS).
 - .13 ASTM G 154-[06], Standard Practice for Operating Fluorescent Light Apparatus UV Exposure of Nonmetallic Materials.

1.3 Administrative Requirements**1.3.1 Pre-installation Meetings:**

- .1 Convene pre-installation meeting 4 weeks prior to beginning work of this Section, with contractor's representative and related trades, City of Toronto Representative and Consultant in accordance with Section 01 31 19 - Project Meetings 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**1.4.1 Submit in accordance with Section 01 33 00 - Submittal Procedures.****1.4.2 Product Data:**

- .1 Submit manufacturer's instructions, printed product literature and data sheets for EIFS system materials and include product characteristics, performance criteria, physical size, finish and limitations.
- .2 Submit copies of WHMIS MSDS in accordance with Section 01 35 29.06 - Health and Safety Requirements.

1.4.3 Shop Drawings:

- .1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Ontario, Canada.
- .2 Indicate on drawings:
 - .1 Wall layout, details, connections, expansion joints, finish system, installation sequence, including interface with doors, windows, air barriers, vapour retarders and other components.

1.4.4 Samples:

- .1 Submit samples of framing components and fasteners.
- .2 Submit one 300 x 300 mm sample of each colour of finished wall system prior to fabrication of mock-up.

1.4.5 Manufacturer's Instructions:

- .1 Provide to indicate special handling criteria, installation sequence; and cleaning procedures.

1.4.6 Manufacturer's Field Reports:

- .1 Submit copies of manufacturers field reports, within 3 days of review, verifying compliance of Work, as described in PART 3 - FIELD QUALITY CONTROL.
- .2 Submit verification of installer qualification to ECC QPI.

1.4.7 Sustainable Design Submittals:

- .1 NA.
- .2 Construction Waste Management:
 - .1 Submit project Waste Management Plan 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.
- .3 Recycled Content:
 - .1 Submit listing of recycled content products used, including details of required percentages of 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.
- .4 Regional Materials: submit evidence that project incorporates required percentage 10% 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 and carpet used in building, showing compliance with VOC and chemical component limits or restriction requirements.

1.5 **Quality Assurance**

1.5.1 Qualifications:

- .1 Installation of exterior insulation and finish wall system by applicators certified and endorsed by manufacturers of system used to ECC EQI.

1.5.2 Mock-ups

- .1 Construct mock-up in accordance with Section 01 45 00 - Quality Control.
- .2 Construct mock up of complete EIFS system on typical exterior wall 1800 mm long x 3000 mm wide x 3000 mm high incorporating:
 - .1 Window and frame to demonstrate back wrap and reinforcement at corners.
 - .2 Door and frame to demonstrate back wrap and reinforcement at corners.
 - .3 Wrappings and terminations: back wrapping and edge wrapping.
 - .4 Joints to demonstrate aesthetic, control and expansion joint construction.
 - .5 Construction at changes in substrate.
 - .6 Construction at corner stop.
 - .7 Construction at sill of wall, windows and doors.
 - .8 Construction at grade and below grade.
 - .9 Construction at parapets and soffits.
 - .10 Construction at both large and small penetrations.
 - .11 Construction at surface mounted objects .
 - .12 Adhesive and mechanical fastening systems.
 - .13 Colour, texture and finish.

1.5.3 Construct mock-up where directed.

1.5.4 Allow 24 hours for inspection of mock-up by CoM Representative and Consultant before proceeding with work.

1.5.5 Mock-up will be used

- .1 To judge workmanship, substrate preparation, operation of equipment and material application.
- .2 For testing to determine compliance with performance requirements. Perform tests as follows:
 - .1 To be determined by independent testing agency.

1.5.6 When accepted, mock-up will demonstrate minimum standard of quality required for this work.

- .1 Approved mock-up may remain as part of finished work.
- .2 NA.
- .3 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

1.5.7 **Quality Assurance.** Minimum 4 weeks prior to starting concrete work, submit proposed quality control procedures in accordance with Section 01 45 00 for Owner's Representative approval for following items:

- .1 Independent Inspection Agency

1.6 Delivery, Storage And Handling

- 1.6.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
- 1.6.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labeled with manufacturer's name and address.
- 1.6.3 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 Store and protect EIFS systems from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.
- 1.6.4 Develop Construction Waste Management Plan [Waste Reduction Workplan] related to Work of this Section and in accordance with Section 01 74 21 – Construction/ Demolition.
- 1.6.5 Packaging Waste Management: remove for reuse and return Waste Management and Disposal as specified in Construction Waste Management Plan / Waste Reduction Workplan in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

1.7 Site Conditions

- 1.7.1 Ambient Conditions:
 - .1 Temperature, relative humidity, moisture content.
 - .1 Apply insulation only when surfaces and ambient temperatures are within manufacturers' prescribed limits.
 - .2 Apply EIFS components at temperatures, relative humidity, and substrate moisture content and substrate temperature in accordance with manufacturer's written instructions.
 - .3 Maintain ambient temperature above 4 degrees C during adhesive application and until cured minimum 24 hours.
 - .4 Maintain ambient temperature above 4 degrees C during base coat application and until cured minimum 24 hours.
 - .5 Maintain ambient temperature above 4 degrees C during finish coat application and until cured minimum 24 hours.
 - .2 Safety: comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of insulation, adhesive and caulking materials.
 - .3 Ventilation:
 - .1 General Contractor will arrange for ventilation system to be operated during installation of insulation. Ventilate area of work as directed by MOL by use of approved portable supply and exhaust fans.
 - .2 Ventilate enclosed spaces in accordance with Section 01 51 00 - Temporary Utilities.
 - .3 Provide continuous ventilation during and after insulation application. Run ventilation system 24 hours per day during installation; provide continuous ventilation for 7 days after completion of insulation installation.

1.8 Warranty

- 1.8.1 For work of this Section 07 24 00 - Exterior Insulation and Finish System 12 months warranty period is extended to 60 months.
- 1.8.2 Contractor warrants that exterior insulation and finish system will not leak or delaminate in accordance with General Conditions (GC)-CCDC GC 12.3, but for 60 months.

2 PRODUCTS**2.1 System Description**

2.1.1 Exterior insulation and finish system to be site applied cladding system consisting of adhesive, insulation board, base coat with reinforcing mesh and finish.

- .1 Adhesive applied. Systems such as Durock Insulrock or BASF SENEPLEX Channeled receive or Dryvit Outsulation RMD, or Sto Therm ci.

2.2 Design Requirements

2.2.1 Design panels in accordance with design hourly wind pressure stipulated by engineer kPa.

2.2.2 Design to ECC QPI recommendations.

2.3 Performance Requirements

2.3.1 Ensure installed modified polymer coat wall system has performance properties as follows:

- .1 Comply with CAN/ULC-S134.
.2 Finish-abrasion resistance: falling sand method to ASTM D 968, no deleterious effects after 500 litres.
.3 Finish-salt spray resistance: to ASTM B 117, after 300 hours exposure to 5% salt spray solution - no effects.
.4 Finish-moisture resistance: to ASTM D 2247, after 14 days exposure - no deleterious effects.
.5 Accelerated weathering: to CAN/CGSB-1.162 ASTM G 154, 2000 hours - no effect.
.6 Impact resistance: to ASTM E 72, only slight dents observed up to 108.465J EIMA 101.86 Level 1, 3-6 and Level 3, 10-17 joules.
.7 Bond strength: to CAN/CGSB-1.162 ASTM C 297, dry, wet-2 hour dry, wet-7 day dry, minimum 1 MPa.
.8 Permeability: to CAN/CGSB-1.162, ASTM E 96, 5.93 perms.

2.4 Surface Preparation Materials

2.4.1 Conditioner: water base acrylic, clear conditioner/sealer compatible with system materials, recommended by system manufacturer.

2.4.2 Leveller: polymer-modified, cement-based, reinforced leveling compound, such as Vapour Block by DuRock.

2.5 Adhesives

2.5.1 Acrylic, non-cementitious adhesive.

2.5.2 Polymer-modified cement-based, reinforced adhesive.

2.5.3 Acrylic based, reinforced adhesive.

2.6 Mechanical Fasteners

2.6.1 Use mechanical fasteners when self-adhering membranes extend no more than 50mm (2 inches) behind the EIFS. Insulation shall be mechanically fastened at locations where polyethylene-faced membranes extended more than 75 mm (3 inches) behind the EIFS.

2.6.2 Wind-Devil 2 by Wind-Lock Corp. high density plastic washers, 51 mm (2inches) in diameter, used in combination with corrosion resistant screws that are suitable for the substrate.

2.7 Insulation

2.7.1 Molded expanded polystyrene EPS: to CAN/ULC-S701, Type 2 and ASTM E 2430, RSI as indicated.

2.7.2 Extruded polystyrene XPS: to CAN/ULC-S701, Type 3, RSI indicated, for reinforced EIFS areas.

2.7.3 NA.

2.8 Base Coat

- 2.8.1 Test Adhesive Base Coat to: ASTM C 297, ASTM E 2134.
- 2.8.2 Modified polymer: non-cementitious, fibre reinforced, premixed base coat system, colour warm grey.
- 2.8.3 Modified, cementitious one component base coat system: Portland cement, silica sand aggregate, acrylic liquid admixture, 13.2% acrylic to cement ratio, colour warm grey.
- 2.8.4 Acrylic: non-cementitious, fibre reinforced base coat system, texture “sand coat” by DuRock colour warm grey.

2.9 Reinforcing Mesh

- 2.9.1 Reinforcing Mesh to: [ASTM E 2098].
- 2.9.2 Balanced, woven glass fibre fabric made from twisted multi-end strands, treated, alkali resistant, compatible with chemical bonding system base coat and finish coat, weight standard – 163 and intermediate - 380 g/m².
 - 2.9.2.1 Use Additional 380g/m² mesh on all EFFF panels within 8FT of grade
- 2.9.3 Speciality mesh:
 - .1 Detail mesh: flexible, symmetrical, woven glass fibre fabric made from twisted multi-end strands, treated, alkali resistant, compatible with chemical bonding system base coat and finish coat, weight 153 g/m².
 - .2 Corner mesh: precreased, non-woven glass fibre fabric made from twisted multi-end strands, treated, alkali resistant, compatible with chemical bonding system base coat and finish coat, weight 212 g/m².

2.10 Finish Coat

- 2.10.1 Modified polymer finish coat system: acrylic resins in dispersion, silica aggregate, integral mineral pigmentation and additives, colour warm grey selected from manufacturer's standard range by Representative CoM and Consultant.
- 2.10.2 Modified finish coat system: synthetic stucco, acrylic type, Portland cement, silica sand aggregate, integral mineral pigmentation and additives, warm grey colour and 2 mm exposed aggregate texture finish, selected by Representative CoM and Consultant to match sample.

2.11 Primer

- 2.11.1 Acrylic based primer.
- 2.11.2 Primer: to SCAQMD Rule 1113.

2.12 Accessories

- 2.12.1 Accessories: galvanized zinc alloy steel or PVC corner beads, casing beads, stop beads, starter strips and accessories, as recommended by exterior insulated wall system manufacturer to suit system components.

2.13 Expansion Joints

- 2.13.1 Expansion joints: PVC or zinc alloy.
- 2.13.2 Ensure expansion joints are back wrapped.
- 2.13.3 Joint Cleaner: non-corrosive and non-staining type, compatible with joint forming materials and in accordance with sealant manufacturer's written recommendations.
- 2.13.4 Sealant primer: as recommended by sealant manufacturer.
- 2.13.5 Joint filler: extruded polyethylene, closed cell, Shore A hardness 20, tensile strength 140 - 200 kPa, oversized 30 to 50%.
- 2.13.6 Sealant: in accordance with Section 07 92 00 - Joint Sealants, compatible with systems materials, recommended by system manufacturer.

- .1 Weather seals: multi-component, chemical curing to CAN/CGSB-19.24, Type 2, Class B.
- .2 Panel joints: multi-component, chemical curing to CAN/CGSB-19.24, Type 2, Class B.
- .3 Sealant: to SCAQMD Rule 1168.

2.14 **Materials: Site Mix**

- 2.14.1 Cement: to CAN/CSA-A3001, Type GU.
- 2.14.2 Sand: dry bag.
 - .1 For white cement: silica sand, 30-50 mesh.
 - .2 For grey cement: mortar sand to ASTM C 144.
- 2.14.3 Water: potable.

2.15 **Mixes**

- 2.15.1 General:
 - .1 Mixer: high speed, clean and rust free.
 - .2 Mixing pail: clean and rust free.
 - .3 Mixes: additive free.
- 2.15.2 Conditioner: mix in accordance with manufacturer's written instructions.
- 2.15.3 Leveler: mixed to uniform consistency in accordance with manufacturer's written instructions.
- 2.15.4 Adhesive: mixed in accordance with manufacturer's written instructions.
- 2.15.5 Base coat: mixed to uniform consistency in accordance with manufacturer's written instructions.
- 2.15.6 Finish coat: mixed to uniform consistency in accordance with manufacturer's written instructions.

3 **EXECUTION**

3.1 **Installers**

- 3.1.1 Acceptable Installers: use only installers or applicators who are certified and endorsed by manufacturers of system used by ECC EQI.

3.2 **Examination**

- 3.2.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for EIFS installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate in presence City of Toronto and Consultant.
 - .2 Examine surfaces to receive EIFS to ensure they are smooth, dry, and free from conditions that will adversely affect execution, permanence, or quality of work of this Section.
 - .3 Inform Representative City of Toronto and Consultant 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 City of Toronto and Consultant.

3.3 **Preparation**

- 3.3.1 Preparatory protection:
 - .1 Protect adjacent surfaces from damage resulting from Work of this Section.
 - .2 Protect finished Work from water penetration at end of each day or on completion of each section of Work.
 - .3 Protect installation from moisture for 48 hours minimum after completion of each portion of Work.
 - .4 Protect top of parapet walls, and openings until flashings and trim, are installed.
- .2 Surface preparation:
 - .1 Ensure environmental and site conditions are suitable for installation of system.
 - .2 Prepare new existing surfaces in accordance with manufacturer's

written instructions.

3.4 **Installation**

3.4.1 Install system to CAN/ULC-S134 ECC EQI.

3.4.2 Surface preparation:

.1 Conditioner: water base acrylic, clear conditioner/sealer compatible with system materials, substrate and as recommended by system manufacturer.

.1 Add water and mix.

.2 Apply to clean, dry substrate surfaces ensuring complete even coverage in accordance with manufacturer's written instructions.

.2 Leveller: polymer-modified, cement based, reinforced leveling compound.

.1 Add water and mix.

.2 Allow set time.

.3 Apply to existing substrate, 6 mm thick maximum.

.4 Allow time to fully cure as outlined in manufacturers' written instructions.

3.4.3 Insulation anchors: install insulation anchors to spacing and pattern recommended by EIFS manufacturer. Maintain continuity of air barrier system.

3.4.4 Adhesives application and installation of insulation board:

.1 Apply uniform ribbons of adhesive to back of and parallel to long dimension of insulation board, using recommended notched trowel.

.2 Offset insulation joints.

.3 Immediately place insulation boards in running bond pattern on walls with long dimension horizontal, starting from level base line. Apply firm pressure over entire surface of board to ensure full contact. Determine location and pattern of sheathing joints. Bridge sheathing joints by minimum of 200 mm.

.4 Butt vertical and horizontal joints tightly together. Ensure joints between boards are free of adhesive.

.5 Cut insulation board in L-shaped pattern to fit around openings. Do not align joints with corners of openings.

.6 Remove individual boards periodically when adhesive is still wet to check for satisfactory contact with substrate and back of insulation board.

3.4.5 Back wrapping:

.1 Ensure edge of insulation board is wrapped with base coat prior to installation to substrate.

.2 Apply strip of detail mesh with adhesive to substrate at level base line and at terminations.

.3 Ensure width of detail mesh is adequate to adhere 100 mm of mesh onto substrate and to wrap around insulation board edge with minimum 64 mm coverage on outside of insulation board.

.4 After adhering detail mesh to substrate ensure, mesh ends hang free for completion of back wrapping procedure after insulation application.

3.4.6 Accessories:

.1 Install required accessories as detailed and as required by EIFS manufacturer and to CAN/ULC-S134 ECC EQI, such as PVC extrusion at base of walls and PVC or metal flashings above windows, doors or other protrusions.

3.4.7 Preparation of Insulation Board surface:

.1 Fill open joints in insulation board with slivers of insulation or spray foam as recommended by manufacturer's written instructions.

.2 Rasp surface to achieve smooth, level, even surface after insulation boards have firmly adhered to substrate.

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- .1 Remove ultraviolet ray damage. Rasp smooth any irregularities in insulation board greater than 1.6 mm.
 - .2 Ensure insulation board tolerance not greater than 6 mm in 2,500 mm and in accordance with manufacturer's written instructions.
- 3.4.8 Joints:
- .1 Reveals and aesthetic grooves:
 - .1 Cut reveals and aesthetic grooves with appropriate tool in locations indicated.
 - .2 Offset reveals minimum 75 mm from insulation joints.
 - .3 Maintain minimum 19 mm insulation board thickness at bottom of groove after cutting.
 - .4 Install deep V control joints to divide wall area into maximum 14 m² panels with maximum 5.5 linear meters in any direction at floor lines at dissimilar substrates at masonry wall joints.
 - .5 Install shallow V surface mount control joints at colour separations, window corners, door corners, drip grooves, to sub-divide panels into 1200 x 1200 mm areas.
 - .2 Expansion joints:
 - .1 Install expansion joints in locations indicated and to manufacturers written instructions.
 - .2 Install expansion joints at isolation joints in substrate where new construction abuts existing construction at locations where movement is expected.
- 3.4.9 Back wrapping completion:
- .1 Complete back wrapping procedure by applying base coat to exposed edges of insulation board and 100 mm onto face of insulation board.
 - .2 Pull mesh tight around board and embed it in base coat with trowel.
 - .3 Use corner trowel for clean, straight lines.
 - .4 Smooth wrinkles or gaps in mesh.
- 3.4.10 Mesh and base coat application:
- .1 Apply 225 x 300 mm diagonal strips of detail mesh at corners of windows, doors and penetrations through insulation. Embed strips in wet base coat and trowel from centre to mesh edge to avoid wrinkles.
 - .2 Apply detail mesh at reveals. Embed mesh in wet base coat and trowel from base of reveal to mesh edges.
 - .3 Apply corner mesh at inside and outside corners. Embed mesh in wet base coat and trowel from corner of mesh edges.
 - .4 High impact mesh application: apply base coat over insulation board to uniform thickness of approximately 3 mm. Work horizontally or vertically in 1000 mm strips, and immediately embed mesh into wet base coat by trowelling from centre to edge of mesh. Butt mesh at seams. Allow base coat to dry.
 - .5 Standard mesh application:
 - .1 Apply base coat over insulation board, including areas with high impact mesh to uniform thickness of approximately 3 mm.
 - .2 Work horizontally or vertically in 1000 mm strips, and immediately embed mesh into wet base coat by troweling from centre to mesh edge.
 - .3 Overlap mesh 64 mm minimum at mesh seams and overlaps of detail mesh.
 - .4 Feather seams and edges.
 - .5 Double wrap inside and outside corners with minimum 64 mm overlap in each direction. Embed corner mat in wet base coat, allow to dry, then overlap up to corner with standard reinforcing mesh embedded in base coat.
 - .6 Avoid wrinkles in mesh.
 - .7 Fully embed mesh so that no mesh colour shows through base coat when dry.
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- .8 Ensure minimum base coat thickness 1.6 mm when dry. Re-skim base coat if 1.6 mm thickness not achieved during initial application. Allow base coat to thoroughly dry before applying primer or finish coat.
- 3.4.11 Finish coat application:
 - .1 Apply finish coat in accordance with manufacturer's writing installation instructions.
 - .2 Prime dry base coat and allow to dry thoroughly before applying finish coat.
 - .3 Apply finish coat directly over base coat, or primed base coat, only after base coat or primer has thoroughly dried.
 - .4 Apply finish by spray or trowel as recommended by manufacturer.
 - .5 Apply finish in continuous application, and work towards wet edge.
 - .6 Do not install separate batches of finish coat side by side.
 - .7 Do not apply finish into or over sealant joints. Apply finish to outside of wall only.
 - .8 Do not apply finish over irregular or unprepared surfaces.
 - .9 Apply textured or aggregate finishes to wall areas as indicated and in accordance with manufacturer's written instructions.

3.5 **Below Grade Installation – NA**

3.6 **Sills And Horizontal Projection**

- 3.6.1 Base coat application standard mesh application:
 - .1 Apply base coat over insulation board, including areas with high impact mesh to uniform thickness of approximately 3 mm.
 - .2 Work horizontally or vertically in strips of 1000 mm, and immediately embed mesh into wet base coat by trowelling from centre to mesh edge.
 - .3 Overlap mesh not less than 64 mm at mesh seams and at overlaps of detail mesh.
 - .4 Feather seams and edges.
 - .5 Double wrap inside and outside corners with minimum 64 mm overlap in each direction. Embed corner mat in wet base coat, allow to dry, then overlap up to corner with standard reinforcing mesh embedded in base coat.
 - .6 Avoid wrinkles in mesh.
 - .7 Fully embed mesh so that no mesh colour shows through base coat when dry.
 - .8 Ensure minimum base coat thickness of 1.6 mm when dry. Re-skim base coat if 1.6 mm thickness not achieved during initial application. Allow base coat to thoroughly dry before applying primer or finish coat.
 - .9 Apply waterproof base coat and mesh over dry standard application base coat and mesh on sloped surface and immediately above and below grade.
- 3.6.2 Finish coat application:
 - .1 Apply finish coat in accordance with manufacturer's written installation instructions.
 - .2 Prime dry base coat and allow to dry thoroughly before applying finish coat.
 - .3 Apply finish directly over base coat, or primed base coat, only after base coat or primer has thoroughly dried.
 - .4 Apply finish by spray or trowel as recommended by manufacturer.
 - .5 Apply finish in continuous application, and work towards wet edge.
 - .6 Do not apply separate batches of finish coat side by side.
 - .7 Do not apply finish into or over sealant joints. Apply finish to outside of wall only.
 - .8 Do not apply finish over irregular or unprepared surfaces.
 - .9 Apply textured or aggregate finishes to wall areas as indicated and in accordance with manufacturer's written instructions.

3.7 Site Quality Control**3.7.1 Manufacturers' Field Services:**

- .1 Have manufacturer of products supplied under this Section 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 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 25% and 60% complete.
 - .3 Upon completion of Work, after cleaning is carried out.
- .4 Obtain reports within [three] days of review and submit.
- .5 Arrange more frequent reviews (daily at start of installation by Third Party Inspection Agency).

3.8 Cleaning**3.8.1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.**

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

3.8.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.**3.8.3 Clean adjacent surfaces.****3.8.4 Waste Management: separate waste materials for recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.**

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

END OF SECTION

1. GENERAL**Summary**

This Section includes requirements for supply and installation of air and vapour membranes that prevent exfiltration and infiltration between interior and exterior of building through roof transition construction under all conditions of air pressure differentials forming an integral part of the building enclosure installed intact and continuous on warm side of roof system.

1.1 Related Sections

- 1.1.1 Section 01 33 00 – Submittal Procedures
- 1.1.2 Section 01 74 11 – Cleaning
- 1.1.3 Section 06 16 43 – Exterior Gypsum Sheathing
- 1.1.4 Section 07 24 00 - Exterior Insulation and Finish Systems
- 1.1.5 Section 07 52 00 - Modified Bitumen Membrane Roofing
- 1.1.6 Section 07 62 00 – Sheet Metal Flashing and Trim
- 1.1.7 Section 07 92 00 – Joint Sealants
- 1.1.8 Section 08 11 10 – Metal Doors and Frames
- 1.1.9 Section 08 11 16 – Aluminum Doors and Frames

1.2 Administrative Requirements

- 1.2.1 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 Submittals

- 1.3.1 Provide required information in accordance with Section 01 33 00 – General Requirements: Submittals.
- 1.3.2 Action Submittals: Provide the following submittals before starting any work of this Section:
 - 1.3.2.1 Product Data: Submit manufacturer's product literature, and installation instructions required for complete and proper installation of air and vapour retarder elements including membranes, primers, fasteners, proprietary application equipment, and detailing requirements to suit specific project installation.
 - 1.3.2.2 Samples: Submit representative sample of air and vapour membrane minimum 300 mm x 300 mm with factory applied identification clearly visible.

1.4 Quality Assurance

- 1.4.1 Qualifications: Provide proof of qualifications when requested by Consultant:
 - 1.4.1.1 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.
 - 1.4.1.2 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

- 1.5.1 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.
- 1.5.2 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**

1.6.1 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.

1.7 **Warranty**

1.7.1 Manufacturer's Warranty: Submit manufacturer's warranty stating that air and vapour membranes and accessories are free of defects and are manufactured to meet manufacturer's published physical properties and material specifications as of the date of product delivery.

1.7.2 Installer's Warranty: Submit installers warranty stating that air and vapour membranes and accessories are installed in accordance with manufacturer's recommendations and that membrane, transitions and through-wall flashing membranes, primers, mastics, adhesives and sealants are sourced from one manufacturer.

2 **PRODUCTS**

2.1 **Manufacturers**

2.1.1 Acceptable Materials Manufacturers: Subject to compliance with requirements specified in this Section use any of the listed manufacturers' products in accordance with Section 01 00 06 General Requirements: Product Options including the following:

2.1.1.1 Bakor Inc. (Henry Canada)

2.1.1.2 Soprema Canada

2.1.1.3 Tremco Commercial Sealants and Waterproofing

2.2 **Performance Requirements**

2.2.1 Provide materials and installations that meet the following material and assembly performance ratings, and as follows:

2.2.1.1 Material Performance: Provide materials having an air permeance rating not exceeding 0.02 l/sec-m² measured at 75 Pa pressure differential in accordance with ASTM E2178; and having a vapour permeance rating not exceeding 3.5 g/sec-m² in accordance with ASTM E96.

2.2.1.2 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-m² 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.

2.3 **Air And Vapour Membrane Assembly**

2.3.1 Primers and Undercoats: Manufacturer's recommended primer or surface conditioner to improve bond between membranes to substrates.

2.3.2 Exterior Walls, Parapet, and Underside of the Soffit:

Self Adhering Membrane: Self adhering SBS modified bitumen reinforced membrane complete with engineered thermoplastic film; having low temperature formulation appropriate for installation requirements; tested in accordance with ASTM E96 and

ASTM E2178, and having the following nominal properties:

2.3.2.1 Low Temperature Flexibility: Less than -20°C
2.3.2.2 Nominal Thickness: 1.5 mm

2.3.2.3 Acceptable Materials:

- .1 Bakor Blueskin VP160, Contact name: Michael Hooper (416) 577-6138, mhooper@henry.com
- .2 or approved equal by Soprema or Tremco.

2.3.3 Roof Deck Sheathing: Refer to Section 07 52 00 – SBS Modified Bitumen Membrane Roofing.

2.3.4 Through Wall Flashing Membranes and around Doors and Window Openings:

Alternate self-adhering membrane for all window and window sill flashings, door openings, inside and outside corners and other transitions shall be HE200 AM Metal Clad manufactured by Henry; a SBS modified bitumen, self-adhering sheet membrane complete with surface layer of metallic aluminum film that many sealants adhere well to. Membrane shall have the following physical:

2.4.3.1 Service Temperature Range: 40°C to $+80^{\circ}\text{C}$
2.4.3.2 Thickness: 1.0 mm
2.4.3.3 Acceptable Materials:

- .1 Bakor Blueskin VP160, Contact name: Michael Hooper (416) 577-6138, mhooper@henry.com
- .2 or approved equal by Soprema or Tremco.

2.3.5 Roofing Cap and Roofing base: refer to Section 07 52 00 SBS Modified Bitumen Membrane Roofing.

2.4 **Primer**

2.4.1 Primer for self-adhering membranes at temperatures above 25 degrees F shall be Aquatac™ Primer manufactured by Henry; a polymer emulsion based adhesive, quick setting. Primer shall have the following physical properties:

1. Color: Aqua,
2. Weight: 8.7 lbs/gal,
3. Solids by weight: 53%,
4. Water based, no solvent odors,
5. Drying time (initial set): 30 minutes at 50% RH and 70 degrees F

2.5 **Penetration and Termination Sealant**

2.5.1 Termination Sealant shall be HE925 BES or Polybitume 570-55 Sealant manufactured by Henry; a moisture cure, medium modulus polymer modified sealing compound having the following physical properties:

- .1 Compatible with sheet air barrier, roofing and waterproofing membranes and substrate,
- .2 Complies with Fed. Spec. TT-S-00230C, Type II, Class A,
- .3 Complies with ASTM C 920, Type S, Grade NS, Class 25,
- .4 Elongation: 450 – 550%,
- .5 Remains flexible with aging,
- .6 Seals construction joints up to 1 inch wide

2.6 **Insulation Adhesive**

2.6.1 Insulation adhesive shall be Air-Bloc 21 Insulation Adhesive manufactured by Henry; a synthetic, trowel applied, rubber based adhesive, having the following physical properties:

- .1 Compatibility: With air barrier membrane, substrate and insulation,
- .2 Air leakage: 0.0026 CFM/ft² @ 2.1 lbs/ft² to ASTM E283,
- .3 Water vapor permeance: 0.03 perms to ASTM E96,
- .4 Long term flexibility: CGSB 71-GP-24M

2.7 **Accessories**

- 2.7.1 Waterproofing Mastic: Manufacturer's recommended trowel applied waterproofing mastic containing compatible modified bitumen, fibres and mineral fillers.
- 2.7.2 Roof-to-Wall Transition Membranes: Manufacturer's recommended reinforced self adhesive, torch grade membrane where required, compatible with roofing air and vapour membranes and wall materials specified in this Section.
- 2.7.3 Opening Transition Membranes: Manufacturer's recommended reinforced, self adhesive membrane compatible with adjacent materials, and air and vapour membranes specified in this Section.
- 2.7.4 Through Wall Membranes: Manufacturer's recommended reinforced self adhesive, torch grade membrane where required, compatible with air and vapour membrane and that will not become plastic and extrude onto finished surfaces when exposed to high wall temperatures.
- 2.7.5 Insulation Adhesive: Manufacturer's recommended trowel applied adhesive compatible with membrane system and insulation.

3 **EXECUTION**

3.1 **Examination**

- 3.1.1 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**

- 3.2.1 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:
 - 3.2.1.1 Exterior 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.
 - 3.2.1.2 Masonry Substrates: Apply air and vapour barrier membranes to masonry substrates having smooth flush mortar joints; fill voids and holes with lean mortar mix, non-shrinking grout or parge coat.
 - 3.2.1.3 Adjacent Materials: Treat construction joints and install flashings as recommended by manufacturer.
- 3.2.2 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**

- 3.3.1 Install air and vapour membranes in accordance with manufacturer's written requirements, using appropriate equipment and skilled workers and as follows:
 - 3.3.1.1 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.
 - 3.3.1.2 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.
- 3.3.1.3 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.
- 3.3.1.4 Through Wall and Flexible Flashings: Install flexible membranes where required to maintain flow direction to divert water away from face of building envelope.
- 3.3.2 Separate air and vapour membranes from incompatible materials, and provide manufacturer's recommended transition materials required to maintain continuity of building envelope.
- 3.3.3 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**
- 3.4.1 Allow access for review of installed air and vapour membranes, and repair of deficiencies before placement of insulation materials.
- 3.4.2 Non-Conforming Work: Repair or replace non-conforming work at no additional expense to the Project.
- 3.5 **Closeout Activities**
- 3.5.1 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.
- 3.5.2 Cleaning: Remove masking materials, debris, excess materials and equipment from site at completion of the work; conduct ongoing daily cleaning as directed by the Contractor; clean stains, drips or spills of coatings, sealants, mastic or primers visible on finished surfaces.

END OF SECTION

1. GENERAL**Summary**

Work of this section includes installing 2-ply Modified Bitumen membrane roofing over a steel deck to achieve min R40 at the lowest point of the roof. This Section includes, but is not limited to the following:

- Mechanically fastened gypsum sheathing
- Self-adhesive vapour retarder
- Polyiso insulation in adhesive and tapered insulation
- Composite panel of asphaltic board and Base Sheet in adhesive
- Self-adhesive Base Sheet Flashing
- Torch-on Cap and Cap Sheet Flashing

1.1. Related Section

- 1.1.1. Section 01 33 00 Submittal Procedure
- 1.1.2. Section 01 35 29.06 Health and Safety Requirements
- 1.1.3. Section 01 45 00 Quality Control
- 1.1.4. Section 01 78 00 Closeout Submittals
- 1.1.5. Section 06 08 99 Rough Carpentry for Minor Works
- 1.1.6. Section 07 62 00 Sheet Metal Flashing and Trim
- 1.1.7. Section 07 92 00 Joint Sealants
- 1.1.8. Mechanical Specifications

1.2. Reference Standards

- 1.2.1. Perform roofing and sheet metal work in conformance with roofing manufacturer's written recommendations as well as requirements of ULC laboratories Class C, and Canadian Roofing Contractor's Association (CRCA).
- 1.2.2. CGSB 37-GP-56M-[80], Membrane Modified, Bituminous, Prefabricated, and Reinforced for Roofing.
- 1.2.3. CAN/CGSB-51-26-[M86], Thermal Insulation, and Isocyanurate, Board, Faced.
- 1.2.4. ASTM D 6162, Standard Specification for SBS Modified Bitumen Sheet Materials using a combination of polyester and fibreglass reinforcement.
- 1.2.5. ASTM D 6164, Standard Specification for SBS Modified Bitumen Sheet Materials using polyester reinforcement.

1.3. Compatibility

- 1.3.1. Provide all waterproofing materials by one manufacturer.

1.4. Technical Documents

- 1.4.1. Submit two (2) copies of the most current technical data sheets. These documents must describe the materials' physical properties and explanations about product installation, including installation techniques, restrictions, limitations and other manufacturer's recommendations.

1.5. Quality Assurance And Environmental Management

- 1.5.1. The manufacturer of elastomeric bitumen products will provide proof of ISO 9001 and ISO 14001 Certifications.

1.6. Contractor Qualifications

- 1.6.1. Roofing contractors and sub-contractors must, when tendering or performing work, possess a roofing contractor operating license. Only qualified, certified installers employed by a company with the appropriate equipment may execute the roofing work.

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- 1.6.2. A Platinum Warranty (Systems & Workmanship) is required, roofing contractors and sub-contractors must also be registered with Soprema's (or approved equal) PAQ +S, and provide the architect with certificate to this effect before beginning any roofing work.
- 1.6.3. Only qualified, certified installers employed by company with the appropriate equipment may execute the roofing work.
- 1.7. Manufacturer's Representative
- 1.7.1. The roofing product manufacturer can delegate a representative to visit work site at the starts of roofing installation.
- 1.7.2. The contractor must at all times enable and facilitate access to the work site by said representative.
- 1.8. **Pre-Installation Meeting**
- 1.8.1. Hold a pre-installation meeting prior to start of waterproofing works, with the roofing contractor's representative, the manufacturer and the owner. The purpose of this meeting is to review particular installation conditions to each project. Prepare a report after this meeting.
- 1.9. **Storage And Delivery**
- 1.9.1. Deliver and store materials in dry location in their original packaging, displaying the manufacturer's name, product name, weight, and reference standards, as well as all other indications or references considered standard.
- 1.9.2. Store adhesives and waterproofing mastics at a minimum +5 °C. Store adhesives and solvent-based mastics at sufficiently high temperatures to ensure ease of application.
- 1.9.3. Keep membrane materials stored in rolls standing on end, selvage edge up elevated from moisture at temperatures no less than 5 °C.
- 1.9.4. Avoid material overloads that may affect the structural integrity of specific roof areas.
- 1.10. **Warranties**
- 1.10.1. The membrane manufacturer will issue a written document in the owner's name, valid for a ten (10), year period, stating that they will repair any leaks in the roofing membrane to restore the roofing system to a dry and watertight condition, to the extent that membrane manufacturing or installation defects caused water infiltration. The warranty must cover for the entire cost of the repair(s) during the entire warranty period. The warranty must be transferable, at no extra cost, to subsequent building owners starting from the date of acceptance
- 1.10.2. The contractor will provide a warranty for this project, valid for a period of ten (10) years covering labour, materials and workmanship for entire area of roofing project.
2. **PRODUCTS**
- 2.1. **Gypsum Sheathing Board**
- 2.1.1. Sheathing board to ASTM C1177. Minimum 13 mm thick, glass mat faced, exterior grade gypsum board. Primed finish
- 2.1.2. Specified product : Securock by CGC or DensDeck Prime by Georgia Pacific.
- 2.2. **Fasteners**
- 2.2.1. Description: #14 Phillips pre-assembled mechanical fasteners made of case-hardened carbon steel with a rust preventive coating that comply with FMR approval standards. 50 mm diameter, barbed stress plates that comply with the CSA B35.3 and FM 4470 approval standard.
- 2.2.2. Specified products: SOPRIFIX FASTENERS/PLATES by SOPREMA or approved equal.

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- 2.2.3. Roofing nails: spiral nails with steel round-top cap 25 mm in diameter and 3 mm diameter shank; long enough to penetrate solid wood supports by at least 38 mm and plywood substrates by at least 20 mm.
- 2.3. **Primer**
- 2.3.1. Description: Stabilised bituminous emulsion primer used to enhance adhesion of membranes.
- 2.3.2. Specified product: ELASTOCOL STICK by SOPREMA (for self adhesive membranes) or approved equal.
- 2.4. **Vapour Retarder**
- 2.4.1. Description: Self- adhesive air/vapour barrier membrane composed of glass mat reinforcement coated with oxidized bitumen: both sides sanded to allow installation by bonding with hot bitumen. The width of the membrane is 1.14 meters (45 inches) to allow the membrane to fit on the top flute of most wood decks. The self- adhesive under face is covered with a silicone release sheet.
- 2.4.2. Specified product: SOPRAGLASS 100 by SOPREMA or approved equal.
- 2.5. **Adhesive**
- 2.5.1. Description: Low-rise two-part urethane adhesive with no solvents. Allows a complete cure in few minutes, with no temperature restrictions.
- 2.5.2. Specified product: DUOTACK ADHESIVE by SOPREMA or approved equal.
- 2.6. **Insulation**
- 2.6.1. Closed-cell, polyisocyanurate foam core integrally laminated to heavy-coated glass facers, meeting requirements of CAN/ULC-S107-M87, ASTM E119, ASTM C1289-95 and FM Standard 4450/4470. Conforming to CAN/ULC-S770
- 2.6.2. Board size: 2 layers of 1220 mm x 1220 mm x 64mm
- 2.6.3. Specified product: SOPRA-ISO PLUS by SOPREMA or approved equal.
- 2.7. **Tapered Insulation**
- 2.7.1. Description: Polyisocyanurate insulation that meets CAN/ULC S-704-03, ASTM E119, ASTM C1289-95 and FM Standard 4450/4470. Conforming to CAN/ULC-S770, top and bottom face finished with inorganic facer. Tapered starting from ½" (12.5mm) at the drain with a 2% slope.
- 2.7.2. Specified product: SOPRA-ISO PLUS TAPERED by SOPREMA or approved equal.
- 2.8. **Membranes**
- 2.8.1. Roof membrane Base Sheet Flashing:
- 2.8.1.1. CGSB 37-GP-56M, Type 2 for covered roofing application, Class C, Plain surfaced, Grade 2
- 2.8.1.2. Roofing membrane with glass and polyester reinforcement and SBS modified bitumen to ASTM D6162. Top face covered with thermofusible poly film, under side self-adhesive. Top face marked with three (3) distinctive blue chalk lines to ensure proper roll alignment.
- 2.8.1.3. Specified product: SOPRALENE FLAM STICK by SOPREMA or approved equal.
- 2.8.2. Roofing membrane Cap Sheet and Cap Sheet Flashing:
- 2.8.2.1. CGSB 37-GP-56M, Type 1 for exposed roofing application, Class A, Granule surfaced, Grade 2
- 2.8.2.2. ULC certifications, Class C
- 2.8.2.3. High Albedo roofing membrane with a composite of glass and polyester reinforcement and elastomeric bitumen to ASTM D6162. Top surface covered
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with granules, underface with thermofusible poly film with a minimum SRI of 78.

2.8.2.4. Specified products: SOPRASTAR HDGR by SOPREMA or approved equal.

2.8.3. Cover Strip

2.8.3.1. Description: Membrane strip of 330 mm (13 in) made of SBS modified bitumen with a composite reinforcement. Both faces are covered with a plastic thermofusible film. The strip ensures water-tightness in the end laps.

2.8.3.2. In conformance with: ASTM D6162.

2.8.3.3. Specified product: SOPRALAP by SOPREMA or approved equal.

2.9. **Waterproofing Mastics**

2.9.1. Waterproofing products: Mastic made of synthetic rubbers, plasticized with bitumen and solvents.

2.9.1.1. Specified product: SOPRAMASTIC by SOPREMA or approved equal.

2.9.1.2. Specified product: SOPRAMASTIC ALU by SOPREMA. (for exposed areas)

2.10. **Waterproofing Of Penetrations**

2.10.1. Description: One component polyurethane /bitumen resin to waterproof roof penetrations and complex details.

2.10.2. Specified product: Alsan Flashing and Alsan Flashing reinforcement by Soprema or approved equal.

3. **EXECUTION**

3.1. **Surface Examination And Preparation**

3.1.1. Complete surface examination and preparation in conformance with recommendations in the Installation Manual, particularly for fire safety precautions.

3.1.2. Do not begin any work before surfaces are smooth, dry, and exempt of ice and debris. Do not use calcium or salt for ice or snow removal.

3.1.3. Do not install materials during rain or snowfall.

3.2. **Method Of Installation**

3.2.1. Prepare surfaces and complete waterproofing work in conformance with manufacturer's requirements.

3.2.2. Install roofing elements on clean and dry surfaces, in conformance with manufacturer's instructions and recommendations.

3.2.3. Complete roofing work in a continuous fashion as surfaces are prepared and weather conditions permit.

3.2.4. Ensure watertight conditions for roofs at all times, including protection during installation work by other trades and progressive protection as work is completed (e.g. vents, drains, etc.)

3.3. **Cleaning**

3.3.1. Immediately before roofing materials are applied, clean decks of roughness, rubbish, dust, dirt, oil, grease, snow and ice.

3.4. **Equipment For Work Execution**

3.4.1. Maintain all roofing equipment and tools in good working order.

3.4.2. Use torches recommended by membrane manufacturer.

3.5. **Installation Of Sheathing Board**

3.5.1. Install sheathing board with adhesive in continuous strips spaced 30 cm (12 in) on the field. Decrease the spacing between ribbons to a minimum of 15 cm (6")

3.5.2. Ensure sheathing is immediately protected with membrane

3.6. Application Of Asphalt Primer

- 3.6.1. Roofing substrates of wood, metal, concrete, masonry or gypsum board surfaces will receive a coat of asphalt primer at a rate of 0.2 to 0.3 l/m² (none required for factory-painted metals). All surfaces to be primed must be free of rust, dust or any residue that may hinder adherence. Cover primed surfaces with roofing membrane as soon as possible. Application temperature limit -10°C.

3.7. Installation Of Vapour Retarder

- 3.7.1. Beginning at the bottom of the slope, without adhering the membrane, unroll onto the substrate for alignment. Do not immediately remove the silicone release sheet.
- 3.7.2. Align the roll parallel to the corrugations of the steel deck. Make sure the membrane overlaps are supported along their entire length.
- 3.7.3. Peel back one end of the silicone release sheet and adhere this part of the membrane to the substrate. Peel back the remaining release sheet at a 45° angle to avoid wrinkles in the membrane.
- 3.7.4. If the membrane is not properly aligned, do not try to adjust it. Instead, cut the roll and start again, making sure that it is properly aligned and that it overlaps the end of the misaligned piece by 150 mm.
- 3.7.5. Overlap adjacent membranes by 75 mm. Overlap end laps by 150 mm. Stagger end laps by at least 300 mm.
- 3.7.6. When the vapour barrier is installed directly on the steel deck, place a thin sheet of metal under the end lap of the vapour barrier.

3.8. Insulation Installation

- 3.8.1. Apply 2 x 65mm (R30) of insulation to vapour retarder with adhesive in conformance with manufacturer's written recommendations.
- 3.8.2. Install only as much insulation as can be covered in the same day.
- 3.8.3. Around the drains lower insulation by 1" to create a sump 4' X 4' in area. Bevel the edge of the 3" insulation on a 45° angle.
- 3.8.4. Install tapered insulation in adhesive where indicated on drawings.

3.9. Installation Of Overlay Board And Base Sheet Composite Panel

- 3.9.1. Install composite board with adhesive in continuous strips spaced 30 cm (12 in) on the field. Decrease the spacing between ribbons to a minimum of 15 cm (6") at the perimeter.
- 3.9.2. Adhere the first 60 mm (2.5 in) of the self-adhesive side and end laps using a membrane roller, then heat-weld the last 40 mm (1.5 in) (self-adhesive, heat-welded side laps).
- 3.9.3. Avoid forming wrinkles, swelling or fishmouths

3.10. Base-Sheet Flashing Installation

- 3.10.1. Apply primer to the substrate at a rate of .25 L/m². Allow primer to dry before installation of Base Sheet
- 3.10.2. Install reinforcing gussets at all inside and outside corners
- 3.10.3. Install base sheet flashing in one- (1) metre widths to cover roofing substrate over 100 mm. Overlap side laps by 75 mm. Stagger side laps by at least 100 mm from base sheet overlaps on roof to avoid excessive layering.
- 3.10.4. Apply base sheet flashing directly onto substrate by removing siliconed paper cover sheet. Proceed from top to bottom. Once in place, apply pressure manually in a uniform fashion to obtain homogenous adherence over entire surface. Preferably seal seams with rubber roller. Nail outside edge at 300 mm o/c.
- 3.10.5. Avoid forming wrinkles, air pockets or fishmouths.
- 3.10.6. Always seal overlaps at the end of the workday.

3.11. Roofing Cap Sheet Installation

- 3.11.1. Once base sheet is applied and no defects are apparent, proceed with cap sheet installation.
- 3.11.2. Begin with double-selvage starter roll. If starter roll is not used, side laps covered in granules must be degranulated by embedding side laps in torch-heated bitumen over a 100 mm width.
- 3.11.3. Unroll cap sheet at drain. Carefully align first side lap (parallel to roof edge).
- 3.11.4. Weld cap sheet onto base sheet with torch recommended by membrane manufacturer. During application, simultaneously melt both designated contact surfaces so a bead of bitumen is apparent as cap sheet unrolls.
- 3.11.5. Avoid overheating.
- 3.11.6. Make sure joints between the two layers are staggered by at least 300 mm.

3.12. Cap Sheet Flashing Installation

- 3.12.1. Install this cap sheet in one-metre-wide strips. The side joints must overlap by 100 mm and must be staggered by at least 100 mm with respect to the joints of the cap sheet on the field surface to avoid areas of excessive membrane thickness. The overlaps on the field surface must be 50 mm wider than those of the base sheet membrane on the upstands and parapets. At end laps, angle-cut the corners that will be covered by following roll.
- 3.12.2. Use a chalk line to draw a straight line on the field surface 150 mm from the upstands and parapets.
- 3.12.3. Use a propane torch and round-nose trowel to embed the surface granules starting from the chalk line on the field surface to the bottom edge of the upstand or parapet as well as on the granulated vertical surfaces that are to be overlapped.
- 3.12.4. Torch this cap sheet directly to the base sheet membrane, proceeding from bottom to top. This technique softens both membranes in order to obtain even, continuous weld.
- 3.12.5. During installation, be careful not to overheat the membrane or to create excessive bitumen bleeding at the joints.
- 3.12.6. Once cap sheet is installed, carefully inspect all joints and surfaces. Take great care to ensure asphalt does not spread out over exposed part of cap sheet.
- 3.12.7. If there are marks of asphalt or excessive asphalt seepage, reheat these areas with a torch and apply matching factory provided granules before bitumen cools to provide clean appearance. Press granules in place with a damp sponge

END OF SECTION

1. GENERAL**Summary**

Work of this section consists of sheet metal flashing and trim for new building's parapet fascia, and canopy.

1.1 Related Sections

- 1.1.1 Section 01 33 00 – Submittal Procedures
- 1.1.2 Section 04 04 99 – Masonry for Minor Works
- 1.1.3 Section 06 10 00 – Rough Carpentry.
- 1.1.4 Section 07 52 00 – SBS Modified Bituminous Membrane Roofing.
- 1.1.5 Section 07 92 00 – Joint Sealants
- 1.1.6 Section 08 11 10 – Metal Doors and Frames
- 1.1.7 Section 08 11 16 – Aluminum Doors and Frames

1.2 References

- 1.2.1 The Aluminum Association Inc. (AAI):
 - .1 AAI-Aluminum Sheet Metal Work in Building Construction-2002.
 - .2 AAI DAF45-03, Designation System for Aluminum Finishes.
- 1.2.2 American Society for Testing and Materials International (ASTM):
 - .1 ASTM A 167-99 (2004), Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet and Strip.
 - .2 ASTM A 240/A 240M-07e1, Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet and Strip for Pressure Vessels and for General Applications.
 - .3 ASTM A 606-04, Standard Specification for Steel, Sheet and Strip, High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, with Improved Atmospheric Corrosion Resistance.
 - .4 ASTM A 653/A 653M-07, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 - .5 ASTM A 792/A 792M-06a, Standard Specification for Steel Sheet, 55 per cent Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.
 - .6 ASTM B 32-04, Standard Specification for Solder Metal.
 - .7 ASTM B 370-03, Standard Specification for Copper Sheet and Strip for Building Construction.
 - .8 ASTM D 523-89 (1999), Standard Test Method for Specular Gloss.
 - .9 ASTM D 822-01 (2006), Standard Practice for Filtered Open-Flame Carbon-Arc Exposures of Paint and Related Coatings.
- 1.2.3 Canadian Roofing Contractors Association (CRCA):
 - .1 Roofing Specifications Manual 1997.
- 1.2.4 Canadian General Standards Board (CGSB):
 - .1 CAN/CGSB-51.32-M77, Sheathing, Membrane, Breather Type.
 - .2 CAN/CGSB-93.1-M85, Sheet Aluminum Alloy, Pre-finished, Residential.
- 1.2.5 Canadian Standards Association (CSA International):
 - .1 CSA A123.3-05, Asphalt Saturated Organic Roofing Felt.
 - .2 AAMA/WDMA/CSA 101/I.S.2/A440-2008, Standard/Specification for Windows, Doors and Unit Skylights.
 - .3 CSA B111-1974 (R2003), Wire Nails, Spikes and Staples.
- 1.2.6 Health Canada/Workplace Hazardous Materials Information System (WHMIS):
 - .1 Material Safety Data Sheets (MSDS).

1.3 Action and Informational Submittals

- 1.3.1 Provide submittals in accordance with Section 01 33 00 – Submittal Procedures.
- 1.3.2 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.
- 1.3.3 Samples: Submit two 100mm x 100mm samples of each type of sheet metal material, finishes and colours.
- 1.4 **Delivery, Storage and Handling**
Deliver, store and handle materials in accordance with Section 01 61 00 – Common Product Requirements.
2. **PRODUCTS**
- 2.1 **Pre-Finished Aluminum Sheet**
- 2.1.1 Finish: Factory applied coating to CAN/CGSB-93.1 supplemented and amended as follows:
- .1 Type 1.
- .2 Class F1S.
- .3 Colour from manufacturer's standard range to later selection by Architect.
- .4 Specular gloss: 30 units.
- .5 Coating thickness: not less than 22 micrometres.
- .6 Outdoor exposure period: 2500 hours.
- .7 Exposure period for humidity resistance: 5000 hours.
- .8 Exposure period for salt spray resistance: 1000 hours.
- 2.1.2 Thickness specified for pre-finished aluminum sheet applies to base metal.
- 2.2 **Metal Flashings, Copings and Fascias**
- 2.2.1 Form factory pre-painted flashings, copings and fascias to profiles indicated of 0.80mm (0.032”) thick pre-finished aluminum.
- 2.2.2 Fascias to be:
- .1 24ga, 7/8” corrugated panel by Westman Steel or approved equal.
Contact Rep:
Tracy Thibideau , 1-519-620-6001 ext 1530 ,
tthibideau@westmansteel.ca
- .2 Factory painted to color by later selection by Architect.
- .3 Fasteners: SD Tek screws at spacing as recommended by manufacturer.
- .4 Header drip flashing and sill J flashing at window headers and sills.
- .5 Provide outside “J” corner metal flashings in color matching the fascia
- .6 Provide inside “J” corner metal flashings in color matching the fascia
- 2.3 **Accessories**
- 2.3.1 Isolation coating: Alkali resistant bituminous paint.
- 2.3.2 Plastic cement: to CAN/CGSB 37.5.
- 2.3.3 Underlay for metal flashing: Dry sheathing to CAN/CGSB-51.32 or as noted on the Contract Drawings.
- 2.3.4 Sealants: Refer to Section 07 92 00 – Joint Sealants.
- 2.3.5 Cleats: of same material and temper as sheet metal, minimum 50mm wide. Thickness same as sheet metal being secured.
- 2.3.6 Fasteners: of same material as sheet metal, to CSA B111, flat head roofing nails of length and thickness suitable for metal flashing application.
- 2.3.7 Washers: of same material as sheet metal, 1mm thick with rubber packings.
- 2.3.8 Flux: Rosin, cut hydrochloric acid or commercial preparation suitable for materials to be soldered.
- 2.3.9 Touch-up paint: as recommended by pre-finished material manufacturer.

2.4 Fabrication

- 2.4.1 Fabricate metal flashings and other sheet metal work as indicated in the Contract Drawings.
- 2.4.2 Fabricate aluminum flashings and other sheet aluminum work in accordance with AAI-Aluminum Sheet Metal Work in Building Construction.
- 2.4.3 Form pieces in 2400mm maximum lengths: Make allowance for expansion at joints.
- 2.4.4 Hem exposed edges on underside 12mm: Mitre and seal corners with sealant.
- 2.4.5 Form sections square, true and accurate to size, free from distortion and other defects detrimental to appearance or performance.
- 2.4.6 Apply isolation coating to metal surfaces to be embedded in concrete or mortar.

2.5 Reglets and Cap Flashings

- 2.5.1 Form metal cap flashing of 0.80mm (0.032") thick pre-finished aluminum sheet metal. Provide slotted fixing holes and steel/plastic washer fasteners.

2.6 Eavestroughs and Downpipes

- 2.6.1 N/A

3. EXECUTION**3.1 Manufacturer's Instructions**

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

3.2 Installation

- 3.2.1 Install sheet metal work in accordance with AAI-Aluminum Sheet Metal Work in Building Construction and as detailed.
- 3.2.2 Use concealed fastenings except where approved before installation.
- 3.2.3 Provide underlay under sheet metal:
 - .1 Secure in place and lap joints 100mm.
- 3.2.4 Counterflash bituminous flashings at intersections of roof with vertical surfaces and curbs:
 - .1 Flash joints using S-lock forming tight fit over hook strips, as detailed.
- 3.2.5 Lock end joints and caulk with sealant.
- 3.2.6 Install surface mounted reglets true and level and caulk top of reglet with sealant.
- 3.2.7 Insert metal flashing into reglets under cap flashing to form weather tight junction.
- 3.2.8 Turn top edge of flashing into recessed reglet or mortar joint minimum of 25mm. Lead wedge flashing securely into joint.
- 3.2.9 Caulk flashing at cap flashing with sealant.
- 3.2.10 Install pans, where shown around items projecting through roof membrane.

3.3 Eavestrough and Downpipes

- 3.3.1 N/A

3.4 Cleaning

- 3.4.1 Proceed in accordance with Section 01 74 11 – Cleaning.
- 3.4.2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.
- 3.4.3 Leave work areas clean, free from grease, finger marks and stains.

END OF SECTION

1. GENERAL**Summary**

This Section includes through penetration firestopping and smoke seal systems for penetrations through fire resistance rated assemblies:

- Fire Rated elevator shaft and wall enclosure at staircase

Materials having only a ULC label will not be acceptable for use on this Project, unless supporting documentation is provided indicating its use in a listed assembly.

1.1 Related Sections

- 1.1.1 Section 01 33 00 – Submittal Procedures
- 1.1.2 Section 01 74 11 – Cleaning
- 1.1.3 Section 04 04 99 – Masonry for Minor Works
- 1.1.4 Section 09 21 16 – Gypsum Board Assemblies
- 1.1.5 Mechanical and Electrical Specifications

1.2 References

- 1.1.1 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).
- 1.1.1 Underwriter's Laboratories of Canada (ULC)
 - .1 ULC-S115-1995, Fire Tests of Fire stop Systems.

1.1 Administrative Requirements

- 1.1.1 Coordination: Coordinate construction of openings and penetrating items and verify that firestopping and smoke seals systems are installed according to specified requirements and as follows:
 - 1. Coordinate sizing of openings, core drilled holes, or cut openings to accommodate firestopping and smoke seals systems.
 - 2. Leave firestopping and smoke seals or joint system installations that will become concealed behind other construction open until Consultant and building inspector, if required by authorities having jurisdiction, have examined each installation.

1.2 Submittals

- 1.2.1 Provide required information in accordance with Section 01 00 06 – General Requirements: Submittals.
- 1.2.2 Action Submittals: Provide submittals required by Section 07 05 53, and as follows:
 - 1. Determine thickness of applied materials from tests of assemblies identical to the assembly to be protected where possible, conducted in accordance with reference standards listed above.
 - 2. Determine system from available engineering studies, or correspondence with the labelling agency indicating the effect of the differences on the fire separation of the assembly where the assembly is protected but does not correspond exactly to a tested assembly; confirm acceptance of system by local authorities having jurisdiction in writing.
 - 3. Use the same system and material as would be required for a tested assembly with similar conditions where the assembly includes conditions which do not correspond to those included in any previously tested assembly and for which no relevant engineering information is available.
- 1.2.3 Informational Submittals: 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.

1.3 Delivery, Storage And Handling

- 1.3.1 Deliver and store materials in a dry protected area, in original undamaged sealed containers with the manufacturer's labels, application instructions, and labelling agency's labels intact.

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- 1.3.2 Keep materials dry until ready for use.
 - 1.3.3 Keep the packages of material off the ground, under cover, and away from sweating walls and other damp surfaces. Discard material that has been exposed to water before actual use.

2 **PRODUCTS**

2.1 **Manufacturers**

2.1.1 Acceptable Materials Manufacturers: Subject to compliance with requirements specified in this Section; and as established by the Basis-of-Design Materials, use any of the listed manufacturers' products:

- 1. A/D Fire Protection Systems Inc.
- 2. Hilti Canada Ltd.
- 3. 3M Canada Inc.
- 4. Tremco Ltd.

2.2 **Design Requirements**

2.2.1 Performance Requirements: Manufacturer shall design proprietary assemblies to withstand the listed ratings in accordance with the Building Code, Underwriters Laboratories Canada, and authorities having jurisdiction, and as follows:

- 1. Provide through penetration firestop and joint systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire resistance rating of assembly penetrated:
 - a) Fire resistance rated load bearing walls, including partitions, with fire protection rated openings.
 - b) Fire resistance rated non-load bearing walls, including partitions, with fire protection rated openings.
 - c) Fire resistance rated floor assemblies.
- 2. F-Rated Systems: Provide through penetration firestop systems with F-ratings indicated, as determined by ULC S115 or ASTM E814, but not less than that equalling or exceeding fire resistance rating of constructions penetrated.
- 3. T-Rated Systems: For the following conditions, provide through penetration firestop systems with T-ratings indicated, as well as F-ratings, as determined per by ULC S115 or ASTM E814, where systems protect penetrating items exposed to potential contact with adjacent materials:
 - a) Penetrations located outside wall cavities.
 - b) Penetrations located outside fire resistive shaft enclosures.
 - c) Penetrations located in construction containing fire protection rated openings.
 - d) Penetrating items larger than 100 mm diameter nominal pipe or 100 cm² in overall cross sectional area.
- 4. Firestopping and Smoke seals Systems Exposed To View: Systems exposed to view, traffic, moisture, and physical damage; provide products that after curing do not deteriorate when exposed to these conditions both during and after construction, and as follows:
 - a) Provide moisture resistant through penetration firestop systems for piping penetrations for plumbing and wet pipe sprinkler systems.
 - b) Provide firestopping and smoke seals systems capable of supporting floor loads involved either by installing floor plates or by other means for floor penetrations with annular spaces exceeding 100 mm in width and exposed to possible loading and traffic.
 - c) Provide firestopping and smoke seals systems not requiring removal of insulation for penetrations involving insulated piping.
 - d) Provide products with flame spread ratings of less than 25 and smoke developed ratings of less than 50 for firestopping and smoke seals and joint systems

exposed to view.

5. Fire Resistance of Joint Systems: Assembly ratings and movement capabilities indicated, but with assembly ratings not less than that equalling or exceeding fire resistance rating of constructions in which joints are located.

2.3 **Firestopping And Smoke seals**

- 2.3.1 Compatibility: Provide firestopping and smoke seals systems that are compatible with one another, with the substrates forming openings, and with the items, if any, penetrating firestopping and smoke seals systems, under conditions of service and application, as demonstrated by firestopping and smoke seals system manufacturer based on testing and site experience, and as follows:
 1. Service penetration assemblies: certified by ULC in accordance with ULC S115 and listed in ULC Guide No. 40 U19.
 2. Service penetration firestopping and smoke seals components: certified by ULC in accordance with ULC S115 and listed in ULC Guide No. 40 U19.13, under the Label Service of ULC.
 3. Fire resistance rating of installed firestopping and smoke seals assembly not less than the fire resistance rating of surrounding floor and wall assembly.
 4. Firestopping and Smoke seals at openings intended for ease of re-entry such as cables: elastomeric seal; do not use cementitious or rigid seal at such locations.
 5. Firestopping and Smoke seals at openings around penetrations for pipes, ductwork and other mechanical items requiring sound and vibration control: elastomeric seal; do not use a cementitious or rigid seal at such locations. Exemption to fire dampers.
- 2.3.2 Accessories: Provide components for each firestopping and smoke seals system that are needed to install fill materials and to comply with 1.3.2.1 above. Use only components specified by firestopping and smoke seals system manufacturer and approved by the qualified testing and inspecting agency for firestopping and smoke seals systems indicated. Accessories include, but are not limited to, the following items:
 1. Permanent forming, damming and backing materials, including the following:
 - a) Slag or rock wool fibre insulation.
 - b) Sealants used in combination with other forming, damming or backing materials to prevent leakage of fill materials in liquid state.
 - c) Fire rated form board.
 - d) Fillers for sealants.
 2. Temporary forming materials.
 3. Substrate primers.
 4. Collars.
 5. Steel sleeves.
 6. Primers: to manufacturer's recommendation for specific material, substrate, and end use.
 7. Water (if applicable): potable, clean and free from injurious amounts of deleterious substances.
 8. Metal fire stop: Commercial galvanized steel, to ASTM A1008/A1008M, zinc coating 260 g/m², minimum metal core thickness 0.912 mm.
 9. Steel Deck Moulded Flute Inserts: One piece moulded mineral fibre flute inserts, sized for steel deck profiles, for placement at top of fire rated wall assemblies:
 - a) Acceptable material: Hilti CP777 Speed Plugs.
 10. Labels: Peel-and-stick labels printed with the following information:
 - a) ATTENTION: FIRE RATED ASSEMBLY. DO NOT MODIFY
 - b) Name of firestopping manufacturer; 2.3.2.10.3 Names of products used; 2.3.2.10.4 Hour Rating of Assembly; 2.3.2.10.5 Manufacturers standard detail number, or Engineered Judgement identifier; ULC or cUL_{US} Number;

2.3.2.10.6 Date of installation; 2.3.2.10.7 Name of installing Subcontractor;
2.3.2.10.8 Contact telephone number for repair or replacement of firestopping materials.

2.4 **Fill Materials**

- 2.4.1 Firestopping and Smoke seals Devices: Factory assembled collars formed from galvanized steel and lined with intumescent material sized to fit specific diameter of penetrating item.
- 2.4.2 Cable Penetration Devices:
 - 2.4.2.1 Premanufactured intumescent blocks, as follows:
 - 2.4.2.1.1 Roxtec Intumescent Blocks
 - 2.4.2.1.2 Hilti CFS-BL Intumescent Blocks
 - 2.4.2.2 Premanufactured sleeves, consisting of an adjustable core, and as follows:
 - 2.4.2.2.1 Specified Technologies EZ-Path Fire Rated Pathway
 - 2.4.2.2.2 Hilti CP 653 Speed Sleeves
- 2.4.3 Mortars: Pre-packaged, dry mixes consisting of a blend of inorganic binders, hydraulic cement, fillers, and lightweight aggregate formulated for mixing with water at Project site to form a non-shrinking, homogeneous mortar.
- 2.4.4 Silicone Foams: Multi-component, silicone based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, non-shrinking foam.
- 2.4.5 Silicone Sealants: Moisture curing, single component, silicone based, neutral curing elastomeric sealants of grade indicated below:
 - 2.4.5.1 Grade for Horizontal Surfaces: Pourable (self levelling) formulation for openings in floors and other horizontal surfaces.
 - 2.4.5.2 Grade for Vertical Surfaces: non-sag formulation for openings in vertical and other surfaces.

2.5 **Mixing**

- 2.5.1 For those products requiring mixing before application, comply with firestopping and smoke seals system manufacturer's written instructions for accurate proportioning of materials, water (if required), type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other items or procedures needed to produce products of uniform quality with optimum performance characteristics for application indicated.

3 **EXECUTION**

3.1 **Examination**

- 3.1.1 Examine surfaces, components, materials to receive firestopping and smoke seals material; report any conditions that would detrimentally affect the application of the material or the proper firestopping and smoke seals of the system.
- 3.1.2 Commence Work when conditions of surfaces and the working conditions are suitable.
- 3.1.3 Verify service lines are in place, tested and approved where penetration sealants or caulking are required.
- 3.1.4 Verify that proper blocking, framing (using non-combustible materials) are properly installed and prepared to receive firestopping and smoke seals. Notify Consultant in writing of any deficiencies affecting the proper performance of the firestopping and smoke seals, do not proceed until deficiencies are corrected.
- 3.1.5 Prepare surfaces in contact with firestopping and smoke seals materials and smoke seals to manufacturer's instructions.
- 3.1.6 Maintain insulation around pipes and ducts penetrating fire separation without interruption to vapour barrier where applicable.
- 3.1.7 Mask where necessary to avoid spillage and over coating onto adjoining surfaces; remove stains on adjacent surfaces.

3.2 **Preparation**

- 3.2.1 Provide and maintain masking, drop cloths and polyethylene coverings for such surfaces

to protect them during installation operations where adjacent finished floors, walls and similar surfaces are exposed.

- 3.2.2 Provide complete enclosures and human protective devices when installing or mixing hazardous materials.
- 3.2.3 Surfaces shall be free of oil, grease, dirt, loose paint, mill scale or any other matter that could impair bond, including paint.
- 3.2.4 Prime surfaces as required.
- 3.2.5 Make provisions for natural ventilation during and subsequent to application of firestopping and smoke seals, sealant or caulking; circulate interior air by use of temporary circulators or exhaust fans in enclosed areas or area lacking openings for natural ventilation.

3.3 Application

- 3.3.1 Apply firestopping and smoke seals materials in strict accordance with manufacturer's printed instructions, accepted and approved tested assemblies, and approved details.
- 3.3.2 Apply firestopping and smoke seals materials/systems to maintain the fire separations in the project as indicated on drawings.
- 3.3.3 Seal holes or voids made by through penetrations, poke through termination devices, and unpenetrated openings or joints and verify continuity and integrity of fire separation are maintained. **Includes existing holes** created by previous M&E installations.
- 3.3.4 Provide temporary forming as required and remove forming only after materials have gained sufficient strength and after initial curing.
- 3.3.5 Tool or trowel exposed surfaces to a neat finish.
- 3.3.6 Remove excess compound promptly as work progresses and upon completion.
- 3.3.7 Place self-sticking labels on a permanent surface adjacent to firestopping or smoke seal installation.

3.4 Cleaning

- 3.4.1 After completion of firestopping and smoke seals work, remove equipment and clean exposed wall and floor areas to remove excess materials, spatter.

3.5 System Schedule

- 3.5.1 Design and provide through penetration firestopping and smoke seals as follows for:
 - 3.5.1.1 Systems with No Penetrating Items: Select one or more of the following fill materials:
 - 3.5.1.1.1 Latex sealant
 - 3.5.1.1.2 Silicone sealant
 - 3.5.1.1.3 Intumescent spray foam
 - 3.5.1.2 Systems for Metallic Pipes, Conduit, or Tubing: Select one or more of the following fill materials:
 - 3.5.1.2.1 Latex sealant
 - 3.5.1.2.2 Silicone sealant
 - 3.5.1.2.3 Intumescent spray foam
 - 3.5.1.3 Systems for Non-metallic Pipe, Conduit, or Tubing: Select one or more of the following fill materials:
 - 3.5.1.3.1 Latex sealant
 - 3.5.1.3.2 Silicone sealant
 - 3.5.1.3.3 Intumescent putty
 - 3.5.1.3.4 Intumescent wrap strips
 - 3.5.1.3.5 Firestopping and Smoke seals device
 - 3.5.1.3.6 Intumescent spray foam
 - 3.5.1.4 Systems for Electrical, and Data and Communications Cables: Select one or more of the following fill materials:
 - 3.5.1.4.1 Prefabricated Firestop Sleeve (Hilti)
 - 3.5.1.4.2 Preformed Intumescent Blocks (Roxtec)
 - 3.5.1.4.3 Prefabricated Cable Pathways (EZ-Path)

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- 3.5.1.5 Systems for Miscellaneous Insulated and Non Insulated Plumbing and Mechanical Penetrations: Select one or more of the following fill materials:
 - 3.5.1.5.1 Firestop collars or as specified in Mechanical Specifications.
 - 3.5.1.6 Systems for Groupings of Penetrations: Select one or more of the following fill materials:
 - 3.5.1.6.1 Latex sealant
 - 3.5.1.6.2 Intumescent wrap strips
 - 3.5.1.6.3 Firestopping and Smoke seals device
 - 3.5.1.6.4 Intumescent composite sheet
 - 3.5.1.6.5 Intumescent foam blocks or boards
 - 3.5.1.6.6 Intumescent spray foam
 - 3.5.2 Design and provide joint firestopping and smoke seals as follows for:
 - 3.5.2.1 Floor-to-Floor, Fire Resistive Joint System: Provide materials to meet the following criteria:
 - 3.5.2.1.1 Assembly Rating: As indicated on drawings (1.0 HR FRR)
 - 3.5.2.1.2 Nominal Joint Width: As indicated
 - 3.5.2.1.3 Movement Capabilities: Compression and extension
 - 3.5.2.2 Floor-to-Wall, Fire Resistive Joint System: Provide materials to meet the following criteria:
 - 3.5.2.2.1 Assembly Rating: As indicated As indicated on drawings (1.0 and 1.5 HR FRR)
 - 3.5.2.2.2 Nominal Joint Width: As indicated
 - 3.5.2.2.3 Movement Capabilities: Confirm, compression, extension, or horizontal shear
 - 3.5.2.3 Wall-to-Wall, Fire Resistive Joint System: Provide materials to meet the following criteria:
 - 3.5.2.3.1 Assembly Rating: As indicated (1.5 HR FRR)
 - 3.5.2.3.2 Nominal Joint Width: As indicated
 - 3.5.2.3.3 Movement Capabilities: Compression and extension
 - 3.6 **Standard Details**
 - 3.6.1 The following pages contain standard details indicating generic materials and assemblies; they do not purport to define a specific manufacturer's listed assembly or every firestopping or smoke seal assembly required for the Project.
 - 3.6.2 Verify site conditions and dimensions for compliance with manufacturers details including, but not limited to:
 - 3.6.2.1 Minimum and maximum joint widths.
 - 3.6.2.2 Type and thickness of fire rated construction.
 - 3.6.3 Use manufacturer's approved alternate details where site conditions do not comply with standard details submitted for review; update Consultant's copies of manufacturer's standard details with alternate details.
 - 3.6.4 Submit manufacturer's Engineered Judgements where alternate details do not match site conditions in accordance with the IFC Guidelines for Evaluating Firestop Systems Engineering Judgments.

END OF SECTION

1. GENERAL**Summary**

Work of this Section consists of sealants used for glazing wall and door systems, around mechanical and electrical equipment penetrations through walls & ceilings and other various caulking required by the work of this Contract.

1.1 Related Sections

- 1.1.1 Section 01 33 00 – Submittal Procedures
- 1.1.2 Section 01 74 00 – Cleaning

1.2 References

- 1.2.1 American Society for Testing and Materials International, (ASTM):
 - .1 ASTM C 919-02, Standard Practice for Use of Sealants in Acoustical Applications.
- 1.2.2 Canadian General Standards Board (CGSB):
 - .1 CGSB 19-GP-5M-1984, Sealing Compound, One Component, Acrylic Base, Solvent Curing (Issue of 1976 reaffirmed, incorporating Amendment No.1).
 - .2 CAN/CGSB-19.13-M87, Sealing Compound, One-component, Elastomeric, Chemical Curing.
 - .3 CGSB 19-GP-14M-1984, Sealing Compound, One Component, Butyl-Polyisobutylene Polymer Base, Solvent Curing (Reaffirmation of April 1976).
 - .4 CAN/CGSB-19.17-M90, One-Component Acrylic Emulsion Base Sealing Compound.
 - .5 CAN/CGSB-19.24-M90, Multi-component, Chemical Curing Sealing Compound.
- 1.2.3 Health Canada/Workplace Hazardous Materials Information System (WHMIS):
 - .1 Material Safety Data Sheets (MSDS).

1.3 Action and Informational Submittals

- 1.3.1 Submit product data in accordance with Section 01 33 00 – Submittal Procedures.
- 1.3.2 Manufacturer's product to describe:
 - .1 Caulking compound.
 - .2 Primers.
 - .3 Sealing compound, each type, including compatibility when different sealants are in contact with each other.

1.4 Delivery, Storage and Handling

- 1.4.1 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

- 1.5.1 Remove from site and dispose of packaging materials at appropriate disposal facilities.
- 1.5.2 Place materials defined as hazardous or toxic in designated containers.
- 1.5.3 Handle and dispose of hazardous materials in accordance with the CEPA, TDGA, Regional and Municipal regulations.
- 1.5.4 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.
- 1.5.5 Divert unused joint sealing material from landfill to official hazardous material collections site.
- 1.5.6 Empty plastic joint sealer containers are not recyclable. Do not dispose of empty containers with plastic materials destined for recycling.

1.6 Site Conditions**1.6.1 Environmental Limitations:**

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.
 - .2 When joint substrates are wet.
- 1.6.2 Joint-Width Conditions:** Do not proceed with installation of joint sealants where joint widths are less than those allowed by joint sealant manufacturer for applications indicated.
- 1.6.3 Joint-Substrate Conditions:** Do not proceed with installation of joint sealants until contaminants capable of interfering with adhesion are removed from joint substrates.

2. PRODUCTS**2.1 Sealant Materials**

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

2.4 Joint Cleaner

- 2.4.1 Non-corrosive and non-staining type, compatible with joint forming materials and sealant recommended by sealant manufacturer.
- 2.4.2 Primer: as recommended by manufacturer.

3. EXECUTION**3.1 Protection**

- 3.1.1 Protect installed work of other trades from staining or contamination.

3.2 Surface Preparation

- 3.2.1 Examine joint sizes and conditions to establish correct depth to width relationship for installation of backup materials and sealants.
- 3.2.2 Clean bonding joint surfaces of harmful matter substances including dust, rust, oil grease and other matter which may impair the Work.
- 3.2.3 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.
- 3.2.4 Ensure joint surfaces are dry and dust free.
- 3.2.5 Prepare surfaces in accordance with manufacturer's directions.

3.3 Priming

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

3.4 Backup Material

- 3.4.1 Apply bond breaker tape where required to manufacturer's instructions.
- 3.4.2 Install joint filler to achieve correct joint depth and shape, with approximately 30 per cent compression.

3.5 Mixing

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

3.6 **Application**

3.6.1 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.

3.6.2 Curing:

- .1 Cure sealants in accordance with sealant manufacturer's instructions.
- .2 Do not cover up sealants until proper curing has taken place.

3.6.3 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

1. GENERAL**Summary**

Work of this section includes new hollow metal frames. Refer to Architectural Plans and Door Schedule.

1.1 Related Sections

- 1.1.1 Section 01 33 00 – Submittal Procedures.
- 1.1.2 Section 07 92 00 – Joint Sealants.
- 1.1.3 Section 08 80 50 – Glazing
- 1.1.4 Section 09 91 99 – Painting for Minor Works.

1.2 References

- 1.2.1 American Society for Testing and Materials International (ASTM):
 - .1 ASTM A 653/A 653M-06a, Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 - .2 ASTM B 29-03, Standard Specification for Refined Lead.
 - .3 ASTM B 749-03, Standard Specification for Lead and Lead Alloy Strip, Sheet and Plate Products.
- 1.2.2 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.
- 1.2.3 Canadian Standards Association (CSA International):
 - .1 CSA-G40.20-04/G40.21-04, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
 - .2 CSA W59-03, Welded Steel Construction (Metal Arc Welding).
- 1.2.4 Canadian Steel Door Manufacturers' Association (CSDMA):
 - .1 CSDMA, Recommended Specifications for Commercial Steel Doors and Frames, 2000.
 - .2 CSDMA, Selection and Usage Guide for Commercial Steel Doors, 1990.
- 1.2.5 National Fire Protection Association (NFPA):
 - .1 NFPA 80-99, Standard for Fire Doors and Fire Windows.
 - .2 NFPA 252-03, Standard Methods of Fire Tests of Door Assemblies.
- 1.2.6 Underwriters' Laboratories of Canada (ULC):
 - .1 CAN/ULC-S701-01, Standard for Thermal Insulation, Polystyrene, Boards and Pipe Covering.
 - .2 CAN/ULC-S702-97, Standard for Thermal Insulation, Mineral Fibre, for Buildings.
 - .3 CAN/ULC-S704-03, Standard for Thermal Insulation, Polyurethane and Polyisocyanurate Boards, Faced.
 - .4 CAN4-S104-M80, Standard Method for Fire Tests of Door Assemblies.
 - .5 CAN4-S105-M85, Standard Specification for Fire Door Frames Meeting the Performance Required by CAN4-S104.

1.3 System Description

Design Requirements:

- 1.3.1 Design exterior frame assembly to accommodate to expansion and contraction when subjected to minimum and maximum surface temperature of -35°C to 35°C.
- 1.3.2 Maximum deflection for exterior steel entrance screens under wind load of 1.2kPa not to exceed 1/175th of span.
- 1.3.3 Steel fire rated doors and frames: labelled and listed by an organization accredited by Standards Council of Canada in conformance with CAN4-S104 and NFPA 252 for ratings specified or indicated.

- 1.3.4 Provide fire labelled frames for openings requiring fire protection ratings. Test products in conformance with CAN4-S104, ASTM E 152 or NFPA 252 and listed by nationally recognized agency having factory inspection services.

1.4 **Action and Informational Submittals**

- 1.4.1 Provide submittals in accordance with Section 01 33 00 – Submittal Procedures.
1.4.2 Provide product data: in accordance with Section 01 33 00 – Submittal Procedures.
1.4.3 Provide shop drawings: in accordance with Section 01 33 00 – Submittal Procedures:
.1 Indicate each type of door, material, steel core thicknesses, mortises, reinforcements, location of exposed fasteners, openings, glazed louvred, arrangement of hardware and fire rating and finishes.
.2 Indicate each type frame material, core thickness, reinforcements, glazing stops, location of anchors and exposed fastenings and reinforcing, and fire rating finishes.
.3 Include schedule identifying each unit, with door marks and numbers relating to numbering on the Contract Drawings.
.4 Submit test and engineering data, and installation instructions.

1.5 **Delivery, Storage and Handling**

- 1.5.1 Deliver, store and handle materials in accordance with Section 01 61 00 – Common Product Requirements.

2. **PRODUCTS**

2.1 **Materials**

- 2.1.1 Hot dipped galvanized steel sheet: to ASTM A 653M, ZF75, minimum base steel thickness in accordance with CSDMA Table 1 – Thickness for Component Parts.
2.1.2 Reinforcement: to CSA G40.20/G40.21, Type 44W, coating designation to ASTM A 653M, ZF75.
2.1.3 Cast or rolled pure sheet lead: to ASTM B 29, thickness 1.6mm (16 Ga.).

2.2 **Door Core Materials**

- 2.2.1 n/a

2.3 **Doors: Core Construction**

- 2.3.1 n/a

2.4 **Door Fabrication General**

- 2.4.1 n/a

2.5 **Frames Fabrication General**

- 2.5.1 Fabricate frames in accordance with CSDMA specifications.
2.5.2 Fabricate frames to profiles and maximum face sizes as indicated.
2.5.3 Interior frames: 1.8mm (18Ga) welded type construction, to ASTM B 29.
2.5.4 Blank, reinforce, drill and tap frames for mortised, templated hardware and electronic hardware using templates provided by finish hardware supplier. Reinforce frames for surface mounted hardware.
2.5.5 Prepare frame for door silencers, three for single door, two at head for double door.
2.5.6 Manufacturer's nameplates on visible faces of frames and screens are not permitted.
2.5.7 Conceal fastenings except where exposed fastenings are indicated.
2.5.8 Provide factory-applied touch up primer at areas where zinc coating has been removed during fabrication.
2.5.9 Protect mortised cutouts with steel guard boxes.
2.5.10 Insulate exterior frame components with polyurethane insulation.

2.6 Frame Anchorage

- 2.6.1 Provide appropriate anchorage to wall construction.
- 2.6.2 Locate each wall anchor immediately above or below each hinge reinforcement on hinge jamb and directly opposite on strike jamb.
- 2.6.3 Provide two anchors for rebate opening heights up to 1520mm and one additional anchor for each additional 760mm of height or fraction thereof.
- 2.6.4 Locate anchors for frames in existing openings not more than 15mm from top and bottom of each jambs and intermediate at 660mm on centre maximum.

2.7 Frames: Welded Type

- 2.7.1 Welding in accordance with CSA W59.
- 2.7.2 Accurately miter or mechanically joint frame product and securely weld on inside of profile.

2.8 Hollow Steel Construction

- 2.8.1 Form face sheets from 1.6mm sheet steel.
- 2.8.2 Reinforce doors with vertical stiffeners, securely welded to face sheets at 150mm on centre maximum.

2.9 Primer

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

2.10 Paint

- 2.10.1 Paint steel frames in accordance with Sections 09 91 99 – Painting for Minor Works. Provide final finish free of scratches or other blemishes.
- 2.10.2 Grind welded joints and corners to a flat plane, fill with metallic paste and sand to uniform smooth finish.
- 2.10.3 Securely attach floor anchors to inside of each jamb profile.
- 2.10.4 Weld in two temporary jamb spreaders per frame to maintain proper alignment during shipment.

2.11 Adhesives

- 2.11.1 Polystyrene and polyurethane cores: heat resistant, epoxy resin based, low viscosity, contact cement.

2.12 Accessories

- 2.13.1 Door gasket to be fire rated where noted (refer to door schedule). Gaskets for Fire Door Assemblies - Surface applied intumescent gaskets. Acceptable product: Lorient Batwing® Seals_ ES980 or equal.
- 2.13.3 Metallic paste filler: to manufacturer's standard.
- 2.13.4 Sealant: refer to Section 07 92 00 – Joint Sealants.

2.13 Glass

- 2.13.1 Refer to Section 08 80 50 – Glazing. In all rated doors provide safety glass or wired glass Type 2.

3. EXECUTION**3.1 Manufacturer's Instructions**

- 3.1.1 Comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions and datasheets.

3.2 Installation General

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

3.3 Frame Installation

- 3.3.1 Set frames plumb, square, level and at correct elevation.
- 3.3.2 Secure anchorages and connections to adjacent construction.
- 3.3.3 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 1200mm wide. Remove temporary spreaders after frames are built-in.
- 3.3.4 Make allowances for deflection of structure to ensure structural loads are not transmitted to frames.
- 3.3.5 Caulk perimeter of frames between frame and adjacent material.
- 3.3.6 Maintain continuity of air barrier and vapour retarder.

3.4 Door Installation

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

3.5 Finish Repairs

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

END OF SECTION

1. GENERAL**Summary**

Work of this Section includes Exterior & Interior Glazed Wall/Door Systems at Vestibule entrance.

1.1 Related Sections

- 1.1.1 Section 01 33 00 – Submittal Procedures.
- 1.1.2 Section 01 61 00 – Common Product Requirements.
- 1.1.3 Section 01 74 11 – Cleaning.
- 1.1.4 Section 01 78 00 – Closeout Submittals.
- 1.1.5 Section 07 92 00 – Joint Sealants
- 1.1.8 Section 08 80 50 – Glazing.
- 1.1.9 Section 08 87 53 - Decorative Films.
- 1.1.10 Section 09 21 16 – Gypsum Board Assemblies

1.2 References

- 1.2.1 American Architectural Manufacturers Association (AAMA)
 - .1 AAMA 609/610-09, Cleaning and Maintenance Guide for Architecturally Finished Aluminum.
- 1.2.2 ASTM International
 - .1 ASTM E 330-02 Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.
- 1.2.3 Canadian General Standards Board (CGSB)
 - .1 CGSB 1.40-97, Anticorrosive Structural Steel Alkyd Primer.
 - .2 CAN/CGSB-12.1-M90, Tempered or Laminated Safety Glass.
 - .3 CAN/CGSB-12.20-M89, Structural Design of Glass for Buildings.
- 1.2.4 CSA International
 - .1 CSA G40.20/G40.21-04(R2009), General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
 - .2 CAN/CSA G164-M92(R2003), Hot Dip Galvanizing of Irregularly Shaped Articles.

1.3 Action And Informational Submittals

- 1.3.1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- 1.3.2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for doors and frames and include product characteristics, performance criteria, physical size, finish and limitations.
- 1.3.3 Shop Drawings:
 - .1 Submit drawings stamped and signed by professional engineer registered or licensed in Ontario, Canada.
 - .2 Indicate materials and profiles and provide full-size, scaled details of components for each type of door and frame. Indicate:
 - .1 Interior trim and exterior junctions with adjacent construction.
 - .2 Junctions between combination units.
 - .3 Elevations of units.
 - .4 Core thicknesses of components.
 - .5 Type and location of exposed finishes, method of anchorage, number of anchors, supports, reinforcement, and accessories.
 - .6 Location of caulking.
 - .7 Each type of door system including location.
 - .8 Arrangement of reinforcing for hardware and joints.

- .9 Arrangement of hardware and required clearances.
- .10 Show glazing detail, reinforcement, finish and location of manufacturer's nameplates.

1.4 **Quality Assurance**

- 1.4.1 Certificates: product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

1.5 **Delivery, Storage And Handling**

- 1.5.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
- 1.5.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labeled with manufacturer's name and address.
 - .1 Apply temporary protective coating to finished surfaces. Remove coating after erection. Use coatings that are easy to remove and residue free.
 - .2 Leave protective covering in place until final cleaning of building.
 - .3 Replace defective or damaged materials with new.

2. **PRODUCTS**

2.1 **Materials**

2.1.1 Manufacturers:

- .1 CRL glazed wall system and doors, Platinum Series Narrow Stile Doors 3" Satin Anodized Full Framed Door, Series FFN1 for swing door system.

CRL Palisades S100 Series for Sliding Door, Satin Anodized finish
Contact at CRL: 1-877-421-6144
- .2 Request for product substitutions must be submitted in writing ten (10) days prior to bid date. Contractor must provide complete product literature and drawings, certificates certifying substitute manufacturer (1) attesting to adherence to specification requirements for curtain wall system performance criteria, and (2) has been engaged in the design, manufacturer and fabrication of glazed wall systems for a period of not less than ten (10) years; test reports verifying compliance with each test requirement required by the project; samples of typical product sections and finish samples in manufacturer's standard sizes.
- 2.1.2 Aluminum extrusions: to Aluminum Association alloy AA 6063-T5 or T6 anodizing quality.
- 2.1.3 Sheet aluminum: to Aluminum Association alloy AA 1100 - H14 or AA 5005 - H32 or H34 anodizing quality.
- 2.1.4 Steel reinforcement: to CSA G40.20/G40.21, grade 300 W.
- 2.1.5 Fasteners: aluminum or stainless steel, finished to match adjacent material.
- 2.1.6 Weatherstrip: replaceable mohair, metal or plastic backed wool pile.
- 2.1.7 Door bottom seal: operable and automatic, adjustable door seal of anodized extruded aluminum frame and vinyl weather seal, recessed in door bottom, automatic retract mechanism when door is open.
- 2.1.8 Primer: to CAN/CGSB-1.105 for steel, CAN/CGSB-1.213 for aluminum and CAN/CGSB-1.181, for galvanized steel surfaces.
- 2.1.9 Isolation coating: alkali resistant.
- 2.1.10 Glass: tempered glass to CAN/CGSB-12.1, "Tempered or Laminated Safety Glass" Type 1, Class A. Refer to Section 08 80 50 - Glazing.
- 2.1.11 Glazing materials: flat safety tempered transparent 3/8" single-unit glass for glass doors, and 13mm single unit glass for glass panels. Apply privacy and décor glass film in

accordance with section 08 87 53 Decorative Films.

2.1.12 Sealants: silicone sealant in accordance with Section 07 92 00 - Joint Sealants.

2.1.13 Fastening: provide carpet grip at bottoms of glazed wall systems and fasten to carpet. Ensure the system is secure in place.

2.2 **Design Criteria**

2.2.1 Design frames and doors to CAN/CSA S157:

.1 Accommodate expansion and contraction within service temperature range.

.2 Movement within system.

.3 Movement between system and perimeter framing components or substrate.

2.2.2 Size glass thickness and glass unit dimensions to limits in accordance with CAN/CGSB-12.20.

2.2.3 Design door system to provide average thermal resistance of:

.1 Door panel assembly with thermal insulation factor RSI of 1.29 (R7.35).

2.3 **Doors**

2.3.1 Doors CRL glazed wall system and doors, color: silver, finish: Satin Adonized. Glazing to be 3/8" thick tempered glass in accordance with Section 08 80 50 - Glazing. Provide tempered laminated glass where indicated.

2.4 **Aluminum Frames**

2.4.1 Frame members, color: silver, finish: Satin Adonized.

2.4.3 Fasten frames to stone flooring as per manufacturer's instructions.

2.5 **Hardware**

2.5.1 Exterior Swing Doors (one and half door): As a minimum include hinges, closers, push paddle (from inside), D-handle pull (from outside), locking devices, Automatic door buttons and weather stripping & door sweep as applicable and recommended by manufacturer.

2.5.2 Hinges: Manufacturer's standard 5 Knuckle, ball bearing full mortise stainless steel hinge w/ finish to match frame finish. Provide minimum as per manufacturer's requirements.

2.5.3 Interior Sliding/Swing Doors (Double door to be identified as swing door and to install to swing on vertical axis in the direction of travel to the exit when pressure applied): As a minimum, include rails, track, fascia, hangers, supports, bumpers, floor guides and accessories as applicable and recommended by manufacturer.

2.5.4 Ensure hardware is supplied and factory installed by door manufacturer.

2.6 **Finishes**

2.6.1 Clear anodic finish to designation AAMA 2604, 2-coat. Appearance and properties of anodized finishes designated by Aluminum Association as Architectural Class 1, Architectural Class 2, and Protective and Decorative.

2.7 **Fabrication**

2.7.1 Doors, glazed panels and framing to be by same manufacturer.

2.7.2 Fabricate doors and frames to profiles and maximum face sizes as indicated.

2.7.3 Provide structural steel reinforcement as required.

2.7.4 Fit joints tightly and secure mechanically to walls.

2.7.5 Conceal fastenings.

2.7.6 Mortise, reinforce, drill and tap doors, frames and reinforcements to receive hardware using templates provided under Section 08 71 00 - Door Hardware.

2.7.7 Isolate aluminum from direct contact with dissimilar metals.

3. EXECUTION**3.1 Examination**

- 3.1.1 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts are acceptable for aluminum doors and frames installation in accordance with manufacturer's written instructions.
- .1 Visually inspect substrate.
 - .2 Inform Consultant 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 Consultant.

3.2 Installation

- 3.2.1 Manufacturer's Instructions: comply with manufacturer's written recommendations, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.
- 3.2.2 Set frames plumb, square, level at correct elevation in alignment with adjacent work.
- 3.2.3 Anchor securely.
- 3.2.4 Install doors and hardware in accordance with hardware templates and manufacturer's instructions.
- 3.2.5 Adjust door components to ensure smooth operation.
- 3.2.6 Make allowances for deflection of structure to ensure that structural loads are not transmitted to frames.
- 3.2.7 Glaze aluminum doors and frames in accordance with Section 08 80 50 - Glazing.
- 3.2.8 Seal joints to provide weathertight seal.
- 3.2.9 Apply sealant in accordance with Section 07 92 00 - Joint Sealants. Conceal sealant within the aluminum work except where exposed use is permitted by Consultant.

3.3 Field Quality Control

- 3.3.1 Have manufacturer of products supplied under this Section review Work involved in handling, installation/application, protection and cleaning of its product[s], and submit written reports in acceptable format to verify compliance of Work with Contract.
- 3.3.2 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.
- 3.3.3 Schedule site visits:
- .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 Upon completion of Work, after cleaning is carried out.
- 3.3.4 Obtain reports within 3 days of review and submit.

3.4 Cleaning

- 3.4.1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
- .1 Leave Work area clean at end of each day.
 - .2 Perform cleaning as soon as possible after installation to remove construction and accumulated environmental dirt.
 - .3 Clean aluminum with damp rag and approved non-abrasive cleaner.
 - .4 Remove traces of primer, caulking, epoxy and filler materials; clean doors and frames.
 - .5 Clean glass and glazing materials with approved non-abrasive cleaner.
- 3.4.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

- 3.5 **Protection**
- 3.5.1 Protect installed products and components from damage during construction.
 - 3.5.2 Repair damage to adjacent materials caused by aluminum door and frame installation.

END OF SECTION

1. GENERAL**Summary**

Work of this Section describes required door hardware.

1.1 Related Sections

- 1.1.1 Section 01 33 00 – Submittal Procedures.
- 1.1.2 Section 01 61 00 – Common Product Requirements.
- 1.1.3 Section 01 74 11 – Cleaning.
- 1.1.4 Section 01 78 00 – Closeout Submittals.
- 1.1.5 Section 08 11 00 – Metal Doors and Frames.
- 1.1.6 Section 08 11 16 – Aluminum Doors and Frames.

1.2 References

- 1.2.1 American National Standards Institute (ANSI)/Builders Hardware Manufacturers Association (BHMA):
 - .1 ANSI/BHMA A156.1-2000, American National Standard for Butts and Hinges.
 - .2 ANSI/BHMA A156.2-2003, Bored and Preassembled Locks and Latches.
 - .3 ANSI/BHMA A156.3-2001, Exit Devices.
 - .4 ANSI/BHMA A156.4-2000, Door Controls – Closers.
 - .5 ANSI/BHMA A156.5-2001, Auxiliary Locks and Associated Products.
 - .6 ANSI/BHMA A156.6-2005, Architectural Door Trim.
 - .7 ANSI/BHMA A156.8-2005, Door Controls – Overhead Stops and Holders.
 - .8 ANSI/BHMA A156.10-1999, Power Operated Pedestrian Doors.
 - .9 ANSI/BHMA A156.12-2005, Interconnected Locks and Latches.
 - .10 ANSI/BHMA A156.13-2002, Mortise Locks and Latches Series 1000.
 - .11 ANSI/BHMA A156.15-2006, Release Devices – Closer Holder, Electromagnetic and Electromechanical.
 - .12 ANSI/BHMA A156.16-2002, Auxiliary Hardware.
 - .13 ANSI/BHMA A156.17-2004, Self-closing Hinges and Pivots.
 - .14 ANSI/BHMA A156.18-2006, Materials and Finishes.
 - .15 ANSI/BHMA A156.19-2002, Power Assist and Low Energy Power – Operated Doors.
- 1.2.2 Canadian Steel Door and Frame Manufacturers' Association (CSDMA):
 - .1 CSDMA Recommended Dimensional Standards for Commercial Steel Doors and Frames – 2009.

1.3 Action and Informational Submittals

- 1.3.1 Submit in accordance with Section 01 33 00 – Submittal Procedures.
- 1.3.2 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.
- 1.3.3 Hardware List:
 - .1 Submit contract hardware list.
 - .2 Indicate specified hardware, including make, model, material, function, size, finish and other pertinent information.

1.4 Closeout Submittals

- 1.4.1 Submit in accordance with Section 01 78 00 – Closeout Submittals.
- 1.4.2 Operation and Maintenance Data: Submit operation and maintenance data for door hardware for incorporation into manual.

1.5 Maintenance Materials Submittals

- 1.5.1 Extra Stock Materials: Supply maintenance materials in accordance with Section 01 78

00 – Closeout Submittals.

1.5.2 Tools: Supply two (2) sets of wrenches for door closers, locksets and fire exit hardware.

1.6 **Quality Assurance**

1.6.1 Regulatory Requirements:

.1 Hardware for doors in fire separations and exit doors certified by a Canadian Certification Organization accredited by Standards Council of Canada.

1.7 **Delivery, Storage and Handling**

1.7.1 Deliver, store and handle materials in accordance with Section 01 61 00 – Common Product Requirements and with manufacturer’s written instructions.

1.7.2 Delivery and Acceptance Requirements: Deliver materials to site in original factory packaging, leveled with manufacturer’s name and address.

1.7.3 Package items of hardware including fastenings, separately or in like groups of hardware, label each package as to item definition and location.

1.7.4 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 Store and protect door hardware from nicks, scratches and blemishes.
- .3 Protect pre-finished surfaces with wrapping.
- .4 Replace defective or damaged materials with new.

2. **PRODUCTS**

2.1 **Hardware Items**

2.1.1 Use one manufacturer’s products only for similar items. Acceptable door hardware manufacturer is Sargent, Dormakaba or equal.

2.1.2 All new locks to be to be compatible w/Medeco X4 cylinders/cores and organised on a master keys system w/sub-master.

2.1.3 Elevator doors to be under master system w/submaster

2.1.4 Low voltage security cables from security panel.

2.1.5 All door gaskets provided to be fire rated.

2.1.6 Provide mortise lock for elevator doors (by lift manufacturer). All elevator doors entrance assembly by lift manufacturer.

2.1.7 Cylinder/core and housing by GC, keying by CofM vendor of record.

2.2 **Door Hardware**

2.2.1 Refer to Door Schedule on Architectural Drawing A700.

2.2.2 Cylinder Lock - Schlage ND Series or equal

2.2.3 D-Handle - Ives 8145 12” or equal

2.2.4 Push Paddle Adam Rite 4590 or equal

2.2.5 Door closer - LCN 4040XP or equal

2.2.6 Door hinges - Ives 5BB1 HW 127 X 114 or equal

2.2.7 Provide CX-12 Plus Door Interface for Relay.

2.2.8 Electric strike to be compatible with HES 1500 Series or equal.

2.2.9 Following items to be provided by CofM vendor of record:

a. Access control devices, Card Readers & Request for Exit PIR and wiring from security panel

b. Cx-12 PLUS relay for doors provided with card reader & ADO

2.2.10 Provide door paddle to door 101-1A from the inside.

2.3 Fastenings

- 2.3.1 Use only fasteners provided by manufacturer. Failure to comply may void warranties and applicable licensed labels.
- 2.3.2 Supply screws, bolts, expansion shields and other fastening devices required for satisfactory installation and operation of hardware.
- 2.3.3 Exposed fastening devices to match finish of hardware.
- 2.3.4 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.
- 2.3.5 Use fasteners compatible with material through which they pass.

2.4 Keying

- 2.4.1 Supply keys in triplicate for every lock in this Contract.
- 2.4.2 Stamp keying code numbers on keys and cylinders.
- 2.4.3 Keying to be integrated with existing master system for building.

3. EXECUTION**3.1 Installation**

- 3.1.1 Manufacturer's Instructions: Comply with manufacturer's written recommendations, including product technical bulletins, product catalogue installation instructions, product carton installation instructions and data sheets.
- 3.1.2 Supply door and frame manufacturers with complete instructions and templates for preparation of their work to receive hardware.
- 3.1.3 Supply manufacturers' instructions for proper installation of each hardware component.
- 3.1.4 Install hardware to standard hardware location dimensions in accordance with CSDFMA Canadian Metric Guide for Steel Doors and Frames (Modular Construction).
- 3.1.5 Install key control cabinet.
- 3.1.6 Use only manufacturer's supplied fasteners: Use of "quick" type fasteners, unless specifically supplied by manufacturer, is unacceptable.
- 3.1.7 Remove construction cores and locks when directed by the Consultant: Install permanent cores and ensure locks operate correctly.
- 3.1.8 Where door stop contacts door pulls, mount stop to strike bottom of pull.

3.2 Adjusting

- 3.2.1 Adjust door hardware, operators, closures and controls for optimum, smooth operating condition, safety and for weather tight closure.
- 3.2.2 Lubricate hardware, operating equipment and other moving parts.
- 3.2.3 Adjust door hardware to ensure tight fit at contact points with frames.

3.3 Cleaning

Progress Cleaning: Clean in accordance with Section 01 74 11 – Cleaning:

- 3.3.1 Leave work area clean at end of each day.
- 3.3.2 Clean hardware with damp rag and approved non-abrasive cleaner and polish hardware in accordance with manufacturer's instructions.
- 3.3.3 Remove protective material from hardware items where present.
- 3.3.4 Final Cleaning: Upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 – Cleaning.

3.4 Demonstration

- 3.4.1 Keying System Setup and Cabinet:
 - .1 Set up key control system with file key tags, duplicate key tags, numerical index, alphabetical index and key change index, label shields, control book and key receipt cards.
 - .2 Place file keys and duplicate keys in key cabinet on their respective hooks.

- .3 Lock key cabinet and turn over key to the Client.
- 3.4.2 Maintenance Staff Briefing:
 - Brief maintenance staff regarding:
 - .1 Proper care, cleaning and general maintenance of projects complete hardware.
 - .2 Description, use, handling and storage of keys.
 - .3 Use, application and storage of wrenches for door closers, locksets and fire exit hardware.
- 3.4.3 Demonstrate operation, operating components, adjustment features and lubrication requirements.

- 3.5 **Protection**
 - 3.5.1 Protect installed products and components from damage during construction.
 - 3.5.2 Repair damage to adjacent materials caused by door hardware installation.

- 3.6 **Schedule**
 - 3.6.1 Refer to Door Schedule in Architectural Drawing A700.

END OF SECTION

1. GENERAL**Summary**

Work of this Section consists of glazing for skylight, glazed partition & glass doors at entrance and glass vision panel in metal doors.

1.1 Related Sections

- 1.1.1 Section 01 33 00 – Submittal Procedures
- 1.1.2 Section 07 92 00 – Joint Sealants.
- 1.1.4 Section 08 11 16 – Aluminum Doors and Frames.
- 1.1.5 Section 08 87 53 – Decorative Film.

1.2 References

- 1.2.1 ASTM International:
 - .1 ASTM C 542-05, Standard Specification for Lock-Strip Gaskets.
 - .2 ASTM D 790-07e1, Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.
 - .3 ASTM D 1003-07e1, Standard Test Method for Haze and Luminous Transmittance of Plastics.
 - .4 ASTM D 1929-96 (R2001) e1, Standard Test Method for Determining Ignition Temperature of Plastics.
 - .5 ASTM D 2240-05, Standard Test Method for Rubber Property – Durometer Hardness.
 - .6 ASTM E 84-10, Standard Test Method for Surface Burning Characteristics of Building Materials.
 - .7 ASTM E 330-02, Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.
 - .8 ASTM F 1233-08, Standard Test Method for Security Glazing Materials and Systems.
- 1.2.2 Canadian General Standards Board (CGSB):
 - .1 CAN/CGSB-12.1-M90, Tempered or Laminated Safety Glass.
 - .2 CAN/CGSB-12.2-M91, Flat, Clear Sheet Glass.
 - .3 CAN/CGSB-12.3-M91, Flat, Clear Float Glass.
 - .4 CAN/CGSB-12.4-M91, Heat Absorbing Glass.
 - .5 CAN/CGSB-12.6-M91, Transparent (One-Way) Mirrors.
 - .6 CAN/CGSB-12.8-97, Insulating Glass Units.
 - .7 CAN/CGSB-12.8-97 (Amendment), Insulating Glass Units.
 - .8 CAN/CGSB-12.9-M91, Spandrel Glass.
 - .9 CAN/CGSB-12.10-M76, Glass, Light and Heat Reflecting.
 - .10 CAN/CGSB-12.11-M90, Wired Safety Glass.
 - .11 CAN/CGSB-12.12-M90, Plastic Safety Glazing Sheets.
 - .12 CAN/CGSB-12.13-M91, Patterned Glass.
- 1.2.3 Glass Association of North American (GANA):
 - .1 GANA Glazing Manual – 2008.
 - .2 GANA Laminated Glazing Reference Manual – 2009.

1.3 Action and Informational Submittals

- 1.3.1 Submit in accordance with Section 01 33 00 – Submittal Procedures.
- 1.3.2 Product Data: Submit manufacturer’s instructions, printed product literature and data sheets for glass, sealant, and glazing accessories and include product characteristics, performance criteria, physical size, finish and limitations.
- 1.3.3 Samples:

- .1 Submit for review and acceptance of each unit.
- .2 Samples will be returned for inclusion into the Work.
- .3 Submit samples of insulated glazed units, complete with spacer and sealant material.
- 1.3.4 Certificates: Submit product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.
- 1.3.5 Test Reports: Certified test reports showing compliance with specified performance characteristics and physical properties.

1.4 **Quality Assurance**

- 1.4.1 Certificates: Product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

1.5 **Delivery, Storage and Handling**

- 1.5.1 Deliver, store and handle materials in accordance with Section 01 61 00 – Common Product Requirements and with manufacturer’s written instructions.
- 1.5.2 Delivery and Acceptance Requirements: Deliver materials to site in original factory packaging, leveled with manufacturer’s name and address.
- 1.5.3 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 Store and protect glazing and frames from nicks, scratches and blemishes.
 - .3 Protect prefinished aluminum surfaces with temporary wrapping and strippable coating.
 - .4 Replace defective or damaged materials with new.

1.6 **Ambient Conditions**

Ambient Requirements:

- 1.6.1 Install glazing when ambient temperature is 10°C minimum. Maintain ventilated environment for 24 hours after application.
- 1.6.2 Maintain minimum ambient temperature before, during and 24 hours after installation of glazing compounds.

2. **PRODUCTS**

2.1 **Materials**

- 2.1.1 Design Criteria:
 - .1 Ensure continuity of thermal enclosure using glass and glazing materials Seal units tight to adjacent surfaces.
 - .2 Size glass to withstand positive and negative live loads to ASTM E330.
 - .3 Limit glass deflection to 1/200 with full recovery of glazing materials.
- 2.1.2 Type 1- Laminated or Tempered Safety Flat Glass:

Glass panels for Glazed Wall Systems: Vestibule glass to CAN/CGSB-12.1-M, transparent single pane 10mm thick for doors.

 - .1 laminated & tempered.
 - .2 Class A-float.
 - .3 Category II.
- 2.1.2 Type 2 - Wired Glass:

Glass panels in door panel for fire rated assemblies: glass to CAN/CGSB-12.11-M, transparent single pane 12mm thick for doors.

 - .1 laminated & tempered.
 - .2 Class A-float.
 - .3 Category II.
- 2.1.3 Type 3 – Skylight Vision Glass:

Glass panels in Skylight: Glass to CAN/CGSB-12.1, transparent single pane 10

mm thick for doors.

- .1 laminated & tempered.
- .2 Class A-float.
- .3 Category II.

2.1.4 Sealant: silicon sealant in accordance with Section 07 92 00 – Joint Sealants.

2.1.5 Provide safety film on Glazed Wall Systems.

2.2 Accessories

2.2.1 Setting blocks: EPDM, 80-90 Shore A durometer hardness to ASTM D 2240, to suit glazing method, glass light weight and area.

2.2.2 Spacer shims: neoprene, 50-60 Shore A durometer hardness to ASTM D 2240, 75mm long x one half height of glazing stop x thickness to suit application. Self adhesive on one face.

2.2.3 Glazing tape:

- .1 Preformed butyl compound with integral resilient tube spacing device, 10-15 Shore A durometer hardness to ASTM D 2240; 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 two per cent, designed for compression of 25 per cent, to effect an air and vapour seal.

2.2.4 Glazing splines: Resilient polyvinyl chloride, extruded shape to suit glazing channel retaining slot, black colour.

2.2.5 Lock-strip gaskets: to ASTM C 542.

3. EXECUTION

3.1 Examination

3.1.1 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 Inform the Consultant of unacceptable conditions immediately upon discovery.
- .4 Proceed with installation only after unacceptable conditions have been remedied.

3.2 Preparation

3.2.1 Clean contact surfaces with solvent and wipe dry.

3.2.2 Seal porous glazing channels or recesses with substrate compatible primer or sealer.

3.2.3 Prime surfaces scheduled to receive sealant.

3.3 Installation: Wet/Dry Method (Preformed Tape and Sealant)

3.3.1 Perform the Work in accordance with GANA Glazing Manual and GANA Laminated Glazing Reference Manual for glazing installation methods.

3.3.2 Cut glazing tape to length and set against permanent stops, below sight line. Seal corners by butting tape and dabbing with sealant.

3.3.3 Apply heel bead of sealant along intersection of permanent stop with frame ensuring full perimeter seal between glass and frame to complete continuity of air and vapour seal.

3.3.4 Place setting blocks at 1/3 points, with edge block maximum 150mm from corners.

3.3.5 Rest glazing on setting blocks and push against tape and heel head of sealant with sufficient pressure to attain full contact at perimeter of light or glass unit.

3.3.6 Install removable stops with spacer strips inserted between glazing and applied stops below sight line. Place glazing tape on glazing light or unit with tape flush with sight line.

3.3.7 Fill gap between glazing and stop with sealant to depth equal to bite of frame on glazing below sight line.

- 3.3.8 Apply cap head of sealant along void between stop and glazing, to uniform line, flush with sight line. Tool or wipe sealant surface smooth.

3.4 **Installation: Wet Method (Sealant and Sealant)**

- 3.4.1 Perform the Work in accordance with GANA Glazing Manual and GANA Laminated Glazing Reference Manual for glazing installation methods.
- 3.4.2 Place setting blocks at 1/3 points and install glazing light or unit.
- 3.4.3 Install removable stops with glazing centred in space by inserting spacer shims both sides at 600mm intervals, below sight line.
- 3.4.4 Fill gaps between glazing and stops with sealant to depth of bite on glazing, below sight line to ensure full contact with glazing and continue air and vapour seal.
- 3.4.5 Apply sealant to uniform line, flush with sight line. Tool or wipe sealant surface smooth.

3.5 **Cleaning**

Progress Cleaning: Clean in accordance with Section 01 74 11 – Cleaning.

- 3.5.1 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 using approved non-abrasive cleaner in accordance with manufacturer's instructions.
- 3.5.2 Final Cleaning: Upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 – Cleaning.

3.6 **Protection**

- 3.6.1 Protect installed products and components from damage during construction.
- 3.6.2 After installation, mark each light with an "X" by using removable plastic tape or paste. Do not mark heat absorbing or reflective glass units.
- 3.6.3 Repair damage to adjacent materials caused by glazing installation.

END OF SECTION

1. GENERAL**Summary**

Work of this section includes opaque (colour) safety exterior/interior window film to be applied on indicated glazed wall systems in Vestibule as indicated in the drawings.

1.1 References

1.1.1 Section 08 11 16 – Aluminum Doors and Frames.

1.1.2 Section 08 80 50 – Glazing.

1.3 Submittals

1.3.1 Manufacturer's Product Data for specified products in accordance with Section 01 33 00 Submittal Procedure.

1.3.2 Submit shop drawings showing layout, profiles, and product components, including dimensions, anchorage, and accessories.

1.3.3 Samples: 4 inch by 4 inch Samples of specified texture, color and/or pattern for verification.

1.4 Quality Assurance

1.4.1 Obtain all products in this section from a single Manufacturer with a minimum of 10 years experience.

1.4.2 Installer: Installation shall be performed by a trained and qualified installer, specialized and experienced in work required for this project.

.1 A list of experienced installation integrators is available from 3M Architectural Markets Department, 1-651-733-9853 or mhasenauer@mmm.com

1.5 Product Delivery, Storage, And Handling

1.5.1 Deliver products in manufacturer's original, unopened, undamaged containers with identification labels intact.

1.5.2 Store products protected from weather, temperature, and other harmful conditions as recommended by supplier.

1.5.3 Product must remain in original plastic bag and boxes and have storage conditions as follows:

.1 40°F (4°C) - 90°F (32°C) storage temperature range

.2 Out of Sunlight

.3 Clean dry area

.4 Original container

.5 Do not stack boxes over six (6) units high. Excessive weight can damage the film

.6 Products are not recommended for interior applications where condensation consistently occurs.

.7 Handle products in accordance with manufacturer's instructions.

.8 Total pre-installation shelf life: 2 years. Up to 2 years unprocessed, OR process within 1 year *and* apply within 1 year of processing

1.6 Project/Site Conditions

1.6.1 Confirm appropriate substrate is suitable for mounting of glass finish components prior to start of installation.

1.6.2 Apply materials when environmental conditions are within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits. Apply the film in a temperature range from 53°F to 100°F (12°C to 38°C).

2. PRODUCTS**2.1 Material**

FM 2 – Glazing Film
Manufacturer: Decorative Films
Series: Luna 6 , SH2PCL6
Colour: White with Transparent dots
Size: Refer to Door Elevations.

3. EXECUTION**3.1 Examination**

- 3.1.1 Examine substrate(s) for compliance. Do not proceed with installation until unsatisfactory conditions have been corrected.
- 3.1.2 Do not proceed with installation until unsatisfactory conditions have been corrected.
- 3.1.3 Responsibility for state of surfaces prior to installation to be pre-determined by installation specialist.
- 3.1.4 Proceeding with installation implies installer's acceptance of substrate and conditions.

3.2 Surface Preparation

- 3.2.1.1 Comply with all manufacturer's instructions for surface preparation.
- 3.2.1.2 Thoroughly clean substrate of substances that could impair the overlay's bond, including mold, mildew, oil, grease.
- 3.2.1.3 Re-clean surfaces with appropriate surface prep solvent and remove any haze or surface contamination.

3.3 Application

- 3.3.1.1 Application must be performed by qualified installer.
- 3.3.1.2 Do not proceed with installation until all finishing work has been completed in and around the work area.
- 3.3.1.3 Verify pattern prior to material acquisition.
- 3.3.1.4 Comply with manufacturer's installation instructions applicable to products and applications indicated, except where more stringent requirements apply.
- 3.3.1.5 Install substrates with no gaps or overlaps. Form smooth, wrinkle-free, bubble-free surface for finished installation.
- 3.3.1.6 Remove air bubbles, wrinkles, blisters and other defects. Use approved procedures to prevent the formation of air bubbles, wrinkles, blisters and other defects.

3.4 Cleaning And Protection

- 3.4.1 Use cleaning methods recommended by architectural surfacing manufacturer for applicable environment.
- 3.4.2 Protect completed glass finish during remainder of construction period.

END OF SECTION

1. GENERAL**Summary**

Work of this Section consists of drywall board installation of partition walls at corridor extension.

1.1 Related Section

- 1.1.1 Section 01 33 00 – Submittal Procedures
- 1.1.2 Section 01 74 11 – Cleaning
- 1.1.4 Section 07 92 00 – Joint Sealants
- 1.1.5 Section 09 91 99 – Painting for Minor Works

1.2 References

- 1.2.1 Aluminum Association (AA):
 - .1 AA DAF 45-03 (R2009), Designation System for Aluminum Finishes.
- 1.2.2 ASTM International:
 - .1 ASTM C 475-02 (2007), Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board.
 - .2 ASTM C 514-04 (2009e1), Standard Specification for Nails for the Application of Gypsum Board.
 - .3 ASTM C 557-03 (2009)e1, Standard Specification for Adhesives for Fastening Gypsum Wallboard to Wood Framing.
 - .4 ASTM C 840-08, Standard Specification for Application and Finishing of Gypsum Board.
 - .5 ASTM C 954-07, Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs From 0.033 in. (0.84mm) to 0.112 in. (2.84mm) in Thickness.
 - .6 ASTM C 1002-07, 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.
 - .7 ASTM C 1047-09, Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base.
 - .8 ASTM C 1280-99, Standard Specification for Application of Gypsum Sheathing.
 - .9 ASTM C 1177/C 1177M-08, Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing.
 - .10 ASTM C 1178/C 1178M-08, Standard Specification for Glass Mat Water-Resistant Gypsum Backing Board.
 - .11 ASTM C 1396/C 1396M-09a, Standard Specification for Gypsum Wallboard.
- 1.2.3 Association of the Wall and Ceilings Industries International (AWCI):
 - .1 AWCI Levels of Gypsum Board Finish-97.
- 1.2.4 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.
- 1.2.5 Underwriters' Laboratories of Canada (ULC):
 - .1 CAN/ULC-S102-07, Standard Method of Test of Surface Burning Characteristics of Building Materials and Assemblies.

1.3 Action and Informational Submittals

- 1.3.1 Submit in accordance with Section 01 33 00 – Submittal Procedures.

1.4 Delivery, Storage and Handling

- 1.4.1 Deliver, store and handle materials in accordance with Section 01 61 00 – Common Product Requirements and with manufacturer's written instructions.

- 1.4.2 Delivery and Acceptance Requirements: Deliver materials to site in original factory packaging, leveled with manufacturer's name and address.
- 1.4.3 Storage and Handling Requirements:
 - .1 Store gypsum board assemblies materials level off ground in dry location and 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.
- 1.4.4 Handle gypsum boards to prevent damage to edges, ends or surfaces.
- 1.4.5 Replace defective or damaged materials with new.

1.5 **Ambient Conditions**

- 1.5.1 Maintain temperature 10°C minimum, 21°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.
- 1.5.2 Apply board and joint treatment to dry, frost free surfaces.
- 1.5.3 Ventilation: ventilate building spaces as required to remove excess moisture that would prevent drying of joint treatment material immediately after its application.

2. **PRODUCTS**

2.1 **Materials**

- 2.1.1 Standard board: to ASTM C 1396/C 1396M regular, 13mm (1/2") thick unless otherwise specified on the Contract Drawings, 1200mm wide x maximum practical length, ends square cut, edges beveled.
- 2.1.2 Metal furring runners, hangers, tie wires, inserts, anchors.
- 2.1.4 Drywall furring channels: 0.5mm core thickness galvanized steel channels for screw attachment of gypsum board.
- 2.1.5 Resilient furring: 0.5mm base steel thickness galvanized steel for resilient attachment of gypsum board.
- 2.1.6 Steel drill screws: to ASTM C 1002.
- 2.1.7 Stud adhesive: to CAN/CGSB-71.25.
- 2.1.8 Casing beads, corner beads, control joints and edge trim: to ASTM C 1047, metal, 0.5mm base thickness, perforated flanges, one piece length per location.
- 2.1.9 Joint compound: to ASTM C 475, asbestos-free.
- 2.1.10 Drywall Reveal Trim: "D300" by Bailey

2.2 **Accessories and Finishes**

- 2.2.1 For shimming: use drywall instead plywood, where possible.
- 2.2.2 Finish: Apply three-coat paint system (one primer, two finish) asbestos-free standard white texture coating and primer-sealer, recommended by gypsum board manufacturer.

3. **EXECUTION**

3.1 **Examination**

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.

- 3.1.1 Inform the Consultant of unacceptable conditions immediately upon discovery.
- 3.1.2 Proceed with installation only after unacceptable conditions have been remedied.

3.2 **Erection**

- 3.2.1 Do application and finishing of gypsum board to ASTM C 840 except where specified otherwise.
- 3.2.2 Do application of gypsum sheathing to ASTM C 1280.
- 3.2.3 Install work level to tolerance of 1:1200.

- 3.2.6 Install 19mm x 91mm furring channels parallel to and at exact locations of steel stud partition header track.
- 3.2.8 Install wall furring for gypsum board wall finishes to ASTM C 840, except where specified otherwise.

3.3 **Application**

- 3.3.1 Apply gypsum board after bucks, anchors, blocking work have been installed.
- 3.3.2 Apply single or double layer gypsum board to metal furring and framing using screw fasteners. Maximum spacing of screws 300mm on centre:
 - .1 Single-Layer Application:
 - .1 Apply gypsum board on ceilings prior to application of walls to ASTM C 840.
 - .2 Apply gypsum board vertically or horizontally, providing sheet lengths that will minimize end joints.
 - .2 Double-Layer Application:
 - .1 Install gypsum board for base layer and exposed gypsum board for face layer.
 - .2 Offset joints between layers at least 250mm.
 - .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 250mm with base layer joints.
- 3.3.3 Install ceiling boards in direction that will minimize number of end-butt joints. Stagger end joints at least 250mm.
- 3.3.4 Install gypsum board on walls vertically to avoid end-butt joints.
- 3.3.5 Install gypsum board with face side out.
- 3.3.6 Do not install damaged or damp boards.
- 3.3.7 Locate edge or end joints over supports. Stagger vertical joints over different studs on opposite sides of wall.

3.4 **Installation**

- 3.4.1 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 150mm on centre.
- 3.4.3 Install casing beads where gypsum board butts against surfaces having no trim concealing junction and where indicated. Seal joints with sealant.
- 3.4.2 Install insulating strips continuously at edges of gypsum board and casing beads abutting door frames, to provide tight seal.
- 3.4.3 Construct control joints of preformed units set in gypsum board facing and supported independently on both sides of joint.
- 3.4.4 Provide continuous polyethylene dust barrier behind and across control joints.
- 3.4.5 Install control joints straight and true.
- 3.4.7 Splice corners and intersections together and secure to each member with three screws.
- 3.4.8 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 3: embed tape for joints and interior angles in joint compound and apply two separate coats of joint compound over joints, angles, fastener heads and accessories; surfaces smooth and free of tool marks and ridges.
- 3.4.9 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.
- 3.4.10 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.

- 3.4.11 Sand lightly to remove burred edges and other imperfections. Avoid sanding adjacent surface of board.
- 3.4.12 Completed installation to be smooth, level or plumb, free from waves and other defects and ready for surface finish.
- 3.4.13 Apply one coat of white primer sealer over surface to be textured. When dry apply textured finish in accordance with manufacturer's instructions.
- 3.4.14 Mix joint compound slightly thinner than for joint taping.
- 3.4.15 Apply thin coat to entire surface using trowel or drywall broad knife to fill surface texture differences, variations or tool marks.
- 3.4.16 Allow skim coat to dry completely.
- 3.4.17 Remove ridges by light sanding or wiping with damp cloth.

3.5 **Cleaning**

Progress Cleaning: Clean in accordance with Section 01 74 11 – Cleaning.

- 3.5.1 Leave work area clean at end of each day.
- 3.5.2 Final Cleaning: Upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 – Cleaning.

3.6 **Protection**

- 3.6.1 Protect installed products and components from damage during construction.
- 3.6.2 Repair damage to adjacent materials caused by gypsum board assembly's installation.

END OF SECTION

1. GENERAL**Summary**

Work of this section consists of new metal stud partitions and framing to be installed to suite new design.

1.1 Related Sections

1.1.1 Section 06 08 99 - Rough Carpentry for Minor Works

1.1.2 Section 09 21 16 - Gypsum Board Assemblies.

1.2 References

1.1.1 American Society for Testing and Materials International, (ASTM):

.1 ASTM C 645-00, Specification for Nonstructural Steel Framing Members.

.2 ASTM C 754-00, Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products.

1.1.2 Canadian General Standards Board (CGSB): CAN/CGSB-1.40-97, Primer, Structural Steel, Oil Alkyd Type.

1.3 Quality Assurance

1.3.1 Test Reports: Certified test reports showing compliance with specified performance characteristics and physical properties.

1.3.2 Certificates: Product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

1.4 Waste Management and Disposal

1.4.1 Divert unused metal materials from landfill to metal recycling facility approved by the Agency and authorities having jurisdiction.

1.4.2 Divert unused gypsum materials from landfill to recycling facility approved by the Agency and authorities having jurisdiction.

2. PRODUCTS**2.1 Materials**

2.1.1 Stud sizes should be confirmed with manufacturer for intended use.

2.1.2 Studs sizes:

.1 362S125-PLAT25 by Bailey

Non-load bearing channel stud framing: to ASTM C 645, 92mm stud size, roll formed from 0.18mil (25ga) thickness hot dipped galvanized steel sheet, for screw attachment of gypsum board. Knock-out service holes at 406mm centres.

2.1.3 Floor and gypsum ceiling tracks: to ASTM C 645, in widths to suit stud sizes, 32mm flange height.

2.1.4 Metal channel stiffener: widths to suit stud sizes, 1.4mm thick cold rolled steel, coated with rust inhibitive coating.

2.1.5 Insulating strip: provide foam gasket with self sticking adhesive to underside of bottom track.

3. EXECUTION**3.1 Erection**

3.1.1 Align partition tracks at floor and ceiling and secure at 600mm on centre maximum.

3.1.2 Install damp proof course under stud shoe tracks of partitions on slabs on grade.

3.1.3 Place studs vertically at 400mm on centre and not more than 25mm 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.

3.1.4 Erect metal studding to tolerance of 1:1000.

3.1.5 Attach studs to track using screws.

3.1.6 Co-ordinate simultaneous erection of studs with installation of service lines. When

- erecting studs ensure web openings are aligned.
- 3.1.7 Co-ordinate erection of studs with installation of door/window frames and special supports or anchorage for work specified in other Sections.
- 3.1.8 Provide two studs extending from floor to gypsum ceiling at each side of openings wider than stud centres specified. Secure studs together, 50mm apart using column clips or other approved means of fastening placed alongside frame anchor clips.
- 3.1.9 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 and below openings in same manner and spacing as wall studs.
- 3.1.10 Install steel studs or furring channel between studs for attaching electrical and other boxes.
- 3.1.13 Extend partitions to underside of gypsum board ceiling except where noted otherwise.
- 3.2 **Cleaning**
- 3.2.1 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

END OF SECTION

1 **GENERAL****1.1** **Related Documents**

1.1.1. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 **Summary**

1.2.1 Section Includes:

1. Resilient Tile (Vinyl Composition Tile) Flooring for Corridor ramp and floor.

1.2.2 Related Sections:

XXX

1.3 **Submittals**

1.3.1 Product Data: For each type of product indicated.

1.3.2 Submittals:

1. For adhesives, include printed statement of low VOC content and chemical components.

1.3.3 Samples for Initial Selection: For each type of product indicated.

1.3.4 Samples for Verification: For each type of product indicated, in manufacturer's standard-size samples of each resilient product color, texture, and pattern required.

1.3.5 Product Schedule: For resilient products. Use same designations indicated on Drawings.

1.4 **Quality Assurance**

1.4.1 Mockups: Provide resilient products with mockups specified in other Sections.

1.5 **Delivery, Storage, And Handling**

1.5.1 Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by Johnsonite, but not less than 55 deg F (13 deg C) or more than 85 deg F (29 deg C).

1.6 **Project Conditions**

1.6.1 Install resilient products after other finishing operations, including painting, have been completed.

- 1.6.2 Maintain ambient temperatures within range recommended by Johnsonite, but not less than 65 deg F (18 deg C) or more than 85 deg F (29 deg C) in spaces to receive resilient products during the following time periods:
1. 48hours before installation
 2. During installation
 3. 48 hours after installationMaintain the ambient relative humidity between 40% and 60% during installation.
 4. Until Substantial Completion, maintain ambient temperatures within range recommended by Johnsonite, but not less than 55 deg F (13 deg C) or more than 85 deg F (29 deg C).

2 PRODUCTS

2.1 Resilient Tile Flooring

- A. Manufacturer: Tarkett, VCT II.

- 2.1.1 Resilient Vinyl Composition Tile Flooring – VT 1_329 Pebble or comparable product.
1. 4” high rubber base

1.4 Installation Materials

- 1.4.1 Trowelable Leveling and Patching Compounds: Latex-modified, Portland cement based or blended hydraulic-cement-based formulation.

- 1.4.2 Edge and Transition Strips: Apply where carpet hits Tile.
- 1.Metal: Hammered surface aluminum.
 - 2.Floor flange minimum 38 mm wide, face minimum 16 mm wide.
 - 3.Finish: clear anodic coating.
 - 4.Preferred Manufacturer: Schluter systems or approved equal.

- 1.4.3 Adhesives: As recommended by Tarkett to meet site conditions.
1. Vinyl Composition Tile:
 2. Refer to manufacturer detail.

3 EXECUTION

3.1 Examination

- 3.1.1 Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the work.

- 3.1.1 Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.

- 3.1.2 Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 Preparation

3.2.1 Prepare substrates according to Johnsonite written instructions to ensure adhesion of Resilient Tile Flooring.

1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
2. Remove substrate paint, coatings and other substances that are incompatible with adhesives or contain soap, wax, oil, solvents, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
3. Mechanically remove contamination on the substrate that may cause damage to the resilient flooring material. Permanent and non-permanent markers, pens, crayons, paint, etc., must not be used to write on the back of the flooring material or used to mark the substrate as they could bleed through and stain the flooring material.
4. Prepare Substrates according to ASTM F 710 including the following:
 - i. Moisture Testing: Perform tests recommended by manufacturer. Proceed with installation only after substrates pass testing.
 - a. Perform anhydrous calcium chloride test, ASTM F 1869. Results must not exceed 5 lbs. Moisture Vapor Emission Rate per 1,000 sq. ft. in 24 hours.

Special Note: If MVER is greater than 5 lbs. but less than 8 lbs. see requirements for Tarkett SpraySmart Adhesive.

– or –

- b. Perform relative humidity test using in situ probes, ASTM F 2170. Results must not exceed 80%.

Special Note: If MVER is greater than 80% but less than 90% see requirements for Tarkett SpraySmart Adhesive.

- ii. A pH test for alkalinity must be conducted. Results should range between 7 and 9. If the test results are not within the acceptable range of 7 to 9, the installation must not proceed until the problem has been corrected.

Special Note: If pH reading exceeds 9 but less than 11 see requirements for Tarkett SpraySmart Adhesive.

- iii. Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer.

5. Wood subfloors must have a minimum 18" (45.7 cm) of cross-ventilated space beneath the bottom of the joist.
 - i. The floor must be rigid, free of movement.
 - ii. Single wood and tongue and groove subfloors should be covered with ¼" (6.4 mm) or ½" (12.7 mm) APA approved underlayment plywood.
 - a) Use ¼" (6.4 mm) thick underlayment panels for boards with a face width of 3" (76 mm) or less.
 - b) Use ½" (12.7 mm) thick underlayment panels for boards with a face width wider than 3" (76 mm).
 - iv. Do not install over OSB (Oriented Strand Board), particle board, chipboard, lauan or composite type underlayments.

3.2.2 Fill cracks, holes, depressions and irregularities in the substrate with good quality Portland cement based underlayment leveling and patching compound and remove bumps and ridges to produce a uniform and smooth substrate.

3.2.3 Floor covering shall not be installed over expansion joints.

3.2.4 Do not install resilient products until they are same temperature as the space where they are to be installed.

1. Move resilient products and installation materials into spaces where they will be installed at least 48 hours in advance of installation.

3.2.5 Sweep and vacuum clean substrates to be covered by resilient products immediately before installation.

3.3 Resilient Tile Flooring Installation

3.3.1 Comply with manufacturer's written instructions for installing resilient tile flooring.

3.3.2 Vinyl Composition Tile Flooring:

1. Install with Johnsonite/Tarkett adhesive specified for the site conditions and follow adhesive label for proper use.
2. Follow Johnsonite's recommendation for Quarter Turn tiles.
3. Open enough cartons of floor tiles to cover each area, and mix tile to ensure shade variations do not occur within any one area.
4. Roll the flooring in both directions using a 100 pound three-section roller.

3.4 Cleaning And Protection

3.4.1 Comply with manufacturer's written instructions for cleaning and protection of resilient products.

3.4.2 Perform the following operations immediately after completing resilient product installation:

1. Remove adhesive and other blemishes from exposed surfaces.
2. Sweep and vacuum surfaces thoroughly.
3. Damp-mop surfaces to remove marks and soil.

3.4.3 Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

3.4.4 No traffic for 24 hours after installation.

Special Note: When Tarkett SpraySmart Adhesive is used traffic may be allowed immediately after installation

3.4.5 No heavy traffic, rolling loads, or furniture placement for 72 hours after installation.

Special Note: When Tarkett SpraySmart Adhesive is used traffic may be allowed immediately after installation

3.4.6 Wait 72 hours after installation before performing initial cleaning.

END OF SECTION

1. GENERAL**Summary**

Work of this section includes painting of drywall and concrete block walls & ceilings, plaster ceiling, metal doors & frames. Apply three coat system (1 primer, 2 finish). Account for minor paint touch-ups where needed.

1.1 Related Sections

- 1.1.1 Section 01 33 00 – Submittal Procedures
- 1.1.2 Section 01 74 11 – Cleaning
- 1.1.3 Section 04 04 99 - Masonry for Minor Works
- 1.1.4 Section 05 50 00 – Metal Fabrications
- 1.1.5 Section 08 11 00 – Metal Doors and Frames
- 1.1.6 Section 09 22 16 – Gypsum Board Assemblies

1.2 References

- 1.2.2 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).
- 1.2.3 The Master Painters Institute (MPI)
 - .1 Architectural Painting Specification Manual - current edition.
 - .2 Maintenance Repainting Manual - current edition.

1.3 Actions and Informational Submittals

- 1.3.1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- 1.3.2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for paint and coating products and include product characteristics, performance criteria, physical size, finish and limitations.
- 1.3.3 Samples:
 - .1 Submit for review and acceptance.
 - .2 Samples will be returned for inclusion into work.
 - .3 Submit sample panels of each paint, stain, clear coating, and / or special finish with specified paint or coating in colours, gloss/sheen and textures required to MPI Painting Specification Manual standards.
- 1.3.4 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

- 1.4.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
- 1.4.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- 1.4.3 Storage and Handling Requirements:
 - .1 Provide and maintain dry, temperature controlled, secure storage.
 - .2 Store painting materials and supplies away from heat generating devices.
 - .3 Store materials and equipment in well ventilated area within temperature as recommended by manufacturer.
- 1.4.4 Fire Safety Requirements:
 - .1 Supply one 9 kg , Type ABC, dry chemical fire extinguisher adjacent to storage area.
 - .2 Store oily rags, waste products, empty containers and materials subject to spontaneous combustion in ULC approved, sealed containers and remove from site on a daily basis.
 - .3 Handle, store, use and dispose of flammable and combustible materials in accordance with National Fire Code of Canada requirements.

1.5 Site Conditions**1.5.1 Heating, Ventilation and Lighting:**

- .1 Co-ordinate use of existing ventilation system with Consultant and ensure its operation during and after application of paint as required.
- .2 Provide minimum lighting level of 323 Lux on surfaces to be painted.

1.5.2 Temperature, Humidity and Substrate Moisture Content Levels:

- .1 Apply paint finishes when ambient air and substrate temperatures at location of installation can be satisfactorily maintained during application and drying process, within MPI and paint manufacturer's prescribed limits.
- .2 Test plaster surfaces for alkalinity as required.
- .3 Apply paint to adequately prepared surfaces, when moisture content is below paint manufacturer's prescribed limits.

1.5.3 Additional application requirements:

- .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. PRODUCTS**2.1 Materials**

- 2.1.1 Supply paint materials for paint systems from single manufacturer such as Benjamin Moore, Sherwin Williams or PPG.
- 2.1.2 Conform to latest MPI requirements for painting work including preparation and priming.
- 2.1.3 Materials in accordance with MPI - Architectural Painting Specification Manual and MPI - Maintenance Repainting Manual "Approved Product" listing.
 - .1 Use MPI listed materials having E3 rating where indoor air quality requirements exist.
 - .2 Primer: VOC limit 100 g/L maximum to GS-11 SCAQMD Rule 1113.
 - .3 Paint: VOC limit 100 g/L maximum to GS-11 SCAQMD Rule 1113.

2.2 Colors

- 2.2.1 At later selection by the Architect (to match existing).
- 2.2.2 Finish Schedule to be read in conjunction with Architectural Contract Drawings.
- 2.2.3 Three coat system – First apply primer, then two coats of finish color.
- 2.2.4 Submit Colour Schedule and drawdown cards to the Architect for review and approval.

2.3 Application

- 2.3.1 Protect all existing and adjacent surfaces from paint spatters.

2.4 Mixing and Tinting**2.4.1 Mixing and tinting:**

- .1 Perform colour tinting operations prior to delivery of paint to site, in accordance with manufacturer's written recommendations. Obtain written approval from Consultant for tinting of painting materials.
- .2 Use and add thinner in accordance with paint manufacturer's recommendations.
 - .1 Do not use kerosene or similar organic solvents to thin water-based paints.
- .3 Thin paint for spraying in accordance with paint manufacturer's written recommendations.
- .4 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.

2.5 Gloss/Sheen Ratings**2.5.1 Gloss/sheen ratings:**

- .1 Paint gloss is defined as sheen rating of applied paint, in accordance with following values shown in table below.
- .2 Gloss level ratings of painted surfaces as noted on Finish Schedule.

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

2.6 **Interior Painting System:**

- 2.6.1 Structural steel and metal fabrications: columns, beams, joists:
 - .1 INT 5.1A - Quick dry enamel semi-gloss finish.
- 2.6.3 Galvanized metal: doors, frames, railings, misc. steel, pipes, and ducts.
 - .1 INT 5.3N - Institutional low odour/low VOC Semi-Gloss finish.
- 2.6.4 Dressed lumber: including doors, door frames:
 - .1 INT 6.3A - High performance architectural latex Semi-Gloss finish.
 - .2 INT 6.3C - Semi-transparent stain finish.
 - .3 INT 6.3F - Lacquer Traditional Gloss finish (over stain).
- 2.6.5 Plaster and gypsum board: gypsum wallboard, drywall:
 - .1 INT 9.2L - Waterborne light industrial coating.
 - .2 INT 9.2M - Institutional low odour/low VOC ; eggshell or semi-gloss finish , as indicated in finish schedule.

3. **EXECUTION**

3.1 **Manufacturer's Instructions**

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

3.2 **General**

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

3.3 **Examination**

- 3.3.1 Investigate existing substrates for problems related to proper and complete preparation of surfaces to be painted. Report to the Consultant damages, defects, unsatisfactory or unfavourable conditions before proceeding with the Work.
- 3.3.2 Conduct moisture testing of surfaces to be painted using properly calibrated electronic moisture meter, except test concrete floors for moisture using simple "cover patch test". Do not proceed with the Work until conditions fall within acceptable range as recommended by manufacturer.
- 3.3.3 Maximum moisture content as follows:

- .1 Stucco, plaster and gypsum board: 12 per cent.
- .2 Wood: 15 per cent.

3.4 **Preparation**

3.4.1 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 surfaces as directed by the Consultant.
- .2 Protect items that are permanently attached such as Fire Labels on doors and frames.
- .3 Protect factory finished products and equipment.

3.4.2 Surface Preparation:

- .1 Remove electrical cover plates, light fixtures, surface hardware on doors and other surface mounted equipment, fittings and fastenings prior to undertaking painting operations. Identify and store items in secure location and re-installed after painting is completed.
- .2 Move and cover portable equipment as necessary to carry out painting operations. Replace as painting operations progress.
- .3 Place "WET PAINT" signs in occupied areas as painting operations progress. Signs to approval of Consultant.
- .4 Clean and prepare surfaces in accordance with MPI - Architectural Painting Specification Manual and MPI - Maintenance Repainting Manual specific requirements and coating manufacturer's recommendations.
- .5 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.
- .6 Where possible, prime non-exposed surfaces of new wood surfaces before installation. Use same primers as specified for exposed surfaces.
- .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.
- .8 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.
- .9 Touch up of shop primers with primer as specified.

3.5 **Application**

3.5.1 Paint only after prepared surfaces have been accepted by Consultant.

3.5.2 Use method of application approved by Consultant.

- .1 Conform to manufacturer's application recommendations.

3.5.3 Apply coats of paint in continuous film of uniform thickness.

- .1 Repaint thin spots or bare areas before next coat of paint is applied.

3.5.4 Allow surfaces to dry and properly cure after cleaning and between subsequent coats for minimum time period as recommended by manufacturer.

3.5.5 Sand and dust between coats to remove visible defects.

3.5.6 Finish top, bottom, edges and cutouts of doors after fitting as specified for door surfaces.

3.5.7 Mechanical/Electrical Equipment:

- .1 Paint conduits, piping, hangers, ductwork and other mechanical and electrical equipment exposed in finished areas, to match adjacent surfaces, except as indicated.
- .2 Do not paint over nameplates.
- .3 Keep sprinkler heads free of paint.
- .4 Paint inside of ductwork where visible behind grilles, registers and diffusers with primer and one coat of matt black paint.

- .5 Paint disconnect switches for fire alarm system and exit light systems in red enamel.
- .6 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.
- .7 Do not paint interior transformers and substation equipment.

3.6 **Field Quality Control**

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

3.7 **Cleaning**

- 3.7.1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
 - .1 Leave Work area clean at end of each day.
- 3.7.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.
- 3.7.3 Place paint, stains, primer defined as hazardous or toxic waste, including tubes and containers, in containers or areas designated for hazardous waste.

END OF SECTION

1. GENERAL**1.1 Scope of work**

1.1.1 Supply and install the following vertical transportation equipment:

1.1.1.1 A single handicap lift.

1.2 Maintenance: 12 months

1.2.1 Provide maintenance of the equipment in accordance with the City of Mississauga Statement Of Work (SOW) for a period of 12 months after Substantial Performance.

1.3 Codes, by-laws, and regulations

1.3.1 Provide equipment and perform work in accordance with all local, provincial and federal codes, by-laws, and regulations.

1.3.2 Provide equipment and perform work in accordance with the latest edition of the B355 Lifts for Persons with Physical Disabilities Code and any other code which may govern the installation.

1.3.3 At the time of bid submission and during the contract provide written notification of any proposed changes in codes, by-laws, or regulations which may affect the work.

1.4 Permits and certificates of inspection

1.4.1 Arrange and pay for all necessary permits, certificates, approvals, variances, and inspections.

1.4.2 Prior to Substantial Performance, arrange and pay for a safety inspection of the equipment by the regulatory authority.

1.5 Warranty

1.5.1 Warrant the work performed, materials, performance, and workmanship for a period of one year from the date of Substantial Performance.

1.5.2 Correct defects which develop within the above mentioned time period.

1.6 Shop drawings and samples

1.6.1 Supply for approval shop drawings and samples of exposed finishes.

1.6.2 Supply at a minimum drawings showing the general arrangement layout, machine room layout, fixtures, entrances, and cab finishes.

1.7 Wiring diagrams and manuals

1.7.1 Prior to substantial performance, supply to the Owner, three sets of manuals describing in detail the operation of the equipment and special features.

1.7.1.1 Detail the operation for special features.

1.7.1.2 Supply, as part of the manual, as-built drawings.

1.7.2 In conjunction with the above, supply three copies and one AutoCAD disk of the as-built wiring and schematic diagrams.

1.7.3 Prior to substantial performance, supply to the Owner, a manual detailing proper maintenance procedures for the equipment.

1.8 **Training**

1.8.1 At completion of the job, provide a training session for the Owner consisting of a review of the documentation and operation of the equipment and features.

1.9 **Trademarks**

1.9.1 Arrange that none of the car or hall equipment has any trademark, company name, or logo.

1.10 **Fixtures**

1.10.1 Unless indicated otherwise in the Specifications or Drawings, provide a choice of fixtures from a third party supplier and your standard products.

1.10.2 Provide buttons with LED illumination and stainless steel targets.

1.11 **Operating conditions**

1.11.1 Provide equipment that will operate normally when the machine room and hoistway temperature is between 5 and 35 degrees Celsius (40 and 95 degrees Fahrenheit).

1.11.2 Provide equipment that will operate normally when the power supply is within 10 percent of its rated voltage.

1.12 **Decommission existing elevator: hydraulic**

1.12.1 Perform the following work on the existing elevator such that it can be removed by another contractor:

1.12.1.1 Lower the elevator to the pit.

1.12.1.2 Disconnect the power to the elevator.

1.13 **Inspection and acceptance**

1.13.1 Provide a meter and test weights (full load) along with an adjuster and helper to assist the engineer with a final acceptance inspection.

1.14 **Non-proprietary equipment**

1.14.1 If proprietary tools and/or information is required to maintain, adjust, or diagnose the equipment provide this to the Owner.

1.14.2 Arrange the equipment such that there are no time, date, trip, or other counters that would shut down the equipment or change its operation.

2. **PRODUCTS**

2.1 **Description**

- 2.1.1 Provide a single roped (or chain) hydraulic handicap lift as follows:
 - 2.1.1.1 Continuous pressure operation.
 - 2.1.1.2 Contract speed of 0.15 m/s (30 fpm) plus or minus 5.0 percent.
 - 2.1.1.3 Capacity of 454 kg (1000 lb).
 - 2.1.1.4 Power operated swing type doors with a width of 915 mm (3'0") and a height of 2030 mm (6'8").
 - 2.1.1.5 Front openings at levels 1 and 2.
 - 2.1.1.6 Cab inside dimensions of 915 mm (3'0") wide and 1524 mm (5'0") deep.
 - 2.1.1.7 Overall cab height of 2030 mm (6'8").
 - 2.1.1.8 Hoistway, pit, overhead dimensions as per the Existing.

2.2 **Power unit**

- 2.2.1 Provide a power unit comprised of an oil tank, hydraulic pump, electric motor, control valves, oil level gauge, and oil pressure gauge.
- 2.2.2 Provide a pump and motor designed for oil hydraulic use and smooth, quiet operation.
- 2.2.3 Provide a control valve assembly containing a relief valve, a check valve, a levelling valve, and a manual lowering valve.
- 2.2.4 Provide a tank shut off valve and a gate valve between the power unit and the jack.
- 2.2.5 Provide a hydraulic muffler in the oil line.

2.3 **Jack**

- 2.3.1 Provide a hydraulic jack of sufficient size to lift the gross load the height specified.
- 2.3.2 Factory test the jack unit to ensure adequate strength and freedom from leakage. Do not use brittle material such as grey cast iron in the jack construction.
- 2.3.3 Provide a jack unit consisting of a plunger of heavy seamless steel tubing accurately turned and polished, a stop ring electrically welded to the plunger to prevent the plunger leaving the cylinder, an internal guide bearing, packing or seal of suitable design and quality, a drip ring around the casing top, and a cylinder made of steel pipe and provided with a pipe connection and air bleeder.
- 2.3.4 Weld brackets to the jack casing for supporting the elevator on pit channels.
- 2.3.5 Provide a second (safety) bulkhead in the lower end of the cylinder.
- 2.3.6 Provide jack units contained within the hoistway with sheaves attached to the piston.

2.4 **Controller**

- 2.4.1 Provide a microprocessor based controller consisting of relays, contactors, switches, capacitors, resistors, fuses, circuit breakers, overload relays, power supplies, circuit boards, static drive units, wiring terminal strips, and related components all enclosed in a cabinet with hinged door panels.
- 2.4.2 Store basic systems operating software in non-volatile EPROMs and store field adjustable parameters in EEPROMs.
- 2.4.3 Install wiring in a neat workmanlike manner with all field wiring terminated at labelled and identified stud blocks. Do not connect more than 2 wires to any single terminal.
- 2.4.4 Label each electrical component in the controller with alpha-numeric identification that matches that shown on the as-built wiring diagrams.
- 2.4.5 Ensure that the elevator control system will restart after a loss of normal power.

2.5 **Entrances**

- 2.5.1 Provide entrances consisting of doors, frames, sills, hinges, interlocks, door closers, and all other equipment required for a complete installation.
- 2.5.2 Provide painted aluminum or steel entrance doors and frames with vision panels.
- 2.5.3 Provide entrances and associated hardware having a 3/4 hour fire rating.

2.6 **Guide rails**

- 2.6.1 Provide standard tongue and groove steel guide rails.
- 2.6.2 Install guide rails using brackets fastened to the building structure.
- 2.6.3 Clamp the guide rails to the bracket with clips arranged to prevent any horizontal movement of the rail.
- 2.6.4 Join the rail sections using steel backing plates.

2.7 **Slipper guides**

- 2.7.1 Provide spring mounted slipper guides located at the top and the bottom of the car frame.
- 2.7.2 Provide guides that are self-aligning and self lubricating with replaceable nylon liners in order to ensure smooth and quiet operation.

2.8 **Car frame, platform, and cab**

-
- 2.8.1 Provide a car frame constructed of steel channels and a platform constructed of steel channels with a wood or metal sub-floor.
- 2.8.2 Isolate the frame and platform from one another so that there is no metal to metal contact in order to prevent the transmission of noise and vibration.
- 2.8.3 Mount the elevator cab shell on the platform in alignment with the hoistway entrances.
- 2.8.4 Isolate the cab from the car frame and platform.
- 2.9 **Cab finishes**
- 2.9.1 Provide cab finishes as follows:
- 2.9.1.1 Full height wall panels finished in applied plastic laminate finish (colour and pattern to be selected by the Owner).
- 2.9.1.2 Brushed stainless steel cylindrical handrails 38 mm (1.5") in diameter on one side wall.
- 2.9.1.3 Brushed stainless steel ceiling with LED down lights.
- 2.9.1.4 Resilient sheet flooring.
- 2.9.2 Submit for approval drawings of the cab design and lists of options for fixtures, interior materials, finishes and colours.
- 2.10 **Car station**
- 2.10.1 Provide one car station.
- 2.10.2 Incorporate in each car station continuous pressure UP and DOWN push buttons, a STOP button, alarm button, and other fixtures required for normal operation.
- 2.10.3 Locate the car station controls at a height between 890 mm (35") and 1220 mm (48") from the cab floor with the emergency controls and door operating buttons grouped together at the bottom.
- 2.10.4 Provide buttons of at least 19 mm (0.75") size with floor designations at least 16 mm (0.63") high and braille located to the left of the button.
- 2.10.5 Engrave the car station with the elevator capacity, identification number, government installation number, and other markings required by code.
- 2.11 **Door operator**
- 2.11.1 Provide concealed power door operators to automatically open and close the hoistway doors.
- 2.11.2 Design the equipment for a minimum of noise.
- 2.12 **Hands-free intercommunication/telephone**
- 2.12.1 Provide a hands-free two-way voice intercommunication / telephone system.
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- 2.12.2 Provide a hands-free intercommunication station with automatic dialer integrated into the car station to meet barrier-free access requirements.
 - 2.12.2.1 Provide a push button identified as "PHONE" to initiate communication along with a speaker.
 - 2.12.2.2 Identify the button with a raised international symbol for telephones and Braille markings.
 - 2.12.2.3 Provide visual indication which is activated to acknowledge that the communication has been established. Extinguish the visual indication when the connection is terminated.
 - 2.12.2.4 Arrange that the communication cannot be terminated from within the cab.
 - 2.12.2.5 Provide twin conductor shielded wiring from the cab to the elevator machine room.
 - 2.12.2.6 Provide 110 volt power at the car station for the intercommunication station.
 - 2.12.3 Provide and pull all wiring to interconnect the equipment including but not limited to wiring between the elevator cab and the machine room.
 - 2.12.4 Provide a junction box with terminal blocks for the intercommunication equipment mounted on the side of a controller in the elevator machine room.
 - 2.12.5 Provide equipment such that all elevators can share one telephone line.
 - 2.12.6 Arrange that the intercommunication system within the car verifies operability of the telephone line automatically on a daily basis without requiring activation of the line. If the verification means determines that the line is not functional, sound and illuminate a signal (identified as "ELEVATOR COMMUNICATIONS FAILURE") at the main floor hall station. Provide a means for authorized personnel to silence the signal.
 - 2.13 **Certificates and licences**
 - 2.13.1 Do not install any certificates or licences in the cab. Arrange and pay for a variance from the TSSA for this if required.
 - 2.14 **Hall push button stations**
 - 2.14.1 Provide one riser of hall stations with continuous pressure UP and DOWN push buttons per lift.
 - 2.14.2 Provide buttons of minimum 20 mm (3/4") size and located with their centerline 1070 mm \pm 25 mm (42" \pm 1") above the floor.
 - 2.15 **Electric wiring**
 - 2.15.1 Provide copper wiring to interconnect the equipment.
 - 2.15.2 Run the wire in metal conduit, duct or electrical metallic tubing.
 - 2.15.3 Make no splices.
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- 2.15.4 Provide travelling cable between car stations and the controller.
- 2.15.5 Provide at least ten percent spare wires in each travelling cable.
- 2.15.6 If required by code, provide auxiliary disconnect switches and wiring.

3. **EXECUTION**

3.1 **Constant pressure operation**

- 3.1.1 Provide microprocessor based operation of the lift using constant pressure operation.
- 3.1.2 Provide continuous pressure button operation by means of UP and DOWN push buttons in the car and at each hall landing.

3.2 **Sound levels**

- 3.2.1 Arrange the elevator equipment so that the sound level as measured in the cab with the elevator running is less than 70 decibels.
- 3.2.2 Measure the sound levels using a sound level meter set to the "A" scale for a fast response.

3.3 **Operating performance**

- 3.3.1 Levelling - Arrange that the car stops within 6 mm (1/4") of the floor level.
- 3.3.2 Acceleration - Arrange that the average acceleration is not less than 0.6 m/s/s (2.0 f/s/s) and the acceleration peaks do not exceed 1.5 m/s/s (5.0 f/s/s).

3.4 **Battery lowering**

- 3.4.1 Provide battery operated emergency lowering.
- 3.4.2 Provide enough battery power to lower the lift to the lowest floor without stopping in the event of a loss of normal power.
- 3.4.3 Provide a charging unit that will re-charge the battery when normal power returns and keep the battery fully charged at all times.

END OF SECTION

1. GENERAL**1.1 Scope of work**

1.1.1 Provide full maintenance of the vertical transportation equipment.

1.2 Work included

1.2.1 Maintain, repair, or replace for the lift pumps, motors, drives, cylinders, pistons, gland packings, hydraulic oil, travelling cables, wiring, controller parts, relays, door equipment, intercommunication system, and other lift components.

1.3 Work not included

1.3.1 Do not maintain, repair, or replace lift cabs, finishes, or entrances.

1.4 Minimum standard

1.4.1 As a minimum, perform to these specifications.

1.5 Codes, by-laws, and regulations

1.5.1 Provide equipment and perform work in accordance with all local, provincial and federal codes, by-laws, and regulations.

1.5.2 Provide equipment and perform work in accordance with the latest edition of the B355 Safety Code for Handicap Lifts and any other code which may govern the installation.

1.5.3 At the time of bid submission and during the contract provide written notification of any proposed changes in codes, by-laws, or regulations which may affect the work.

1.6 Monthly labor

1.6.1 For each handicap lift, provide minimum labor of 2 hours per quarter for regular maintenance.

1.6.2 Perform regular maintenance at least once a quarter.

1.7 24 hour call-back service

1.7.1 Provide twenty-four hour a day, seven day a week call-back service.

1.7.2 Include overtime callbacks.

1.7.3 Respond to regular call-backs within two hours from the time a call is placed until a maintenance person arrives at the site.

1.7.4 Respond to emergency call-backs within 30 minutes (45 minutes outside of regular working hours) from the time a call is placed until a maintenance person arrives at the site.

1.7.5 Provide twenty-four hour a day, seven day a week staffed telephone answering service.

1.8 Invoicing

1.8.1 Submit monthly invoices for payment.

1.9 Non-performance and deficient work

1.9.1 In the event of non-performance or deficient work, the Owner has the right to withhold payment or to pay only for the portion of the work that has been properly performed.

1.9.2 In the event of deficient work, the Owner has the right to hire another contractor to correct the work and deduct the cost of such work from moneys owing on the contract.

1.10 **Termination of contract**

1.10.1 The Owner has the right to terminate the contract if the maintenance is not performed in accordance with the Specifications, as evidenced by a recognized elevator consultant, and if within two months of notice, corrective action has not been taken.

1.10.2 In the event of termination, the Owner may hire another elevator company to perform the required work and charge the cost of this to the Contractor.

1.10.3 The Owner has the right to terminate the contract upon one month's notice if the property is sold, if the equipment undergoes a control modernization, or if the Contractor is sold.

1.11 **Liability insurance**

1.11.1 Provide, during the period of the contract liability insurance and property damage insurance in the amount of \$5,000,000.

1.11.2 For a period of two years after completion of the contract, have in force a completed operations and products liability insurance, in the amount of \$5,000,000.

1.12 **Site personnel**

1.12.1 Ensure that the maintenance personnel present a neat appearance and provide them with company uniforms.

1.13 **Accidents**

1.13.1 In the event of an accident causing personal injury, death, or property damage related to the vertical transportation equipment or maintenance of the equipment, immediately provide a verbal report to the Owner and submit within 48 hours of the accident a written report.

1.14 **Assignment of contract**

1.14.1 Do not assign the contract or sub-contract the work without the written permission of the Owner.

1.15 **Repair work**

1.15.1 Provide the Owner with at least two weeks notice for planned repair work above the regular maintenance.

1.15.2 Advise the Owner immediately of un-planned repair work above the regular maintenance.

1.16 **Third party inspections**

1.16.1 Provide necessary assistance for inspections of the equipment by the Owner or the Owner's representatives.

1.16.2 Perform such maintenance, adjustment, repair, or replacement as listed in a third party report.

1.17 **Site coordination**

1.17.1 At each regular maintenance inspection meet with the Owner's designated representative to discuss the equipment operation and any problems.

1.18 Spare parts available locally

1.18.1 Either on site, in a service vehicle, or at the local office, stock hall station assemblies, push buttons of each type used, hall lanterns, position indicators, hall door equipment, roller guides, fuses, relays, contacts, coils, door operator components, buffer oil, and cleaning supplies.

1.19 Spare parts available within 24 hours

1.19.1 Ensure that circuit boards, jack gland packings, hydraulic valves, and any other parts necessary for the operation of the equipment are available to the site within twenty-four (24) hours.

1.20 Tools available locally

1.20.1 Either on site, in a service vehicle, or at the local office, stock a blower, a vacuum cleaner, barricades, a sound level meter, a stop watch, an electrical multi-meter, a tachometer, test weights, and an oil pressure gauge.

1.21 Parts cabinet

1.21.1 Provide a steel parts cabinet in the lift machine room.

1.22 Building log system

1.22.1 At each visit make the required entries in the building log system.

1.23 Lift maintenance log book

1.23.1 Provide a log book for lift maintenance.

1.23.2 Show information such as date, time, name of maintenance person, regular maintenance, callback, and work performed in the log book.

1.23.3 The log book is the property of the Owner.

1.24 Wiring diagrams

1.24.1 Provide, in the machine room, a set of wiring diagrams plasticized for protection.

1.24.2 Update the wiring diagrams when changes are made to the wiring or control system.

1.25 Annual report

1.25.1 Every year, provide to the Owner a report showing the maintenance activity for the year including, but not limited to, major component repairs or replacement, call backs, and time spent on site.

1.26 Equipment performance

1.26.1 Maintain the equipment and its performance in substantially new condition.

1.26.2 Ensure that the equipment meets the original installation or modernization specified performance standards.

1.26.2.1 Maintain the operating times compatible with reliable, consistent operation without excessive wear.

1.27 Hydraulic oil loss

1.27.1 Do not add hydraulic oil to the system until such time as the cause of the oil loss has been determined and the addition of oil has been authorized by the elevator maintenance supervisor.

1.27.2 Advise the Owner in writing of any addition of hydraulic oil.

1.27.3 Do not keep hydraulic oil on site.

1.28 **Quarterly checks and duties**

1.28.1 For each lift perform the following tasks every tasks month:

1.28.1.1 Check the ride quality, levelling, and general operation;

1.28.1.2 Check the door operation;

1.28.1.3 Check the emergency stop switch and alarm;

1.28.1.4 Check the telephone or intercom;

1.28.1.5 Check the door open and close buttons, position indicators, and floor push buttons;

1.28.1.6 Check the hall door interlocks;

1.28.1.7 Check the hydraulic oil level;

1.28.1.8 Check the jack gland packing.

1.28.1.9 Clean the controller and inspect each relay and controller component;

1.28.1.10 Check the roller guides;

1.28.1.11 Check the buffers;

1.28.1.12 Clean pits, car tops, and machine room floor.

1.29 **Semi-annual checks and duties**

1.29.1 For each lift perform the following tasks every six months:

1.29.1.1 Check the operation of hall doors and other hall door equipment;

1.29.1.2 Check the operation of the limit switches;

1.29.1.3 Check the emergency service operation (if provided);

1.29.1.4 Check the battery lowering;

1.29.1.5 Check the door dwell times for consistency;

1.29.1.6 Check the power unit;

1.29.1.7 Check hydraulic pressure relief valves;

1.29.1.8 Check hydraulic systems for leaks.

1.30 **Yearly checks and duties**

1.30.1 For each lift perform the following tasks every twelve months:

1.30.1.1 Check all safety devices;

1.30.1.2 Check the hall buttons;

1.30.1.3 Open up, clean, and check the car station;

1.30.1.4 Check the travelling cables for wear and broken wires;

1.30.1.5 Measure the performance times and perform a re-adjustment if required;

1.30.1.6 Paint the machine room floor.

END OF SECTION



1 GENERAL

1.1 REFERENCE STANDARDS

- .1 Applicable NFPA standards.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for fire protection system, equipment and accessories. Include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Submit drawings stamped and signed by Professional Engineer licensed in Province of Ontario, Canada. Drawings shall be prepared to scale in AutoCAD (DWG) format. Drawings prepared by consultant indicate general intent of the design and proposed locations for reference. Contractor's Fire Protection Engineer shall complete detailed design, calculations, systems layouts, schematics, and riser diagrams in accordance with NFPA 13, 14, 20 or other applicable NFPA standards.
- .4 Submittals shall include system schematics, riser diagrams, detailed hydraulic calculations, design criteria and list of assumptions. Provide floor plans indicating zoning, location of all equipment and services, including piping sizes and equipment tags.
- .5 Samples:
 - .1 Submit the following samples:
 - .1 Firehose nozzles.
 - .2 Section of hose.
 - .3 Each type of sprinkler head.
 - .4 Signs.
- .6 Test reports:
 - .1 Submit certified test reports for standpipe and hose assembly from approved independent testing laboratories, indicating compliance with specifications for specified performance characteristics and physical properties.
 - .2 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.
- .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 Provide submittals for all proposed equipment, including:
 - .1 Piping system, fittings, and valves for each dry, wet and gas suppression systems.
 - .2 Water flow and pressure switches.
 - .3 Sprinkler heads.
 - .4 Test and drain assemblies.
 - .5 Fire hose cabinets and hose assemblies.
 - .16 Fire extinguishers.

1.3 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Operation and Maintenance Data: submit operation and maintenance data for incorporation into manual.
 - .1 Operation and maintenance manual approved by, and final copies deposited with, Owner's Representative and Consultant prior to final inspection.
 - .2 Operation data to include:
 - .1 Systems schematics, riser diagrams and 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 - Testing, Adjusting and Balancing for HVAC.
 - .5 Manufacturer's catalogue 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.
- .6 Drawings:
 - .1 Sprinkler heads and piping system layout.
 - .1 Prepare 760 mm by 1,050 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.
- .7 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.
- .8 Field Test Reports:
 - .1 Preliminary tests on piping system.
- .7 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. Drawings shall be submitted in AutoCAD 2020 format (.dwg files) and PDF; adhere to Owner's CAD Guidelines whenever applicable – coordinate with Owner's representative prior to preparation of as-built drawings.
 - .2 Submit 760mm by 1,050 mm drawings on reproducible Mylar film with title block similar to full size contract drawings.
- .8 Approvals:
 - .1 Submit 3 copies of draft Operation and Maintenance Manual to Owner's Representative and Consultant for approval. Submission of individual



data will not be accepted unless directed by Consultant.

- .2 Make changes as required and re-submit as directed by Owner's Representative and Consultant.
- .9 Contractor's Fire Protection Engineer Certification
 - .1 Contractor's Fire Protection Engineer shall complete periodic field reviews at their own discretion to witness and certify installation of the systems prior to concealment.
 - .2 Witness start-up, testing and commissioning of the fire protection systems.
 - .3 Once Contractor's Fire Protection Engineer is satisfied with the installation, testing and performance of the fire protection systems, submit stamped letter of conformance for each system, including but not limited to:
 - .1 NFPA 13 – Sprinkler System
- .10 Additional data:
 - .1 Prepare and insert into operation and maintenance manual additional data when need for it becomes apparent during specified demonstrations and instructions.
- .11 Operation and Maintenance Manuals:
 - .1 Provide detailed hydraulic calculations stamped by Engineer licenced in Ontario including summary sheet, and Contractors Material and Test Certificate for aboveground and underground piping and other documentation for incorporation into manual in accordance with NFPA 13, NFPA 14 and Authorities Having Jurisdiction..

1.3 MAINTENANCE MATERIAL SUBMITTALS

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
- .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 glass for each gauge glass.
 - .4 Sprinkler head cabinet with each type of sprinkler head used in the system, quantity of heads shall be in accordance with NFPA and AHJ.
- .3 Provide one set of special tools required to service equipment as recommended by manufacturers and in accordance with Section 01 78 00 - Closeout Submittals.
- .4 Furnish one commercial quality grease gun, grease and adapters to suit different types of grease and grease fittings.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.



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

1.5 QUALITY ASSURANCE

- .1 Qualifications:
 - .1 Installer: company or person specializing in standpipe and hose assembly with a minimum 5 years documented experience.
- .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.

2 PRODUCTS

2.1 GENERAL

- .1 All equipment and materials shall be certified for fire protection installation in Canada and bear all required listings including ULC.
- .2 All materials shall be supplied by single manufacturer.
- .3 Provide fully functioning fire suppression system throughout the building or in work areas denoted on the drawings including wet systems in conditioned spaces, dry system in unheated or exterior spaces, pre-action system as noted on drawings, clean agent fire suppression system, standpipe and fire hose systems, portable fire extinguishers.

3 EXECUTION

3.1 GENERAL

- .1 Grade fire suppression piping in the direction of drain fittings.
- .2 Provide indirect drain of fire protection systems to funnel floor drains.
- .3 Provide minimum schedule 10 pipe sleeves and chrome plated escutcheons for all fire protections piping for all penetrations.
- .4 All piping, systems and services thru fire rated floor and wall assemblies shall be fire stopped in accordance with CAN4-S115-M85 - Standard Method of Fire Tests of Firestop Systems.



- .5 All pipe penetrations thru underground exterior walls shall be sealed with modular link seal assembly.
- .6 Provide all required core drilling, scan or x-ray floors and walls prior to drilling to avoid damage of any encased services or rebar. Obtain permission from Structural Engineer prior to any drilling.

3.2 FIELD QUALITY CONTROL

- .1 Site Tests: conduct following tests in accordance with Section 01 45 00 - Quality Control and submit reports.
- .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.
 - .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.

3.3 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 00 - Cleaning.
 - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00 - Cleaning.
- .3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 19 - Waste Management and Disposal.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.4 PROTECTION

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

END OF SECTION



1 GENERAL

1.1 REFERENCE STANDARDS

- .1 National Fire Prevention Association (NFPA)
 - .1 NFPA 13, Standard for the Installation of Sprinkler Systems.
 - .2 NFPA 20, Standard for the Installation of Stationary Pumps for Fire Protection.
 - .3 NFPA 24, Standard for the Installation of Private Fire Service Mains and Their Appurtenances.
 - .4 NFPA 25, Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems.
- .3 Underwriter's Laboratories of Canada (ULC)
 - .1 CAN4 S543-M984, Standard for Internal Lug Quick Connect Couplings for Fire Hose.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 In accordance with Section 21 05 00 – Common Work Results for Fire Suppression.

1.3 CLOSEOUT SUBMITTALS

- .1 In accordance with Section 21 05 00 – Common Work Results for Fire Suppression.

1.4 QUALITY ASSURANCE

- .1 In accordance with Section 21 05 00 – Common Work Results for Fire Suppression.

1.5 MAINTENANCE MATERIAL SUBMITTALS

- .1 Extra Materials:
 - .1 Provide maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.
 - .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 - Common Product Requirements and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements:



- .1 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.
- .3 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 and return by manufacturer of pallets, crates, padding, and packaging materials in accordance with Section 01 74 19 - Waste Management and Disposal.

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 pipe schedules for ordinary hazard occupancy.
- .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 each hazard occupancy.
 - .2 Uniformly space sprinklers on branch.
- .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.
- .9 Sprinkler Discharge Area:
 - .1 Area: hydraulically most remote area as defined in NFPA 13
- .10 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.

2.2 ABOVE GROUND PIPING SYSTEMS

- .1 Provide fittings for changes in direction of piping and for connections.
 - .1 Making 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 or drywall ceiling, where possible.

2.3 PIPE, FITTINGS AND VALVES

- .1 Pipe:
 - .1 Ferrous: 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 Provide welded, threaded or grooved-end type fittings into which sprinkler heads, sprinkler head riser nipples, or drop nipples are threaded.
 - .3 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.
 - .4 Rubber gasketed grooved-end pipe and fittings with mechanical couplings are permitted in pipe sizes 32 mm and larger.
 - .5 Fittings: ULC approved for use in wet pipe sprinkler systems
 - .6 Ensure fittings, mechanical couplings, and rubber gaskets are supplied by same



manufacturer.

- .7 Side outlet tees using rubber gasketed fittings are [not] permitted.
- .8 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, wall indicator 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

2.4 SPRINKLER HEADS

- .1 General: to NFPA 13 and ULC listed for fire services
- .2 Sprinkler Head Type:
 - .1 Type A: upright bronze.
 - .2 Type B: pendant chrome link and lever type.
 - .3 Type C: pendant chrome glass bulb type.
 - .4 Type D: recessed chrome, glass bulb type with ring and cup.
 - .5 Type E: flush chrome link and lever type.
 - .6 Type F: side wall chrome link and lever type.
 - .7 All sprinkler heads shall be quick response type unless otherwise noted on drawings.
- .3 Provide nominal 1.2 cm orifice sprinkler heads.
 - .1 Release element of each head to be of intermediate temperature rating or higher as suitable for specific application.
 - .2 Provide polished chromium-plated pendent sprinklers below suspended ceilings.
 - .3 Provide corrosion-resistant sprinkler heads and sprinkler head guards in accordance



with NFPA 13

- .4 Provide sprinkler heads to ensure full coverage of the areas in scope of work. Design drawings indicate proposed layouts for general intent and purposes. Contractor's Fire Protection Engineer shall be responsible for hydraulic calculations and detailed design including locations of sprinkler heads, sizing and layout of the distribution piping, location of supervisory and flow switches.
- .5 Deflector: not more than 75 mm below suspended ceilings.
- .6 Ceiling plates: not more than 25 mm deep.
- .7 Ceiling cups: not permitted.
- .4 Sprinkler heads shall be ULC listed for service and use in installed occupancies.
- .5 Sprinkler heads installed in locations subjected to damage or vandalism such as mechanical rooms, machinery room, loading dock, gymnasium, outside, stairs, etc shall be complete with listed guards.

2.5 PIPE SLEEVES

- .1 Provide pipe sleeves where piping passes through walls, floors, and roofs.
- .2 Secure sleeves in position and location during construction.
- .3 Provide sleeves of sufficient length to pass through entire thickness of walls, floors, and roofs.
- .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 mechanically adjustable segmented elastomeric seal.
 - .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 sleeves.
 - .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 0.61 mm thick galvanized steel sheet.



2.6 ESCUTCHEON PLATES

- .1 Provide one piece 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.

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 DESIGN

- .1 Design, provide, inspect and test fully functioning fire protection system to acceptance in accordance with NFPA 13, NFPA 25, Ontario Building Code, Ontario Fire Code and local bylaws.
- .2 System hydraulic calculations and detailed design shall be solely responsibility of the Contractor's Fire Protection Engineer licensed in Ontario. Submit detailed package of stamped submittals to Consultant and AHJ for review and approval.
- .3 Site hydraulic data shall be filed verified by Contractor and used by Fire Protection Engineer for hydraulic calculations.
- .4 Contractor's Engineer shall conduct field inspection of the existing conditions prior to design.
- .5 Contractor's Engineer shall conduct periodic quality assurance review of the progress installation and provide reports noting deficiencies or otherwise confirming compliance with the design intent.
- .6 Prior to substantial completion Contractor's Engineer shall provide stamped Letter of Conformance confirming installation meets design intent, NFPA 13 and local codes.

3.3 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.
- .5 Sprinkler heads shall be installed on center or quarter point of long dimension of the ceiling tiles and on center point of long dimension of ceiling tile. Coordinate location of sprinkler heads with other ceiling mounted devices including smoke detectors, lights, diffusers, speakers, wifi modules, etc and install sprinkler heads in symmetry with these devices.
- .6 Sprinkler heads shall not be reused.
- .7 Do not installed damaged or defective sprinkler heads.
- .8 Installation of grooved piping systems shall be in conformance with manufacturer's requirements. Manufacturer's trained personnel shall provide training to contractor's personnel on installation methods of grooved piping systems. Manufacturer's trained personnel shall complete periodic quality assurance inspections to observe progress installation of the piping system and provide reports. A final conformance letter shall be provided certifying that installation of grooved piping system meets manufacturer's requirements.

3.4 ELECTRICAL CONNECTIONS

- .1 Provide electrical work associated with this section in accordance with Division 26 requirements.
- .2 Provide fire alarm system in accordance with Division 28.
- .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 and existing piping.
- .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 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 50mm 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 attic spaces, [spaces above suspended ceilings, crawl spaces, 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 spaced at maximum of 6 m intervals.

3.8 FIELD QUALITY CONTROL

.1 Site Test, Inspection:

- .1 Perform test to determine compliance with specified requirements in presence of Contractor's Fire Protection Engineer. Owner's Representative or Consultant may chose to witness testing, provide minimum (5) business days' notice prior to tests.

- .2 Test, inspect, and approve piping before covering or concealing.

.3 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

.4 Formal Tests and Inspections:

- .1 Do not submit request for formal test and inspection until preliminary test and corrections are completed and approved.
- .2 Submit written request for formal inspection at least 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.

.2 Site Tests:

- .1 Field test each fire pump, driver and controllers in accordance with NFPA 20. Testing



shall include:

- .1 Verification of proper installation, system initiation, system operation, adjustment and fine tuning.
- .2 Verification of the sequence of operations and alarm systems.
- .2 Testing to be witnessed by Contractor's Fire Protection Engineer and authority having jurisdiction.
- .3 Develop detailed instructions for O & M of this installation.

3.9 CLEANING

- .1 Clean in accordance with Section 01 74 00 - Cleaning.
 - .1 Remove surplus materials, excess materials, rubbish, tools and equipment.
- .2 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 19 - Waste Management and Disposal.

END OF SECTION



1 GENERAL

1.1 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for all equipment, systems and accessories; include product characteristics, performance criteria, materials, physical size, weights, finishes, listings, approvals, limitations, warranty and lead times.
- .3 Shop Drawings:
 - .1 Submit shop drawings for all plumbing systems, components and equipment, including:
 - .1 Plumbing fixtures.
 - .2 Piping system.
 - .3 Valves and fittings.
 - .4 Cleanouts.
 - .5 Floor and roof drains.
 - .6 Trap seal primers.
 - .7 Hot water heaters and storage tanks.
 - .2 Indicate on drawings:
 - .1 Mounting arrangements.
 - .2 Operating and maintenance clearances.
 - .3 List of accessories and options specific to each equipment.
 - .3 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.



- .6 Installation instructions.

1.2 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Operation and Maintenance Data: submit operation and maintenance data for incorporation into manual.
 - .1 Operation and maintenance manual approved by, and final copies deposited with, Owner's Representative and Consultant 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.
 - .8 Testing data (backflow preventer, etc).
 - .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 - Testing, Adjusting and Balancing for HVAC.
 - .5 Approvals:



- .1 Submit 2 copies of draft Operation and Maintenance Manual to Owner's Representative and Consultant for approval. Submission of individual data will not be accepted unless directed by Consultant.
- .2 Make changes as required and re-submit as directed by Consultant.
- .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 Records:
 - .1 As-built drawings of each system.
 - .2 After completion, but before final acceptance, submit complete set of as-built drawings of each system for record purposes. Drawings shall be submitted in AutoCAD 2020 format (.dwg files) and PDF; adhere to Owner's CAD Guidelines whenever applicable – coordinate with Owner's representative prior to preparation of as-built drawings.
 - .3 Submit 760mm by 1,050 mm drawings on reproducible Mylar film with title block similar to full size contract drawings.
 - .4 Use different colour waterproof ink for each service.
 - .5 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. Contractor shall be responsible for all changes, revisions and updates of the AutoCAD drawings.
 - .2 Submit to Consultant 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.

1.3 MAINTENANCE MATERIAL SUBMITTALS

- .1 Submit in accordance with Section [01 78 00 - Closeout Submittals].
- .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 glass for each gauge glass.
- .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.

1.4 DELIVERY, STORAGE AND HANDLING

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

2 PRODUCTS

2.1 N/A

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 and Consultant.
 - .2 Inform Consultant 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 Consultant.



3.2 PAINTING REPAIRS AND RESTORATION

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

3.3 SYSTEM CLEANING

- .1 Clean interior and exterior of all systems including strainers.
- .2 Clean all fixtures and accessories.

3.4 FIELD QUALITY CONTROL

- .1 Site Tests: conduct tests in accordance with Section 01 45 00 - Quality Control and submit reports to Consultant.
- .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 to Consultant.
 - .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 Owner's Representative or Consultant may 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.
- .5 Instruction duration time requirements as specified in appropriate sections.
- .6 Contractor shall record these demonstrations on video tape for future reference.

3.6 CLEANING

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



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

3.7 PROTECTION

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

3.8 CORING

- .1 Provide core drilling for installation of plumbing systems.
- .2 X-ray or scan floor and wall assemblies prior to core drilling, consult with Consultant on any noted interferences. X-ray shall only be carried out after hours, coordinate with Owner's Representative and provide minimum 10 business days' notice.
- .3 Coring and cutting of structural components shall only be completed once approved by Structural Engineer.
- .4 Repair adjacent finishes and any damages as a result of this work to satisfaction of Owner's Representative and Consultant.
- .5 Verify obstructions and interference on the other side of the floor and wall assemblies prior to coring. If any obstructions are noted, contractor shall locate alternate core locations and propose to Consultant for review and approval. Proceed with coring at alternate locations only once approved by Consultant.

END OF SECTION



1 GENERAL

1.1 REFERENCE STANDARDS

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

1.2 DEFINITIONS

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

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Action Submittals: Provide the following in accordance with Section 01 33 00 - Submittal Procedures before starting work of this Section:
 - .1 Construction Waste Management Plan (CWM Plan): Submit plan addressing opportunities for reduction, reuse, or recycling of materials prepared in accordance with Section 01 74 19 - Waste Management and Disposal
- .2 Landfill Records: Indicate receipt and acceptance of selective demolition waste and hazardous wastes by a landfill facility licensed to accept hazardous wastes.



1.4 ADMINISTRATIVE REQUIREMENTS

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

1.5 QUALITY ASSURANCE

- .1 Regulatory Requirements: Perform work of this Section in accordance with the following:
 - .1 Provincial/Territorial Workers' Compensation Boards/Commissions.
 - .2 Provincial/Territorial Occupational Health and Safety Standards and Programs.

1.6 SITE CONDITIONS

- .1 Existing Conditions: Condition of materials identified as being salvaged or demolished are based on their observed condition on date that tender is accepted.

1.7 SALVAGE AND DEBRIS MATERIALS

- .1 Demolished items become Contractor's property and will be removed from Project site;

2 PRODUCTS

2.01 MATERIALS

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

3 EXECUTION

3.01 EXAMINATION

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

3.02 PREPARATION



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

3.03 EXECUTION

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

3.04 CLOSEOUT ACTIVITIES



- .1 Demolition Waste Disposal: Arrange for legal disposal and remove demolished materials to accredited provincial landfill site or alternative disposal site (recycle centre).

END OF SECTION



1 GENERAL

1.1 REFERENCE STANDARDS

- .1 ASTM International (ASTM)
 - .1 ASTM A126, Standard Specification for Gray Iron Castings for Valves, Flanges and Pipe Fittings.
 - .2 ASTM B62, Standard Specification for Composition Bronze or Ounce Metal Castings.
- .2 American Water Works Association (AWWA)
 - .1 ANSI/AWWA C700, Standard for Cold Water Meters-Displacement Type, Bronze Main Case.
 - .2 ANSI/AWWA C701, Standard for Cold Water Meters-Turbine Type for Customer Service.
 - .3 ANSI/AWWA C702, Standard for Cold Water Meters-Compound Type.
- .3 CSA Group (CSA)
 - .1 CSA-B64 Series, Backflow Preventers and Vacuum Breakers.
 - .2 CSA B79, Commercial and Residential Drains and Cleanouts.
 - .3 CAN/CSA-B356, Water Pressure Reducing Valves for Domestic Water Supply Systems.
- .4 Efficiency Valuation Organization (EVO)
 - .1 International Performance Measurement and Verification Protocol (IPMVP).
 - .1 IPMVP.
- .5 National Research Council Canada (NRC)
 - .1 National Plumbing Code of Canada (NPC).
- .6 Plumbing and Drainage Institute (PDI)
 - .1 PDI-G101, Testing and Rating Procedure for Grease Interceptors with Appendix of Installation and Maintenance.
 - .2 PDI-WH201, Water Hammer Arresters Standard.
- .7 American National Standards Institute/National Sanitation Foundation (ANSI/NSF).
 - .1 ANSI/NSF 61, Drinking Water System Components.
 - .2 ANSI/NSF 372, Drinking Water System Components – Lead Content.



2 PRODUCTS

2.1 ROOF DRAINS

- .1 RD-1 (standard roof drain): Duco Cast Iron Body with Combined Flashing Clamp and Gravel Stop, under-deck clamp to suit roof construction, Cast Iron Extension (200 mm) with Gasket and Optional Aluminum Dome.
- .2 Hub shall be selected upon exposing the pipe below (caulk or no-hub)
- .3 Standard of acceptance: J.R. Smith 1010, or approved equal Zurn or Watts

2.2 DIELECTRIC UNIONS

- .1 Provide on connections between dissimilar metals.
- .2 50mm (NPS 2) and under: provide insulating unions.
- .3 65mm (NPS 2 1/2) and over: provide insulating flanges.
- .4 Isolation shall be provided where piping may come in contact with dissimilar metals including hangers, supports, joists and studs.

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 (NPC), Ontario Building Code Part 7 and local authority having jurisdiction.
- .2 Install in accordance with manufacturer's instructions and as specified.

3.3 START-UP

- .1 General:
 - .1 In accordance with 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.

3.4 TESTING AND ADJUSTING

- .1 General:
 - .1 Test and adjust plumbing specialties and accessories in accordance with 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 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.

3.5 CLOSEOUT ACTIVITIES

- .1 Commissioning Reports: in accordance with Section 01 91 13 - General Commissioning Requirements: reports, supplemented as specified.



- .2 Training: provide training in accordance with Section 01 91 13 - General Commissioning Requirements: Training of O&M Personnel, supplemented as specified.

3.6 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 00 - Cleaning.
 - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00 - Cleaning.
- .3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 19 - Waste Management and Disposal.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.7 PROTECTION

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by plumbing specialties and accessories installation.
- .3 Protect existing floor drains when working in existing space, contractor shall be fully responsible for any damages to existing drainage systems as a result of debris accumulation or dumping of construction waste (concrete, dust, grease, etc). All costs of repairs including but not limited to complete replacement of piping, saw cutting of slab, cutting and patching, restoration work shall be solely responsibility of contractor.

END OF SECTION



1 GENERAL

1.1 REFERENCE STANDARDS

- .1 ASTM International (ASTM)
 - .1 ASTM B32, Standard Specification for Solder Metal.
 - .2 ASTM B306, Standard Specification for Copper Drainage Tube (DWV).
 - .3 ASTM C564, Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings.
 - .5 ASTM D2235, Standard Specification for Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings.
 - .6 ASTM D2564, Standard Specification for Solvent Cements for Poly (Vinyl-Chloride) (PVC) Plastic Piping Systems.
- .2 CSA Group (CSA)
 - .1 CSA B67, Lead Service Pipe, Waste Pipe, Traps, Bends and Accessories.
 - .2 CAN/CSA-B70, Cast Iron Soil Pipe, Fittings and Means of Joining.
 - .3 CAN/CSA-B125.3, Plumbing Fittings.
 - .4 CAN/CSA-Series B1800, Thermoplastic Nonpressure Pipe Compendium - B1800 Series.
- .3 Green Seal Environmental Standards (GSES)
 - .1 Standard GS-36-[00], Commercial Adhesives.
- .4 National Research Council Canada (NRC)
 - .1 National Plumbing Code of Canada(NPC).
- .5 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Safety Data Sheets (SDS).
- .6 Canada Green Building Council (CaGBC)
 - .1 LEED Canada-NC Version 1.0, LEED (Leadership in Energy and Environmental Design): Green Building Rating System Reference Package For New Construction and Major Renovations (including Addendum [2007]).
 - .2 LEED Canada-CI Version 1.0, LEED (Leadership in Energy and Environmental Design): Green Building Rating System Reference Guide For Commercial Interiors.



2 PRODUCTS

2.1 COPPER TUBE AND FITTINGS

- .1 Above ground sanitary, storm 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 to ASTM B32.

2.2 CAST IRON PIPING AND FITTINGS

- .1 Buried (inside building) sanitary, storm and vent minimum 80mm (NPS 3) to: CAN/CSA-B70, with one layer of protective coating.
 - .1 Mechanical joints:
 - .1 Neoprene or butyl rubber compression gaskets: to CAN/CSA-B70 or ASTM C564.
 - .2 Stainless steel clamps.
 - .2 Hub and spigot:
 - .1 Caulking lead: to CSA B67
 - .2 Cold caulking compounds.
- .2 Above ground sanitary, storm, and vent: to CAN/CSA-B70
 - .1 Hub and spigot:
 - .1 Caulking lead: to CSA B67
 - .2 Mechanical joints:
 - .1 Neoprene or butyl rubber compression gaskets with stainless steel clamps.

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 15 - Common installation requirements for HVAC pipework.
- .2 Install in accordance with National Plumbing Code, Ontario Building Code Part 7 and local authority having jurisdiction.
- .3 Pitch soil and waste piping no less 1/4 inch per foot.
- .4 Group piping whenever practical.
- .5 Install equipment including backflow preventer, pressure reducing stations and water meters in accordance with manufacturer's instruction, local codes and standards. Provide adequate support, independent of adjacent piping.
- .6 Pipe relief valves to nearest floor drain and provide support of discharge line.
- .7 Provide sleeves on pipe penetrations thru floors and walls.
- .8 Provide pipe hangers and supports in accordance with ASME B13.9 and ASTM F708.
- .9 Provide heat tracing of all exterior piping, unless otherwise indicated.
- .10 Provide unions and isolation valves at connections to equipment.
- .11 Provide spring loaded check valves at discharge of pumps.
- .12 Coordinate connections to municipal storm and sanitary piping with Site Servicing contractor. Contractor shall field verify all inverts, pipe routing and sloping prior to any work.
- .13 Piping penetrations through exterior walls below grade shall be leak tight and complete with modular link seal assembly.

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).

3.05 CLEANING

- .1 Clean in accordance with Section 01 74 00 - Cleaning.
- .2 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 19 - Waste Management and Disposal.

END OF SECTION



1 GENERAL

1.1 REFERENCE STANDARDS

- .1 American National Standards Institute/CSA Group (ANSI/CSA)
 - .1 ANSI Z21.10.1/CSA 4.1, Gas Water Heaters - Volume I, Storage Water Heaters With Input Ratings of 75,000 Btu Per Hour or Less.
 - .2 ANSI Z21.10.1A/CSA 4.1A, Addenda 1 to ANSI Z21.10.1/CSA 4.1, Gas Water Heaters Volume I, Storage Water Heaters With Input Ratings of 75,000 Btu Per Hour or Less.
 - .3 ANSI Z21.10.1b/CSA 4.1b, Addenda 2 to ANSI Z21.10.1/CSA 4.1, Gas Water Heaters - Volume I, Storage Water Heaters With Input Ratings of 75,000 Btu Per Hour or Less.
 - .4 ANSI Z21.10.3A/CSA 4.3, Gas Water Heaters - Volume III - Storage Water Heaters, with Input Ratings Above 75,000 Btu Per Hour, Circulating and Instantaneous.
- .2 CSA Group (CSA)
 - .1 CSA B51, Boiler, Pressure Vessel, and Pressure Piping Code.
 - .2 CAN/CSA-B139, Installation Code for Oil Burning Equipment.
 - .3 CAN/CSA-B140.0, Oil Burning Equipment: General Requirements.
 - .4 CAN/CSA-B149.1, Natural Gas and Propane Installation Code.
 - .5 CAN/CSA-B149.2, Propane Storage and Handling Code.
 - .6 CSA B140.12, Oil-Burning Equipment: Service Water Heaters for Domestic Hot Water, Space Heating, and Swimming Pools.
 - .7 CAN/CSA C22.2 No.110, Construction and Test of Electric Storage Tank Water Heaters.
 - .8 CAN/CSA-C191, Performance of Electric Storage Tank Water Heaters for Household Service.
 - .9 CAN/CSA-C309, Performance Requirements for Glass-Lined Storage Tanks for Household Hot Water Service.
- .3 National Research Council Canada (NRC)
 - .1 National Plumbing Code of Canada (NPC).

1.2 ACTION AND INFORMATIONAL SUBMITTALS



- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Provide manufacturer's printed product literature and datasheets for domestic water heater, and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Shop Drawings:
 - .1 Submit drawings and indicate:
 - .1 Equipment, including connections, fittings, control assemblies and ancillaries, identifying factory and field assembled, weights, dimensions, accessories, rated capacity, operating characteristic, wiring diagram.

1.3 CLOSEOUT SUBMITTALS

- .1 Provide maintenance and engineering data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.4 DELIVERY, STORAGE AND HANDLING

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

2 PRODUCTS

2.1 NATURAL GAS WATER HEATER

- .1 Natural gas fire water heater to ANSI Z21.10.3/CSA 1-4.3.
- .2 Storage capacity, recovery rate, power, dimensions and size as per schedules.
- .4 Modulating gas burner that automatically adjusts the input based on demand.
- .5 Powered anodes that are non-sacrificial and maintenance free.
- .6 Have seamless glass-lined steel tank construction, with glass lining applied to all water-side surfaces after the tank has been assembled and welded;
- .7 Thermal efficiency min 95%
- .8 Have foam insulation and a CSA Certified and ASME rated T&P relief valve;
- .9 Have a down-fired power burner designed for precise mixing of air and gas for optimum



efficiency, requiring no special calibration on start-up;

- .10 Be approved for 0" clearance to combustibles.
- .11 Approvals: water heater shall bear ASME HLW stamp, certified and listed by CSA, efficiency in compliance with ASHRAE 90.1. Water heater efficiency shall be verified through third party testing by AHRI and listed in AHRI certification directory.
- .12 Maximum working pressure: 1,100 kPa (160 psi).
- .13 The control shall be an integrated solid-state temperature and ignition control device with integral diagnostics, graphic user interface, fault history display, and shall have digital temperature readout. No charge connectivity shall be provided allowing for remote viewing and fault notification via app.
- .11 Warranty: 3 years.
- .12 Standard of acceptance: AO Smith Cyclone MXi or approved equivalent.

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 Provide structural steel for horizontal mounted tanks and for instantaneous heaters.
- .3 Provide insulation between tank and supports.
- .4 Install natural gas fired domestic water heaters in accordance with CAN/CSA-B149.1.
- .5 Install level and plumb on housekeeping pad.
- .8 Pipe pressure and temperature relief valves to floor drain.
- .9 Provide temperature gauges on inlets and outlets of the water heater.
- .10 Install isolation valves and unions at minimum 200mm (8 in) above top of the water heater to permit replacement without piping disassembly.



- .11 Provide piping heat traps on inlets and outlets of water heaters unless integral to the unit.
- .12 Provide venting and combustion air in accordance with specifications, refer to Section 23 51 00 - Breechings Chimneys and Stacks.
- .13 Provide dielectric units at connections between dissimilar metals.
- .14 For installation of multiple water heaters in parallel arrange cold and hot piping equal header arrangement to ensure even water distribution at each tank.

3.3 FIELD QUALITY CONTROL

- .1 Manufacturer's factory trained, certified Engineer to start up and commission DHW heaters.

3.4 CLEANING

- .1 Clean in accordance with Section 01 74 00 - Cleaning.
 - .1 Remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION



1 GENERAL

1.1 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for all equipment, systems, 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 Ontario, Canada.
 - .2 Indicate on drawings:
 - .1 Mounting arrangements.
 - .2 Operating and maintenance clearances.
 - .3 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.
 - .6 Equipment lead times.
 - .7 List of spare parts.
 - .8 Flow diagrams, controls schematic, wiring diagrams.
 - .9 Part load (0-100% in 10% increments) and full load efficiencies.
 - .10 Performance/capacity.
 - .11 Construction of equipment.
 - .12 Product warranty.
- .4 In addition to transmittal letter referred to in Section 01 33 00 - Submittal Procedures: use "Shop Drawing Submittal Title Sheet". Identify section and paragraph number.



- .4 Coordination Shop Drawings:
 - .1 Submit complete consolidated and coordinated shop drawings for all new systems, and for existing systems that are in the same areas.
 - .2 The coordination/shop drawings shall include plan views, elevations and sections of all systems in AutoCAD format and shall be on a scale of not less than 1:50. Clearly identify and dimension the proposed locations of the equipment. The drawings shall clearly show locations and adequate clearance for all equipment, piping, valves, control panels and other items. Show the access means for all items requiring access for operations and maintenance.
 - .3 Provide detailed coordination/shop drawings of all piping and duct systems.
 - .4 Do not install equipment foundations, equipment or piping until coordination/shop drawings have been approved.
- .5 Rigging Plan:
 - .1 Provide documentation of the capacity and weight of the rigging and equipment intended to be used. The plan shall include the path of travel of the load, the staging area and intended access, and qualifications of the operator and signal person.
 - .2 Confirm equipment staging areas and crane locations with the Owner's Representative prior to preparation of the plan.
 - .3 Indicate extents of the fencing, signage, barrier and temporary provisions on the plans.
 - .4 Include necessary permitting (road closure, traffic control, etc) for all required rigging and craning of the equipment.

1.2 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Operation and Maintenance Data: submit operation and maintenance data for all equipment for incorporation into manual.
 - .1 Operation and maintenance manual approved by, and final copies deposited with, Owner's Representative and Consultant 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 - Testing, Adjusting and Balancing for HVAC.
- .5 Approvals:
 - .1 Submit 2 copies of draft Operation and Maintenance Manual Owner's Representative and Consultant for approval. Submission of individual data will not be accepted unless directed by Consultant.
 - .2 Make changes as required and re-submit as directed by Consultant.
- .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 Consultant will provide 1 set of reproducible mechanical drawings – "Issued for Construction" in AutoCAD 2020 format. Contractor shall be responsible for all revisions, modifications and additions to AutoCAD drawing as required to accurately reflect as-built conditions.
 - .2 Transfer information weekly to reproducible, revising reproducible to show work as actually installed.
 - .3 Adhere to Owner's CAD Guidelines, obtain copy of the guidelines from Owner's



Representative.

- .4 Make drawings available to Owner's Representative and Consultant 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 in AutoCAD 2020 format.
 - .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 Owner's Representative and Consultant 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.
 - .6 As-built drawings shall be prepared in accordance with Owner's CAD Guidelines, obtain copy of the guidelines from Owner's Representative.
- .9 Submit copies of as-built drawings for inclusion in final TAB report.

1.3 MAINTENANCE MATERIAL SUBMITTALS

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
- .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 for hydronic system and one set of filter media for each filter bank for air systems in addition to final operating set.\
- .3 Provide one set of special tools required to service equipment as recommended by manufacturers including but not limited to boiler burner cleaning kit, chiller tube cleaning kit, etc.
- .4 Furnish one commercial quality grease gun, grease and adapters to suit different types of



grease and grease fittings.

1.4 DELIVERY, STORAGE AND HANDLING

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

1.5 CODES, REGULATIONS AND STANDARDS

- .1 All mechanical work shall be in compliance with the latest editions of the applicable codes, regulations and bylaws, including:
 - .1 Ontario Building Code
 - .2 Ontario Fire Code
 - .3 Canadian Standards Association
 - .4 Canadian Gas Association
 - .5 ASHRAE
 - .6 ASME
 - .7 NFPA
 - .8 SMACNA
 - .9 NECB
 - .10 Local Municipal Bylaws and Regulations
 - .11 Owner Specific Standards and Guidelines
- .2 Refer to Section 01 41 00 – Regulatory Requirements for complete list.
- .3 Where discrepancies between contract documents and references codes/standards are identified, Contractor shall request clarification from Consultant prior to proceeding with work.



- .4 Referenced codes, standards, regulations and guidelines are noted as a minimum requirement and shall not be used to alter, reduce or modify requirements of the contract documents.

1.6 PERMITS AND APPROVALS

- .1 Contractor shall be responsible for all costs associated with permitting and approvals by Authorities Having Jurisdiction (AHJ), including but not limited to:
 - .1 Application and obtaining of permits
 - .2 Permit fees
 - .3 Inspection fees
 - .4 Demonstration
- .2 Contractor shall be responsible for coordinating and scheduling progress inspection prior to work concealment and final acceptance.
- .3 Provide sufficient notice for inspections, provide qualified and licensed technicians to demonstrate work to inspectors.
- .4 Complete all repairs and adjustments to satisfaction of AHJ and schedule for follow-up inspection as required to complete the project.
- .5 Collect and submit all inspection certificates and permit closeout letters for all disciplines, include in closeout manuals.

1.7 TEST REPORTS

- .1 Contractor shall complete all required testing as specified in the contract documents.
- .2 Provide sufficient notice (minimum 10 working days) to Owner's Representative, Consultant, Commissioning Authority, inspectors and Authorities Having Jurisdiction (AHJ). Tests may be witnessed in their entirety or partially at discretion of these parties.
- .3 Make repairs, adjustments and troubleshoot issues when test results are not acceptable.
- .4 Submit all test reports for review and approval to the Consultant, including but not limited to:
 - .1 Pressure testing of piping systems and equipment (boilers, heat exchangers, etc)
 - .2 Piping flushing, cleaning and chemical treatment
 - .3 Water and Air Systems Balancing (TAB)
 - .4 Ductwork and equipment leakage test reports
 - .5 Equipment start-up reports



- .6 Sprinkler system certificates and Contractor's Fire Protection Engineer's NFPA 13 compliance letter
- .7 Standpipe system certificates and Contractor's Fire Protection Engineer's NFPA 14 compliance letter
- .8 Controls point to point verification report and sensor calibration report
- .9 Manufacturer's troubleshooting and service reports documenting encountered issues and corrective steps taken
- .10 Approvals by AHJ (TSSA, ESA, etc)

1.8 QUALITY ASSURANCE

- .1 All systems shall be safe, reliable, efficient, durable, easily and safely operable and maintainable, easily and safely accessible, and in compliance with applicable codes as specified. All construction personnel shall be experienced and qualified specialists in industrial and institutional HVAC.
- .2 Products Criteria:
 - .1 The design, model and size of each item shall have been in satisfactory and efficient operation on at least three installations for approximately three years. All controllers and software shall be of the latest version with the latest version of the firmware. Refer other specification sections for any exceptions and/or additional requirements.
 - .2 All items furnished shall be free from defects that would adversely affect the performance, maintainability and appearance of individual components and overall assembly.
 - .3 The products and execution of work specified shall conform to the referenced codes and standards as required by the specifications. Local codes and amendments shall be enforced, along with requirements of local utility companies. The most stringent requirements of these specifications, local codes, or utility company requirements shall always apply.
 - 5. Multiple Units: When two or more units of materials or equipment of the same type or class are required, these units shall be of the same manufacturer and model number, or if different models are required they shall be of the same manufacturer and identical to the greatest extent possible (i.e., same model series).
 - 6. Assembled Units: Performance and warranty of all components that make up an assembled unit shall be the responsibility of the manufacturer of the completed assembly.
 - 7. Nameplates: Nameplate bearing manufacturer's name or identifiable trademark shall be securely affixed in a conspicuous place on equipment, or name or trademark cast



integrally with equipment, stamped or otherwise permanently marked on each item of equipment.

8. Use of asbestos products or equipment or materials containing asbestos is prohibited.
- .3 Systems Welding:
 - .1 All welding shall be completed in accordance with Section 23 05 17 – Pipe Welding.
 - .2 Submit required certificates, procedures, and credentials prior to any work.
- .4 Testing, Adjusting and Balancing:
 - .1 All systems shall be tested, adjusted and balanced in accordance with Section 23 05 93 – Testing, Adjusting and Balancing for HVAC.
 - .2 Work shall be completed by certified agencies, submit certificates and credentials for all personnel.
 - .3 Submit test instrumentation information and calibration certificates prior to any work.
- .5 Systems Commissioning
 - .1 Carry out commissioning of all installed systems and existing systems where new systems are integrated in accordance with Section 01 91 13 – General Commissioning Requirements.

1.9 ALTERNATE EQUIPMENT

- .1 The design has been prepared based on the “basis of the design” equipment specified in schedules and specifications. If Contractor substitutes the basis of the design equipment with the approved alternates, the Contractor shall incur all costs associated with the re-design and all aspects of the installation of alternate equipment including, but no limited to delivery of equipment to the proposed location, disassembly/reassembly of equipment, removal or relocation of the existing services, additional electrical, structural, architectural or building envelope work as required to accommodate alternate equipment.

2.1 GENERAL

- .1 All materials shall be new in accordance with the specifications of contract documents.
- .2 All products shall be listed and approved by relevant authorities.
- .3 All equipment and materials shall be transported, stored, craned, rigged and moved in accordance with manufacturer’s instructions; any damages to equipment and/or parts of equipment shall be replaced by Contractor at no cost to Owner.

2.2 ACCESS PANELS/DOORS



- .1 Provide access panels at all locations of concealed equipment, fittings requiring access for operation, maintenance and repair including but not limited to balancing dampers, fire dampers, smoke dampers, fire/smoke dampers, motorized dampers, sensors, filters and other components and devices requiring maintenance/service access.
- .2 Access doors shall be located to provide complete access to concealed equipment and devices.
- .3 Construction:
 - .1 Plaster or wet wall: 16 ga steel flush with surface complete with gasket and concealed flange.
 - .2 Masonry or drywall: 16 ga steel flush with surface complete with gasket and concealed flange.
- .4 Finish:
 - .1 Tiled or marble surfaces: type 304 stainless steel, #4 satin polish.
 - .2 Other areas: prime coated steel, finished to match adjacent.
- .5 Options and accessories:
 - .1 Continuous concealed hinges.
 - .2 Adjustable anchoring straps to suit installation.
 - .3 Mineral wool insulation (for fire rated panels).
 - .4 Self latching screw driver operated slam latch.
 - .5 Automatic panel closer.
 - .6 Inside latch release.
- .6 Sizing:
 - .1 Access panels/doors shall be of adequate size to facilitate access to all components. The following are minimum recommended sizes:
 - .1 Hand access: 300x300mm (12"x12")
 - .2 Body entry access: 600x600mm (24"x24")
- .7 Fire rating
 - .1 Access doors/panels installed in fire rated floor and wall assemblies shall have similar fire rating and corresponding ULC label.

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 Owner's Representative.
 - .2 Inform Consultant 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 Consultant.
- .2 Carry out field inspections of the proposed work and existing conditions affecting work prior to tender submission. Additional inspections may be arranged thru Owner's Representative. No additional costs will be considered for additional work where these conditions would have been discovered by such inspections. Report any potential challenges and issues which may impact proposed work to the Consultant for clarification within Q&A period, during Tender phase.

3.2 PAINTING REPAIRS AND RESTORATION

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

3.3 CLEARANCES

- .1 Provide clearance around systems, equipment and components for observation of operation, inspection, servicing, maintenance and as recommended by manufacturer, codes and bylaws.
- .2 Provide space for disassembly, removal of equipment and components as recommended by manufacturer, codes and bylaws without interrupting operation of other system, equipment, components.
- .3 Contractor shall coordinate installation of each equipment components with all trades prior to any work to avoid service obstruction to equipment. Any infractions of service clearances be responsibility of the contractor and must be corrected prior to substantial completion.

3.4 DIELECTRIC COUPLINGS

- .1 Provide on connections between dissimilar metals.
- .2 50mm (NPS 2) and under: provide insulating unions.
- .3 65mm (NPS 2 1/2) and over: provide insulating flanges.



- .4 Isolation shall be provided where piping may come in contact with dissimilar metals including hangers, supports, joists and studs.

3.5 SLEEVES

- .1 General: install where pipes pass through masonry, concrete structures, fire rated assemblies, and as indicated.
- .2 Material: schedule 40 black steel pipe.
- .3 Construction: use annular fins continuously welded at mid-point at foundation walls and where sleeves extend above finished floors.
- .4 Sizes: 6 mm minimum clearance between sleeve and uninsulated pipe or between sleeve and insulation.
- .5 Provide minimum 50mm (2") extended sleeves above floors prone to collection of water including but not limited to mechanical rooms, janitor closets, plenums, shafts.
- .6 Where passing thru fire rated assemblies, seal space between sleeve and piping with listed non-combustible insulation to meet fire rating of given assembly.
- .7 Provide tight fitting clamps on each side of the sleeve and finish with chrome plated escutcheons at penetrations in finished surfaces and millwork.
- .8 Before installation, paint exposed exterior surfaces with heavy application of zinc-rich paint to CAN/CGSB-1.181
- .6 Sealing:
 - .1 Foundation walls and below grade floors: fire retardant, waterproof non-hardening mastic.
 - .2 Elsewhere:
 - .1 Provide space for fire stopping.
 - .2 Maintain the fire-resistance rating integrity of the fire separation.
 - .3 Sleeves installed for future use: fill with lime plaster or other easily removable filler.
 - .4 Ensure no contact between copper pipe or tube and sleeve.

3.6 ESCUTCHEONS

- .1 Install on pipes passing through walls, partitions, floors, and ceilings in finished areas.
- .2 Construction: one piece type with set screws.
 - .1 Chrome or nickel plated brass or type 302 stainless steel.



- .3 Sizes: outside diameter to cover opening or sleeve.
 - .1 Inside diameter to fit around pipe or outside of insulation if so provided.

3.7 PREPARATION FOR FIRE STOPPING

- .1 Coordinate the installation of fire stopping around pipes, insulation and adjacent fire separation in accordance with Section 07 84 00 - Fire Stopping.
- .2 Pipes subject to movement: conform to fire stop system design listing to ensure pipe movement without damaging fire stopping material or installation.
- .3 Insulated pipes: ensure integrity of insulation and vapour barriers.

3.8 EXISTING SYSTEMS

- .1 Connect into existing piping systems at times approved by Departmental Representative. Provide detailed Methods of Procedures (MOP) for all connections to the existing systems.
- .2 Request written approval by Departmental Representative 10 days minimum, prior to commencement of work.
- .3 Unless otherwise noted, connections to the existing live piping systems shall be completed via hot tapping means to minimize system shut downs. Pipe freezing shall also be used when isolation valve is not available to prevent disruption of the piping network.
- .4 Be responsible for damage to existing plant by this work.

3.9 FIELD QUALITY CONTROL

- .1 Site Tests: conduct following tests in accordance with Section 01 45 00 - Quality Control and submit reports.
- .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.
 - .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.

3.10 MECHANICAL AND ELECTRICAL COORDINATION

- .1 All motor control centers, starters, power wiring and conduit shall be provided by Division 26.
- .2 Where packaged mechanical equipment is shipped with integrated starter, Division 26 shall



- provide power wiring in conduit. Refer to schedules and relevant specifications for details.
- .3 All remote disconnect switches, service receptacles shall be provided by Division 26.
 - .4 All mechanical control wiring shall be provided by this division, except for life safety and fire alarm systems.
 - .5 All motors for mechanical systems shall be provided by this division.
 - .6 Wiring to smoke dampers, combination fire and smoke dampers, damper end switches shall be provided by Division 26.
 - .7 All relays required for mechanical systems shall be provided by this division.
 - .8 Electric heat tracing systems for piping systems and basin heaters for cooling tower sumps shall be provided by this division, with power provisions by Division 26.
 - .9 All relays and mechanical systems shutdowns by fire alarm systems shall be provided by Division 26.
 - .10 Mechanical contractor shall coordinate with Division 26 for all power requirements to mechanical control systems; Division 26 to provide power wiring and transformer where required.

3.11 DEMONSTRATION

- .1 Owner's Representative may 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 Contractor shall record these demonstrations on video tape for future reference.

3.12 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 00 - Cleaning.
 - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00 - Cleaning.
- .3 Waste Management: separate waste materials for reuse and recycling in accordance with



Section 01 74 19 - Waste Management and Disposal.

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

3.13 PROTECTION

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

END OF SECTION



1 GENERAL

1.1 REFERENCE STANDARDS

- .1 American National Standards Institute/American Society of Mechanical Engineers (ANSI/ASME)
 - .1 ANSI/ASME B31.1, Power Piping.
 - .2 ANSI/ASME B31.3, Process Piping.
 - .3 ANSI/ASME Boiler and Pressure Vessel Code:
 - .1 BPVC 2007 Section I: Power Boilers.
 - .2 BPVC 2007 Section V: Nondestructive Examination.
 - .3 BPVC 2007 Section IX: Welding and Brazing Qualifications.
- .2 American National Standards Institute/American Water Works Association (ANSI/AWWA)
 - .1 ANSI/AWWA C206, Field Welding of Steel Water Pipe.
- .3 American Welding Society (AWS)
 - .1 AWS C1.1M/C1.1, Recommended Practices for Resistance Welding.
 - .2 AWS Z49.1, Safety in Welding, Cutting and Allied Process.
 - .3 AWS W1, Welding Inspection Handbook..
- .4 CSA Group (CSA)
 - .1 CSA W47.1, Certification of Companies for Fusion Welding of Aluminum.
 - .2 CSA W48, Filler Metals and Allied Materials for Metal Arc Welding.
 - .3 CSA B51, Boiler, Pressure Vessel and Pressure Piping Code.
 - .4 CSA-W117.2, Safety in Welding, Cutting and Allied Processes.
 - .5 CSA W178.1, Certification of Welding Inspection Organizations.
 - .6 CSA W178.2, Certification of Welding Inspectors.

1.2 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 and welding procedures to Consultant within 15 days of project award and prior to any work.
- .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.

1.3 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.
- .3 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding and packaging materials in accordance with Section 01 74 19 - Waste Management and Disposal.

2 PRODUCTS

2.1 ELECTRODES

- .1 Electrodes: in accordance with CSA W48 Series

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 B31.1, 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 special procedures specified elsewhere in Mechanical Division 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 50mm (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 Owner's Representative before work is started.
- .2 Formulate "Inspection and Test Plan" in co-operation with Owner's 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:
 - .1 Perform examinations and tests by specialist qualified to CSA W178.1 and CSA W178.2 and approved by Consultant.
 - .2 To ANSI/ASME Boiler and Pressure Vessels Code, Section V, CSA B51 and



requirements of authority having jurisdiction

- .3 Inspect and test welds in accordance with "Inspection and Test Plan" by non-destructive visual examination and magnetic particle (hereinafter referred to as "particle") tests and/or spot or full gamma ray radiographic (hereinafter referred to as "radiography") tests. As per applicable reference standard or as specified.
- .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 Consultant of total of up to 15% of welds, selected at random by Consultant by radiographic tests.
- .5 Full radiographic tests for steam piping systems.
 - .1 Spot radiography:
 - .1 Conduct spot radiographic tests of up to 10% of welds, selected at random by Consultant from welds which would be most difficult to repair in event of failure after system is operational.
 - .2 Radiographic film:
 - .1 Identify each radiographic film with date, location, name of welder, and submit to Consultant. Replace film if rejected because of poor quality.
 - .3 Interpretation of radiographic films:
 - .1 By qualified radiographer, submit report describing observations and recommendations.
 - .4 Failure of radiographic tests:
 - .1 Extend tests to welds by welder responsible when those welds fails tests.
 - .2 Repair or replace all failed welds, joints as required.

3.6 DEFECTS CAUSING REJECTION

- .1 As described in ANSI/ASME B31.1 and ANSI/ASME Boiler and Pressure Vessels Code
- .2 In addition, chilled water systems below 1,034 kPa (100 psi):
 - .1 Undercutting greater than 0.8 mm adjacent to cover bead on outside of pipe.
 - .2 Undercutting greater than 0.8 mm adjacent to root bead on inside of pipe.



- .3 Undercutting greater than 0.8 mm at combination of internal surface and external surface.
- .4 Incomplete penetration and incomplete fusion greater than total length of 38 mm in 1500 mm length of weld depth of such defects being greater than 0.8 mm.
- .5 Repair cracks and defects in excess of 0.8 mm in depth.
- .6 Repair defects whose depth cannot be determined accurately on basis of visual examination or radiographic tests.

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 WELDING SMOKE MANAGEMENT AND RESTRICTIONS

- .1 Welding, soldering, cutting, grinding or any other work resulting in fumes, smoke or dust particles inside mechanical plenums or rooms used as a return air plenum for HVAC systems is not permitted during regular hours when HVAC systems are in operation to prevent recirculation of smoke and dust particles. Welding in these areas shall be completed during afterhours, once equipment is shut down. All surfaces must be thoroughly cleaned by qualified personnel using soap and steam prior to reinstating equipment in operation.
- .2 Welding in contained spaces such as service shafts, tunnels, crawl spaces, etc shall only be carried out once effective means of smoke evacuation is provided. Contractor shall be responsible for assessing existing site conditions and preparing smoke management plan prior to welding operations, submit plan to Owner's Representative and Consultant for approval prior to any work. These measures may include but not be limited to temporary floor/wall openings, air transfer fans, HEPA filtration and scrubber units, fume extraction equipment, temporary power provisions, temporary generator, hoarding, fencing, fire alarm bypasses, fire watch, etc as required to provide effective management and evacuation of welding fumes.
- .3 Contractor shall be responsible for coordinating with welding personnel and other sub-trades to prepare smoke management plant, supply labour and materials for execution.
- .4 Contractor shall be solely responsible for all costs associated with the requirements in this section.

3.9 CLEANING

- .1 Clean in accordance with Section 01 74 00 - Cleaning.
- .2 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 19 - Waste Management and Disposal.



END OF SECTION



1 GENERAL

1.1 REFERENCE STANDARDS

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

1.2 ACTION AND INFORMATIONAL SUBMITTALS

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

2 PRODUCTS

2.1 MANUFACTURER'S EQUIPMENT NAMEPLATES

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

2.2 SYSTEM NAMEPLATES

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



Size # 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.
 - .3 Rooftop/outdoor equipment: use size#9.
 - .4 Equipment concealed above ceiling or inside walls: use size#2 secured to ceiling or wall.
 - .5 Equipment elsewhere: sizes as appropriate.

2.3 EXISTING IDENTIFICATION SYSTEMS

- .1 Apply existing identification system to new work.
- .2 Where existing identification system does not cover for new work, use identification system specified this section.
- .3 Before starting work, obtain written approval of identification system from Owner's Representative and Consultant.

2.4 PIPING SYSTEMS GOVERNED BY CODES

- .1 Identification:
 - .1 Natural and propane gas: to CSA/CGA B149.1. Piping shall be painted in yellow colour with markers indicating service ("natural gas" or "propane gas") and service pressure ("XX psi" or "XX in w.c."). Paint shall encompass entire surface area of the pipe, apply paint prior to installation at roof level. All piping installed at roof level and other exterior areas shall be weatherproof.
 - .2 Sprinklers: to NFPA 13.
 - .3 Standpipe and hose systems: to NFPA 14.

2.5 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 Owner's Representative and Consultant.
 - .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
Domestic hot water supply	Green	DOM. HW SUPPLY
Dom. HWS recirculation	Green	DOM. HW CIRC
Domestic cold water supply	Green	DOM. CWS
Storm water	Green	STORM
Sanitary	Green	SAN
Plumbing vent	Green	SAN. VENT
Natural gas	to Codes	
Propane	to Codes	



Contents	Background colour marking	Legend
Gas regulator vents	to Codes	

2.6 IDENTIFICATION DUCTWORK SYSTEMS

- .1 50 mm (2 inch) high stencilled letters and directional arrows 150 mm (6 inch) long x 50 mm (2 inch) high.
- .2 Colours: back, or co-ordinated with base colour to ensure strong contrast.
- .3 Identification to include air flow type (supply air, exhaust air, return air, etc), airflow direction and associated system (RTU-X, AHU-X, EF-X, SF-X, RF-X, etc).

2.7 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.

2.8 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.
- .3 Provide label on ceiling tile or access door to identify each control valves and devices.

2.9 CONCEALED DEVICES

- .1 Provide 25mm (1 inch) high nameplates for all devices and equipment concealed above ceiling (plaster, t-bar, etc) and within walls or chases.
- .2 Labels shall be color coded for each system's type as follows:
 - .1 Red – fire and fire/smoke dampers
 - .2 Yellow – HVAC terminals (VAV, fan powered boxes, coils, etc), devices (fans, dampers, etc), control and isolation valves
 - .3 Green – plumbing and drainage
- .3 Confirm colours and locations with Owner's Representative prior to installation.

2.10 SYSTEM DIAGRAMS

- .1 Provide one A1 size (841x594mm) laminated color control system diagram on 12mm thick backboard for each mechanical system including heating water, chilled water, condenser water, glycol, air handling.
- .2 Install system diagram inside mechanical room or control room, confirm location with Owner's representative prior to installation.

2.11 LANGUAGE



- .1 Identification in English.

3 EXECUTION

3.1 TIMING

- .1 Provide identification only after painting has been completed.

3.2 INSTALLATION

- .1 Perform work in accordance with CAN/CGSB-24.3 except as specified otherwise.
- .2 Provide ULC and CSA registration plates as required by respective agency.

3.3 NAMEPLATES

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

3.4 LOCATION OF IDENTIFICATION ON PIPING AND DUCTWORK SYSTEMS

- .1 On long straight runs in open areas in boiler rooms, equipment rooms, galleries, tunnels: at not more than 17 m intervals and more frequently if required to ensure that at least one is visible from any one viewpoint in operating areas and walking aisles.
- .2 Adjacent to each change in direction.
- .3 At least once in each small room through which piping or ductwork passes.
- .4 On both sides of visual obstruction or where run is difficult to follow.
- .5 On both sides of separations such as walls, floors, partitions.
- .6 Where system is installed in pipe chases, ceiling spaces, galleries, confined spaces, at entry and exit points, and at access openings.
- .7 At beginning and end points of each run and at each piece of equipment in run.
- .8 At point immediately upstream of major manually operated or automatically controlled valves, and dampers. 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.



3.5 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 Consultant. Provide one copy (reduced in size if required) in each operating and maintenance manual.
- .3 Number valves in each system consecutively.

3.6 CLEANING

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

END OF SECTION



1 GENERAL

1.1 SUMMARY

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

1.2 REFERENCE STANDARDS

- .1 American Society of Heating, Refrigerating and Air Conditioning Engineers, Inc. (ASHRAE):
 - .1 Handbook, HVAC Applications ASHRAE Handbook, Chapter 39, Testing, Adjusting, and Balancing and Chapter 49, Sound and Vibration Control
 - .2 Standard 111, Measurement, Testing, Adjusting and Balancing of Building HVAC Systems
- .2 National Environmental Balancing Bureau (NEBB):
 - .1 Procedural Standards for Testing, Adjusting, Balancing of Environmental Systems.
 - .2 Procedural Standards for the Measurement of Sound and Vibration.
 - .3 Standard for Whole Building Technical Commissioning of New Construction.
- .3 Sheet Metal and Air Conditioning Contractors National Association (SMACNA):
 - .1 HVAC SYSTEMS Testing, Adjusting and Balancing TABB- TAB Procedural Guide.

1.3 QUALIFICATIONS OF TAB PERSONNEL

- .1 Submit to Consultant within 90 days of award of contract the following information on TAB agency:
 - .1 Names of personnel responsible for TAB, their qualifications and experience
 - .2 Certificates of calibration for all test equipment, must be valid within 3 months of the TAB activities.
 - .3 TAB procedures
 - .4 Sample TAB report and forms
- .2 Provide documentation confirming qualifications, successful experience.
- .3 TAB: performed in accordance with the requirements of standard under which TAB Firm's



qualifications are approved:

- .1 Associated Air Balance Council, (AABC) National Standards for Total System Balance, MN-1.
- .2 National Environmental Balancing Bureau (NEBB) TABES, Procedural Standards for Testing, Adjusting, Balancing of Environmental Systems.
- .3 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA), HVAC TAB HVAC Systems - Testing, Adjusting and Balancing.
- .4 Recommendations and suggested practices contained in the TAB Standard: mandatory.
- .5 Use TAB Standard provisions, including checklists, and report forms to satisfy Contract requirements.
- .6 Use TAB Standard for TAB, including qualifications for TAB Firm and Specialist and calibration of TAB instruments.
- .7 Where instrument manufacturer calibration recommendations are more stringent than those listed in TAB Standard, use manufacturer's recommendations.
- .8 TAB Standard quality assurance provisions such as performance guarantees form part of this contract.
 - .1 For systems or system components not covered in TAB Standard, use TAB procedures developed by TAB Specialist.
 - .2 Where new procedures, and requirements, are applicable to Contract requirements have been published or adopted by body responsible for TAB Standard used (AABC, NEBB, or TABB), requirements and recommendations contained in these procedures and requirements are mandatory.
- .9 Qualifications
 - .1 TAB agency and lead technician shall be AABC or NEBB certified, in good standing and valid certificates for the duration of the entire project.

1.4 PURPOSE OF TAB

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



- .4 Adjust and balance domestic cold, hot and recirculation systems.
- .5 Carry out equipment and duct leakage testing.
- .6 Establish differential pressure setpoint(s) for all hydronic systems and static pressure setpoint(s) for all air systems, coordinate setpoints with controls contractor.
- .7 Test and verify accuracy of all air and water metering devices across entire operating range and at minimum at 25%, 50%, 75% and 100% of the design flows. Provide report to Consultant. Where accuracy does not match specified tolerances, coordinate with the respective contractor or manufacturer to arrange for calibration or replacement of devices as required. Re-test devices following repairs, calibration or replacement to verify accuracy.
- .8 Test and adjust minimum outdoor air damper to match specified air flows for each system, coordinate setpoints with controls contractor.
- .9 Provide final marking on permanent labels of final settings and corresponding values (flows, pressure, etc) of all HVAC systems.
- .10 Carry out intermediate test(s) and final test as required, provide reports to Consultant.

1.5 CO-ORDINATION

- .1 Schedule time required for TAB (including repairs, re-testing) into project construction and completion schedule to ensure completion before acceptance of project.
- .2 Do TAB of each system independently and subsequently, where interlocked with other systems, in unison with those systems.
- .3 Ensure cleaning of the systems has been completed and all air system filter media and water systems strainers, suction guides have been replaced with clean units.

1.6 PRE-TAB REVIEW

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

1.7 START-UP

- .1 Follow start-up procedures as recommended by equipment manufacturer unless specified otherwise.



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

1.8 OPERATION OF SYSTEMS DURING TAB

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

1.9 START OF TAB

- .1 Notify Owner's Representative and Consultant minimum 10 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, and caulking.
 - .5 Pressure, leakage, other tests specified elsewhere Division 23.
 - .6 Provisions for TAB installed and operational.
 - .7 Start-up, verification for proper, normal and safe operation of mechanical and associated electrical and control systems affecting TAB including but not limited to:
 - .1 Proper thermal overload protection in place for electrical equipment.
 - .2 Air systems:
 - .1 Filters in place, clean.
 - .2 Duct systems clean.
 - .3 Ducts, air shafts, ceiling plenums are airtight to within specified tolerances.
 - .4 Correct fan rotation.
 - .5 Fire, smoke, volume control dampers installed and open.
 - .6 Coil fins combed, clean.
 - .7 Access doors, installed, closed.
 - .8 Outlets installed, volume control dampers open.
 - .3 Liquid systems:
 - .1 Flushed, filled, vented.
 - .2 Correct pump rotation.
 - .3 Strainers in place, baskets clean.



- .4 Isolating and balancing valves installed, open.
- .5 Calibrated balancing valves installed, at factory settings.
- .6 Chemical treatment systems complete, operational.
- .7 Bypass valves in closed position.
- .8 Verify expansion tank charge pressure and ensure tank is not waterlogged.
- .9 Verify pressure reducing valve settings.
- .10 Verify system is free of air and air vents are installed and properly operating.

1.10 APPLICATION TOLERANCES

- .1 Do TAB to following tolerances of design values:
 - .1 Air handling units, exhaust fans: plus 10%, minus 0%
 - .2 Hydronic systems: plus 10%, minus 5%
 - .3 Exhaust hoods: plus 10%, minus 0%
 - .4 Minimum outside air: plus 10%, minus 0%
 - .5 Grilles, diffusers, registers: plus 10%, minus 5%
 - .5 Terminal units: plus 10%, minus 5%

1.11 INSTRUMENTS

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

1.12 ACTION AND INFORMATIONAL SUBMITTALS

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

1.13 PRELIMINARY TAB REPORT

- .1 Submit for checking and approval of Consultant, prior to submission of formal TAB report, sample of rough TAB sheets. Include:



- .1 Details of instruments used.
- .2 Details of TAB procedures employed.
- .3 Calculations procedures.
- .4 Summaries.

1.14 TAB REPORT

- .1 Format in accordance with referenced standard.
- .2 TAB report to show results in SI units and to include:
 - .1 Air Systems
 - .1 Project record drawings.
 - .2 System schematics.
 - .3 Fan curves and operating conditions plotted, include fan speed, kW, Amps, Voltage
 - .4 Instrumentation procedures
 - .5 Static profile for each air handling system
 - .6 Distribution air flows (registers, grilles, terminal units, mains and duct branch to each zone)
 - .7 Coils entering and leaving dry bulb and wet bulb temperatures
 - .8 Outside, return, supply, exhaust air flows for each air handling system in various modes of operation including economizer off (min OA), economizer on (max OA)
 - .9 Verification of all air flow metering devices accuracy at 25%, 50%, 75% and 100% of the design air volumes
 - .10 Verification of all temperature, humidity and CO2 sensors accuracy
 - .11 Description of noted, corrected and uncorrected deficiencies and applicable explanatory comments on the test results and variance between the design and actual values. Include recommendations for further action.
 - .3 Submit TAB Report in PDF format to Consultant for verification and approval, in English..

2 PRODUCTS



2.1 NOT USED

- .1 Not used.

3 EXECUTION

3.1 VERIFICATION

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

3.2 SETTINGS

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

3.3 COMPLETION OF TAB

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

3.4 AIR AND WATER SYSTEMS

- .1 Standard: TAB to most stringent of AABC, NEBB or SMACNA.
- .2 Do TAB of systems, equipment, components, controls specified Division 23.
- .4 Measurements: to include as appropriate for systems, equipment, components, controls: air/water velocity, static pressure, flow rates, pressure drop (or loss), temperatures (dry bulb, wet bulb, dewpoint), duct cross-sectional area, RPM, electrical power, voltage, noise, vibration.
- .7 Locations of systems measurements to include as appropriate: main ducts, main branch, sub-branch, run-out (or grille, register or diffuser).

3.5 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 Laboratory fume hoods:
 - .1 Standard: Treasury Board of Canada Handbook of Occupational Health and safety, 4th edition and applicable Provincial standards.
 - .2 TAB procedures: as described in standard.
- .3 Building pressure conditions:
 - .1 Adjust HVAC systems, equipment, controls to ensure specified pressure conditions during winter, summer design conditions at all times.
- .4 Zone pressure differences:
 - .1 Adjust HVAC systems, equipment, controls to establish specified air pressure differentials, with systems in every possible combinations of normal operating modes.
- .5 Smoke management systems:
 - .1 Test for proper operation of all smoke and fire dampers, interlock with fan systems, sensors, detectors, installed as component parts of air systems specified Division 23.
- .6 Measurement of noise and vibration from equipment specified in Division 23.

3.5 PHASING

- .1 TAB activities to follow project with areas shall be completed per the project phasing. Upon completion of the project all areas shall have been tested and balanced per the contract documents.
- .2 Systems serving areas outside of the project scope shall not be adversely affected. Provide measure existing parameters to document system capacity of these areas.

3.6 POST-OCCUPANCY TAB

- .1 Complete necessary adjustments of systems as required to meet design operating conditions, submit proposed measures and adjustments to Consultant for review and approval prior to implementation.

END OF SECTION



1 GENERAL

1.1 REFERENCE STANDARDS

- .1 American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)
 - .1 NSI/ASHRAE/IESNA 90.1, SI; Energy Standard for Buildings Except Low-Rise Residential Buildings.
- .2 ASTM International (ASTM)
 - .1 ASTM B209M, Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric).
 - .2 ASTM C335, Standard Test Method for Steady State Heat Transfer Properties of Pipe Insulation.
 - .3 ASTM C411, Standard Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation.
 - .4 ASTM C449/C449M, Standard Specification for Mineral Fiber-Hydraulic-Setting Thermal Insulating and Finishing Cement.
 - .5 ASTM C547, Standard Specification for Mineral Fiber Pipe Insulation.
 - .6 ASTM C553, Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.
 - .7 ASTM C612, Standard Specification for Mineral Fiber Block and Board Thermal Insulation.
 - .8 ASTM C795, Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel.
 - .9 ASTM C921, Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.
 - .10 ASTM C1136, Standard Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation.
 - .11 ASTM C1290, Standard Specification for Flexible Fibrous Glass Blanket Insulation Used to Externally Insulate HVAC Ducts.
 - .12 ASTM C1338, Test Method for Determining Fungi resistance of Insulation Materials and Facings
 - .13 ASTM E84, Standard Test Method for Surface Burning Characteristics of Building Materials.



- .3 Canadian General Standards Board (CGSB)
 - .1 CGSB 51-GP-52Ma, Vapour Barrier, Jacket and Facing Material for Pipe, Duct and Equipment Thermal Insulation.
- .4 Green Seal Environmental Standards (GSES)
 - .1 Standard GS-36, Commercial Adhesives.
- .5 South Coast Air Quality Management District (SCAQMD), California State
 - .1 SCAQMD Rule 1168, Adhesive and Sealant Applications.
- .6 Thermal Insulation Association of Canada (TIAC): National Insulation Standards (2005).
- .7 Underwriters Laboratories of Canada (ULC)
 - .1 CAN/ULC-S102, Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.
 - .2 CAN/ULC-S701, Standard for Thermal Insulation, Polystyrene, Boards and Pipe Covering.

1.2 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.

1.4 QUALITY ASSURANCE

- .1 Qualifications:
 - .1 Installer: specialist in performing work of this section, and have at least 3 years successful experience in this size and type of project, qualified to standards, member of TIAC.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle in accordance with Section 01 61 00 - Common Product



Requirements.

- .2 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address and ULC markings.

2 PRODUCTS

2.1 FIRE AND SMOKE RATING

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

2.2 INSULATION

- .1 Glass fiber insulation with integrated vapour barrier, minimum thickness as scheduled in PART 3.
- .2 Thermal conductivity ("k" factor) not to exceed 0.042 W/m/°C at 24°C mean temperature when tested in accordance with ASTM C335.
- .3 TIAC Code C-1: Rigid mineral fibre board to ASTM C612, with factory applied vapour retarder jacket to CGSB 51-GP-52 Ma (as scheduled in PART 3 of this Section)
- .4 TIAC Code C-2: Mineral fibre blanket to ASTM C553 faced with factory applied vapour retarder jacket to CGSB 51-GP-52 Ma (as scheduled in PART 3 of this section)
 - .1 Mineral fibre: to ASTM C553
 - .2 Jacket: to CGSB 51-GP-52 Ma
 - .3 Maximum "k" factor: to ASTM C553
- .5 Insulating materials shall be free of asbestos, lead, mercury or mercury compounds.
- .6 Standard of acceptance: Johns Manville Microlite FSK, Owens Corning FRK or approved equivalent.

2.4 JACKETS

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



- .1 Maximum VOC limit 50 g/L
- .3 Aluminum:
 - .1 To ASTM B209 with or without moisture barrier as scheduled in PART 3 of this section.
 - .2 Thickness: 0.50 mm sheet.
 - .3 Finish: Corrugated.
 - .4 Jacket banding and mechanical seals: 19 mm wide, 0.5 mm thick stainless steel.
- .4 Stainless steel:
 - .1 Type: 304 or 316 stainless steel.
 - .2 Thickness: 0.50 mm sheet.
 - .3 Finish: Corrugated.
 - .4 Jacket banding and mechanical seals: 19 mm wide, 0.5 mm thick stainless steel.

2.5 ACOUSTIC DUCT LINING

- .1 Rigid fiber glass board meeting or exceeding ASTM C1071 Type II duct liner requirements.
- .2 Sound absorption coefficient (NRC) of minimum 0.75 for 25mm (1 in) thick lining as tested in accordance with ASTM C423 and ASTM E795.
- .3 Thermal conductance of 1.31 W/m² °C (0.23 BTU/hr ft² °F).
- .4 Adhesive to ASTM C916.
- .5 Standard of acceptance: Johns Manville Linacoustic R-300, Owens Corning QUIETR or approved equivalent.

2.5 ACCESSORIES

- .1 Vapour retarder lap adhesive:
 - .1 Water based, fire retardant type, compatible with insulation.
 - .1 Maximum VOC limit 50 g/L.
- .2 Indoor Vapour Retarder Finish:
 - .1 Vinyl emulsion type acrylic, compatible with insulation.
- .3 Insulating Cement: hydraulic setting on mineral wool, to ASTM C449
- .4 ULC Listed Canvas Jacket:
 - .1 220 gm/m² cotton, plain weave, treated with dilute fire retardant lagging adhesive to



ASTM C921.

- .5 Outdoor Vapour Retarder Mastic:
 - .1 Vinyl emulsion type acrylic, compatible with insulation.
 - .2 Reinforcing fabric: Fibrous glass, untreated 305 g/m².
- .6 Tape: self-adhesive, aluminum, reinforced, 75 mm wide minimum.
- .7 Contact adhesive: quick-setting
 - .1 Maximum VOC limit 50 g/L.
- .8 Canvas adhesive: washable.
 - .1 Maximum VOC limit 50 g/L.
- .9 Tie wire: 1.5 mm stainless steel.
- .10 Banding: 19 mm wide, 0.5 mm thick stainless steel.
- .11 Facing: 25 mm stainless steel hexagonal wire mesh stitched on both faces of insulation.
- .12 Fasteners: 4 mm diameter pins with 35 mm diameter clips, length to suit thickness of insulation.

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.
- .2 Provide thermal insulation on ductwork distribution as noted on plans and as follows:
 - .1 Outdoor air intake – all ductwork shall be thermally insulated, including plenums
 - .2 Exhaust air – insulate first 3m (10 ft) from wall or roof penetration.
 - .3 Supply/return air – insulate all ductwork passing through unconditioned spaces and plenums.
 - .4 ERV – insulate entire length of outdoor and exhaust air ductwork between outside wall or roof and ERV unit.

3.2 PREINSTALLATION 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 - Hangers and Supports for HVAC Piping and Equipment.
 - .1 Apply high compressive strength insulation where insulation may be compressed by weight of ductwork.
- .6 Fasteners: install at 300 mm on centre in horizontal and vertical directions, minimum 2 rows each side.
- .7 Where a vapor retarder is specified, seal tears, punctures and other penetrations of the duct wrap facing using one of the above methods to provide a vapor tight system.
- .8 Upon completion of insulation work and before operation is to commence, visually inspect the work and verify that it has been correctly installed.
- .9 Check the duct system to ensure that there are no air leaks through joints.
- .10 Open all system dampers and turn on fans to blow all scraps and other loose pieces of material out of the duct system. Allow for a means of removal of such material.
- .11 Replace damaged insulation, which cannot be satisfactorily repaired, including insulation with duct liner damage and moisture- saturated insulation.
- .12 The insulation contractor shall advise the general and/or the mechanical contractor as to requirements for protection of the insulation work during the remainder of the construction period, to avoid damage and deterioration of the finished insulation work.
- .13 Duct liner shall be installed in accordance with manufacturer's instructions and NAIMA Fibrous Glass Duct Liner Installation Standard.

3.4 DUCTWORK INSULATION SCHEDULE

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



	TIAC Code	Vapour Retarder	Thickness (mm)
Rectangular cold and dual temperature supply air ducts	C-1	Yes	50
Round cold and dual temperature supply air ducts	C-2	yes	50
Rectangular warm air ducts	C-1	No	25
Round warm air ducts	C-1	no	25
Supply, return and exhaust ducts exposed in space being served			none
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	Yes	50
Round ducts outside	C-1	Yes	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 00 - Cleaning.
- .1 Remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION



1 GENERAL

1.1 REFERENCE STANDARDS

- .1 American Society of Mechanical Engineers (ASME)
 - .1 ASME B16.5, Pipe Flanges and Flanged Fittings.
 - .2 ASME B16.18, Cast Copper Alloy Solder Joint Pressure Fittings.
 - .3 ASME B16.22, Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings.
 - .4 ASME B18.2.1, Square and Hex Bolts and Screws Inch Series.
- .2 ASTM International (ASTM)
 - .1 ASTM A47/A47M, Standard Specification for Ferritic Malleable Iron Castings.
 - .2 ASTM A53/A53M, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc Coated, Welded and Seamless.
 - .3 ASTM B75M, Standard Specification for Seamless Copper Tube.
 - .4 ASTM B837, Standard Specification for Seamless Copper Tube for Natural Gas and Liquefied Petroleum (LP) Gas Fuel Distribution Systems.
- .3 CSA Group (CSA)
 - .1 CSA W47.1, Certification of Companies for Fusion Welding of Steel.
- .4 CSA Group (CSA)/Canadian Gas Association (CGA)
 - .1 CAN/CSA B137.4, Polyethylene (PE) Piping Systems for Gas Services.
 - .2 CAN/CSA B149.1, Natural Gas and Propane Installation Code.
 - .3 CAN/CSA B149.1HB, Natural Gas and Propane Installation Code Handbook.
 - .4 CAN/CSA B149.2, Propane Storage and Handling Code.
 - .5 CAN/CSA Z662-15, Oil and Gas Pipeline Systems.
- .5 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Safety Data Sheets (SDS).

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Co-ordinate submittal requirements and provide submittals required by Section 01 47 15 -



Sustainable Requirements: Construction.

- .3 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and datasheet for piping, fittings and equipment.
 - .2 Indicate on manufacturers catalogue literature following: valves.
 - .3 Submit WHMIS SDS, indicate VOC's for adhesive and solvents during application and curing.
- .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 Instructions: submit manufacturer's installation instructions.
- .7 Closeout Submittals: submit maintenance and engineering data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.3 QUALITY ASSURANCE

- .1 Pre-Installation Meeting:
 - .1 Convene pre-installation meeting one week prior to beginning work of this Section and on-site installations.
 - .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.
 - .5 Facility services shutdowns.
 - .6 Utility provisions (meter station, etc).
 - .7 AHJ approvals and inspections.
- .2 Qualifications:
 - .1 All work shall be completed by qualified personnel (G1 technicians), holding valid certificates. Submit credentials of all personnel prior to any work.
- .3 Single Source Responsibility:



- .1 Ensure primary materials provided in this Section are each obtained from a single source by a single manufacturer and secondary materials are obtained from sources recommended by primary materials manufacturers.
- .4 System Design Approval:
 - .1 Apply for, on TSSA forms, approval of the gas system design by the TSSA prior to work beginning at the site and prior to ordering any equipment. Submit the completed TSSA Form and copies of shop drawings/product data sheets as required to the TSSA and obtain an approval certificate. Pay all costs for the TSSA review and approval process. If the TSSA requires revisions to the system and the revisions result in an extra cost, a Notice of Change will be issued by the Consultant for the revision.

2 PRODUCTS

2.1 GENERAL

- .1 Provide complete natural gas system to CSA B149.1 and to Canadian Gas Association (CGA) requirements.
- .2 Apply and secure all required permits, fill out applications for new meter or capacity increase where required.
- .3 Provide pressure reducing assemblies, regulating and relief valve assemblies at the interface between appliances and building/site natural gas services. Provide relief piping in accordance with CSA B149.1 and terminate outside.
- .4 Arrange and pay the costs of all inspections by TSSA. Complete necessary repairs where infractions are discovered and schedule follow-up inspection(s) as required to rescind noted infractions.
- .5 Support, paint and label natural gas services in accordance with CSA B149.1.
- .6 Carefully review clearances of all equipment and coordinate with other sub-trades prior to laying out pipework.

2.2 PIPE SYSTEM – ABOVE GROUND

- .1 Steel pipe: to ASTM A53/A53M, Schedule 40, seamless as follows:
 - .1 12mm to 50mm (NPS 1/2 to 2): screwed.
 - .2 65mm (NPS 2 1/2) and over: flanged and welded.
- .2 Copper tube: to ASTM B837
- .3 Jointing Material



- .1 Screwed fittings: pulverized lead paste.
- .2 Welded fittings: to CSA W47.1
- .3 Flange gaskets: nonmetallic flat.
- .4 Brazing: to ASTM B837.
- .4 Fittings
 - .1 Steel pipe fittings, screwed, flanged or welded:
 - .1 Malleable iron: screwed, banded, Class 150.
 - .2 Steel pipe flanges and flanged fittings: to 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 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 ASME B16.18
 - .2 Wrought copper fittings: to ASME B16.22
- .5 Valves
 - .1 Provincial Code approved, lubricated plug or ball type.
 - .2 Standard of acceptance: Kitz 68, Toyo 5044C or Crane F9202.

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 PIPING

- .1 Install in accordance with Section 23 05 05 - Installation of Pipework, applicable Provincial/Territorial Codes, CAN/CSA B149.1, CAN/CSA B149.2, supplemented as specified.
- .2 Install drip points:



- .1 At low points in piping system.
- .2 At connections to equipment.
- .3 Use eccentric reducers at pipe size change to ensure positive drainage.
- .4 Independently support all piping in accordance with CAN/CSA B149.1.
- .5 Pressure test and purge all piping in accordance with CAN/CSA B149.1.
- .6 Provide pressure test tags on all piping.
- .7 Arrange and pay for all inspections by TSSA/AHJ.

3.3 VALVES

- .1 Install valves with stems upright or horizontal unless otherwise approved by Consultant.
- .2 Install valves at branch take-offs to isolate pieces of equipment, and as indicated.

3.4 FIELD QUALITY CONTROL

- .1 Site Tests/Inspection:
 - .1 Test system in accordance with CAN/CSA B149.1, CAN/CSA B149.2 and requirements of authorities having jurisdiction.
- .2 Manufacturer's Field Services:
 - .1 Have manufacturer of products supplied under this Section 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 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 on which 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.
- .3 Obtain reports within 3 days of review and submit immediately to Consultant.

3.5 ADJUSTING

- .1 Purging: purge after pressure test in accordance with CAN/CSA B149.1 and CAN/CSA



B149.2.

.2 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

- .1 Cleaning: in accordance with Section 23 08 16 - Cleaning and Start-Up of HVAC Piping Systems, CAN/CSA B149.1, CAN/CSA B149.2.
- .2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION



1 GENERAL

1.1 REFERENCE STANDARDS

- .1 ASTM International (ASTM)
 - .1 ASTM A480/A480M, Standard Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet and Strip.
 - .2 ASTM A635/A635M, 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, Standard Specification for Steel Sheet, Zinc Coated
- .2 Green Seal Environmental Standards (GS)
 - .1 GS-36, Standard for Adhesives for Commercial Use.
- .3 National Fire Protection Association (NFPA)
 - .1 NFPA 90A, Standard for the Installation of Air-Conditioning and Ventilating Systems.
 - .2 NFPA 90B, Standard for the Installation of Warm Air Heating and Air-Conditioning Systems.
 - .3 NFPA 96, Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations.
- .4 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)
 - .1 SMACNA HVAC Duct Construction Standards - Metal and Flexible.
 - .2 SMACNA HVAC Air Duct Leakage Test Manual.
 - .3 IAQ Guideline for Occupied Buildings Under Construction.

1.2 RELATED REQUIREMENTS

- .1 07 84 00 - Fire Stopping
- .2 23 05 29 - Hangers and Supports for HVAC Piping and Equipment
- .3 23 05 00 – Common Work Results for HVAC
- .4 23 01 31 - Air Duct Cleaning for HVAC Systems
- .4 23 05 94 - Pressure Testing of Ducted Air Systems
- .5 23 05 53 - Identification for HVAC Piping and Equipment



- .6 23 05 93 - Testing, Adjusting and Balancing for HVAC
- .7 23 05 94 – Pressure Testing of Ducted Air Systems
- .8 23 07 13 – Duct Insulation
- .9 23 33 00 – Air Duct Accessories
- .10 23 33 14 – Dampers – Balancing
- .11 23 33 15 – Dampers – Operating
- .12 23 33 16 – Dampers – Fire and Smoke
- .13 23 33 46 – Flexible Ducts
- .14 23 33 53 – Duct Liners

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for ductwork distribution system including ductwork, dampers, accessories. Include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Shop Drawings:
 - .1 Submit drawings for duct distribution system and accessories, including:
 - .1 Rectangular and round ductwork system
 - .2 Duct liner
 - .3 Sealants and gaskets
 - .4 Access doors
 - .5 Dampers - balancing, back draft, motorized
 - .6 Hangers and supports
 - .7 Fire dampers, fire doors, and smoke dampers with installation instructions
 - .8 Sound attenuators, including pressure drop and acoustic performance
 - .9 Flexible ducts and clamps, with manufacturer's installation instructions
 - .10 Flexible connections
 - .11 Instrument test fittings



- .12 Duct system insulation
- .13 Duct system identification
- .4 Test and Evaluation Reports:
 - .1 Certification of Ratings:
 - .1 Catalogue or published ratings to be those obtained from tests carried out by manufacturer or independent testing agency signifying adherence to codes and standards.
- .5 Construction IAQ Management Plan:
 - .1 Submit Indoor Air Quality (IAQ) Plan for construction and pre-occupancy phases of building.
 - .2 During construction meet or exceed the requirements of SMACNA IAQ Guideline for Occupied Buildings Under Construction.

1.4 DELIVERY, STORAGE AND HANDLING

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

2 PRODUCTS

2.1 SEAL CLASSIFICATION

- .1 Classification as follows:

Maximum Pressure Pa	SMACNA Seal Class
500 (2 in w.c.)	C
250 (1 in w.c.)	C



Maximum Pressure Pa	SMACNA Seal Class
125 (0.5 in w.c.)	C

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

2.2 SEALANT

- .1 Sustainability Characteristics:
 - .1 Adhesives and sealants: VOC limit 30 g/L maximum.
- .2 Sealant: oil resistant, water borne, polymer type flame resistant duct sealant. Temperature range of minus 30°C (-22°F) to plus 93°C (200°F).

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 of 1.5 times width of duct.
 - .2 Round: smooth radius or centreline radius of 1.5 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: with radius on branch 1.5 times width of duct or 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 Full radiused elbows as required.
- .7 Obstruction deflectors: maintain full cross-sectional area.
 - .1 Maximum included angles: as for transitions.

2.6 FIRE STOPPING

- .1 Retaining angles around duct, on both sides of fire separation in accordance with Section 07 84 00 - Fire Stopping.
- .2 Coordinate with 07 84 00 - Fire Stopping to ensure fire stopping materials and installation does not distort duct.

2.7 GALVANIZED STEEL

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

2.8 STAINLESS STEEL

- .1 To ASTM A480/A480M, Type 304.
- .2 Finish: number 4.
- .3 Thickness, fabrication and reinforcement: to SMACNA.
- .4 Joints: to SMACNA, to be continuous inert gas welded.

2.9 ALUMINUM



- .1 To SMACNA, aluminum type: 3003-H-14.
- .2 Thickness, fabrication and reinforcement: to SMACNA.
- .3 Joints: to SMACNA, be continuous weld.

2.10 BLACK STEEL

- .1 To ASTM A635/A635M
- .2 Thickness: 1.2 mm or as indicated.
- .3 Fabrication: ducts and fittings to SMACNA.
- .4 Reinforcement: as indicated.
- .5 Joints: continuous weld.

2.11 KITCHEN EXHAUST SYSTEMS

- .1 Construct in accordance with NFPA 96.
- .2 Material: Type 304 stainless steel.
- .3 Thickness: 1.61 mm (16 ga).
- .4 Fabrication: to NFPA 96.
- .5 Flanges: provide gasketed flanges at connection to kitchen exhaust hood and appliances.
- .6 Drainage: provide gasketed cleanouts at every 3m (10ft), thickness and materials of the cleanouts shall match ductwork.
- .7 Grease filters: to Section 23 38 13 - Commercial Kitchen Hoods.

2.12 EXTERIOR DUCTWORK

- .1 All exterior ductwork shall be of watertight construction, insulation, membrane and jacketing materials shall be suitable for exterior use.
- .2 Slope top of duct to prevent ponding of water.
- .3 All curbs shall be at minimum 400mm (16 in) high, unless otherwise noted.
- .4 Provide unistrut duct support system for all exterior ductwork.

2.12 HANGERS AND SUPPORTS

- .1 Hangers and Supports: in accordance with Section 23 05 29 - Hangers and Supports for



HVAC Piping and Equipment.

- .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 galvanized steel rods to SMACNA as follows:

Duct Size	Angle Size	Rod Size
(mm)	(mm)	(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

- .4 Upper hanger attachments:
 - .1 For concrete: manufactured concrete inserts.
 - .2 For steel joist: manufactured joist clamp.
 - .3 For steel beams: manufactured beam clamps.
- .5 Provide saddles at all hangers and supports installed on insulated duct systems.

3 EXECUTION

3.1 GENERAL

- .1 Do work in accordance with referenced standards.
- .2 Do not break continuity of insulation vapour barrier with hangers or rods.



- .1 Insulate strap hangers 100 mm beyond insulated duct, Ensure diffuser is fully seated.
- .3 Support risers in accordance with ASHRAE, SMACNA and as indicated.
- .4 Install breakaway joints in ductwork on sides of fire separation.
- .5 Install proprietary manufactured flanged duct joints in accordance with manufacturer's instructions.
- .6 Manufacture duct in lengths and diameter to accommodate installation of acoustic duct lining.
- .7 All duct sizes are clear inside dimensions, oversize ductwork where interior lining is specified as required to meet required clear inside dimensions.
- .8 Provide fire dampers at penetrations thru all fire rated floors and walls assemblies. Damper shall not restrict free duct area. Provide access panels for all fire and fire & smoke dampers for inspection and maintenance purposes.
- .9 Provide turning vanes in accordance with SMACNA, where installation of full radius or smooth elbows is not practical.
- .10 Provide slopped floors, floor drains c/w trap seals in outside air plenums/sections and humidifier sections, terminate with air gap to nearest floor drain.
- .11 Design drawings indicate general proposed duct routing and do not indicate offsets, fittings, adapters, etc. Contractor shall supply all required devices for a fully functioning system.
- .12 Provide flexible connections at all connections to fans.
- .13 Provide access panels at all balancing, fire, fire & smoke and motorized damper locations to permit inspection and maintenance.

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 SMACNA and as follows:

Duct Size	Spacing
(mm)	(mm)
to 1500	3000
1501 and over	2500



3.3 WATERTIGHT DUCT

- .1 Provide watertight duct for:
 - .1 Dishwasher exhaust.
 - .2 Fresh air intake.
 - .3 Minimum 3,000 mm from duct mounted humidifier in all directions.
 - .4 Exterior ductwork.
 - .5 As indicated.
- .2 Form bottom of horizontal duct without longitudinal seams.
 - .1 Weld joints of bottom and side sheets.
 - .2 Seal other joints with duct sealer.
- .3 Slope horizontal branch ductwork toward exterior louvres c/w weep holes.
 - .1 Slope header ducts down toward risers.
- .4 Fit base of riser with 150 mm deep drain sump and 32 mm drain connected, with deep seal trap and valve, trap primer and discharging to open funnel drain.

3.4 KITCHEN EXHAUST SYSTEMS

- .1 Install to NFPA 96 and as indicated.

3.5 SEALING AND TAPING

- .1 Apply sealant in accordance with SMACNA and to manufacturer's recommendations.
- .2 Bed tape in sealant and recoat with minimum of 1 coat of sealant to manufacturers recommendations.

3.6 LEAKAGE TESTS

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



Consultant for review and approval.

3.7 TESTING, ADJUSTING AND BALANCING

- .1 In accordance with Section 23 05 93 - Testing, Adjusting and Balancing for HVAC.

3.8 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 00 - Cleaning.
 - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00 - Cleaning.
- .3 Carry out cleaning in accordance with Section 23 01 31 - Air Duct Cleaning for HVAC Systems.

END OF SECTION



1 GENERAL

1.1 REFERENCE STANDARDS

- .1 American National Standards Institute/Air Movement and Control Association (ANSI/AMCA)
 - .1 ANSI/AMCA Standard 99, Standards Handbook.
 - .2 ANSI/ASHRAE 51 (ANSI/AMCA 210), Laboratory Methods of Testing Fans for Aerodynamic Performance Rating.
 - .3 ANSI/AMCA Standard 300, Reverberant Room Method for Sound Testing of Fans.
 - .4 ANSI/AMCA Standard 301, Methods for Calculating Fan Sound Ratings from Laboratory Test Data.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for [roof and wall exhausters] and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Shop Drawings:
 - .1 Include:
 - .1 Fan performance curves showing specified point of operation.
 - .2 Sound rating data.
 - .3 Weight and dimensional data.
 - .4 Electrical data and schematics.
 - .5 Accessories (dampers, speed controllers, curb, disconnect switch, etc).

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. Provide confirmation of testing.

- .2 Capacity: as indicated on drawing schedules.
- .2 Statically and dynamically balanced. Constructed to ANSI/AMCA Standard 99
- .3 Sound ratings: comply with ANSI/AMCA Standard 301, tested to ANSI/AMCA Standard 300. Unit shall bear AMCA certified sound rating seal.
- .4 Performance ratings: based on tests performed in accordance with ANSI/AMCA Standard 210, unit to bear AMCA certified rating seal.
- .5 Bearings: sealed lifetime ball bearings or heavy duty grease lubricated ball or roller bearings of self aligning type with oil retaining, dust excluding seals and a certified minimum rated life of 100,000 hours.

2.2 ROOF EXHAUSTERS

- .1 Centrifugal or axial direct driven or V-belt as noted on schedules.
 - .1 Housings: spun aluminum complete with resilient mounted motor and fan.
 - .2 Impeller: aluminum non-overloading.
 - .3 Adjustable motor sheave.
 - .4 12mm mesh 2.0 mm diameter aluminum birdscreen.
 - .5 Motorized gasketed aluminum backdraft dampers.
 - .6 Disconnect switch within fan housing.
 - .7 Continuous curb gaskets, stainless steel securing bolts and screws, and special mated sound insulating 400 mm high curbs where indicated. Hinge curb plate for access to internals for maintenance.
- .2 Sound curbs: of same manufacturer as fan and built to suit model specified.
- .2 Standard of Acceptance
 - .1 Greenheck GB series or approved equal

2.3 TAILPIPE EXHAUST FAN

- .1 Centrifugal direct driven as noted on schedules.
 - .1 Sheet metal, painted grey, RAL 7045.
 - .2 Protection Class IP55



.2 Standard of Acceptance

.1 Nederman NCF or approved equal



3 EXECUTION

3.1 INSTALLATION

- .1 Install in accordance with manufacturer's instructions.
- .2 Provide weather resistance special nameplate on each fan, indicating:
 - .1 Fan tag.
 - .2 Served area(s) or system.
 - .3 Power source.
- .3 All roofing modifications, curb flashing and seal shall be base building roofing vendor.

3.2 CLEANING

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

END OF SECTION



1 GENERAL

1.1 REFERENCE STANDARDS

- .1 Sheet Metal and Air Conditioning Contractors National Association (SMACNA)
- .2 Underwriters' Laboratories of Canada (ULC)

1.2 RELATED REQUIREMENTS

- .1 Section 22 33 00 – Domestic Water Heaters.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for chimneys and stacks and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Shop Drawings:
 - .1 Indicate following:
 - .1 Methods of sealing sections.
 - .2 Methods of expansion.
 - .3 Details of thimbles.
 - .4 Bases/Foundations.
 - .5 Supports.
 - .6 Guy details.
 - .7 Rain caps.
 - .8 Isometric venting system layout, indicating all horizontal and vertical offsets.
 - .9 Flue draft calculations.
 - .10 Warranty certificates.
- .4 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.



1.4 QUALITY ASSURANCE

- .1 Regulatory Requirements: work to be performed in compliance with applicable Provincial regulations.
- .2 Certifications:
 - .1 Catalogued or published ratings: obtained from tests carried out by independent testing agency or manufacturer signifying adherence to codes and standards.
- .3 All products furnished under this Section shall conform to the requirements of The National Fuel Gas Code, ANSI Z223.1 / NFPA-54 and ULC-S636, the Canadian Standard for Type BH gas vent systems. Components coming in direct contact with products of combustion shall carry the appropriate Intertek listing.

1.4 WARRANTY

- .1 The Manufacturer shall warrant the Positive Pressure Vent System against defects in material and workmanship for a period of 15 years from the date of original installation. Any portion of the vent repaired or replaced under the warranty shall be warranted for the remainder of the original warranty period.

2 PRODUCTS

2.1 DIRECT VENT - COMBUSTION AIR VENT

- .1 Chlorinated Polyvinyl Chloride (CPVC) system, ULC S636 Class IIB certification, certified for use up to and including 90°C (194°F).
- .2 Cement and primer materials in accordance with manufacturer's recommendations.
- .2 Standard of acceptance: IPEX System 636 of approved equivalent.

2.3 ACCESSORIES

- .1 Hangers and supports: in accordance with recommendations SMACNA and manufacturer's instructions.
- .2 Wall brackets: provide wall brackets for securement of vent system in accordance with manufacturer's recommendations. Provide support plate for anchoring of each vertical stack.

3 EXECUTION

3.1 INSTALLATION - GENERAL



- .1 Follow manufacturer's and SMACNA installation recommendations for shop fabricated components
- .2 Support chimneys at bottom, roof and intermediate levels as indicated.
- .3 Install flashings on chimneys penetrating roofs, as indicated.
- .4 Install rain caps and cleanouts, as indicated.
- .5 Slope horizontal venting at minimum 2% slope towards appliance and/or vent stack.
- .6 Provide CPVC drain tubing c/w trap and neutralizer kit at each vent stack and drain connections, terminate to nearest floor drain. Provide pipe ramps above all tubing located in path of travel.
- .7 Provide condensate drains at every vertical stack and for every 9m (30ft) of horizontal venting. Provide condensate drain fitting, CPVC tubing and neutralization kit for each drain.
- .8 Maintain required clearances between venting systems and combustible materials in accordance with listings, consult venting system label for instructions.
- .9 Terminate venting system in accordance with CAN CSA B149.1.
- .10 Verify seams and joints for gas tightness prior to connection to appliance and startup.
- .11 Provide inspection tees on all vents for flue gas analysis.
- .12 Provide slab, wall and roof openings as required. All roof openings shall be provided with adjustable storm collar supplied by venting system manufacturer and flashed into the roofing system by basebuilding roofing contractor.
- .13 Provide guy wires c/w reflective tape and supports of venting systems as required.
- .14 Install CPVC system in accordance with ULC S636 and CAN CSA B149.1.
- .15 Provide all required fittings including cleanouts, boots, tees, wyes, transitions, adapters, termination cone/cap, thimbles, support plates, barometric dampers, etc for a fully functioning system.

3.2 CLEANING

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

END OF SECTION





1 GENERAL

1.1 REFERENCE STANDARDS

- .1 American Gas Association (AGA)
- .2 American National Standards Institute/Air-Conditioning, Heating and Refrigeration Institute (ANSI/AHRI)
 - .1 ANSI/AHRI 210/240, Performance Rating of Unitary Air-Conditioning and Air-Source Heat Pump Equipment.
 - .2 ANSI/AHRI 270, Sound Rating of Outdoor Unitary Equipment.
- .3 CSA Group (CSA)
 - .1 CSA B52, Mechanical Refrigeration Code.
 - .2 CSA C22.1, Canadian Electrical Code, Part 1 (22nd Edition), Safety Standard for Electrical Installations.
- .4 National Fire Protection Association (NFPA)
 - .1 NFPA 90A, Standard for the Installation of Air Conditioning and Ventilating Systems.
- .5 ANSI/ASHRAE/IESNA 90.1 - Energy Standard for New Buildings Except Low-Rise Residential Buildings.

2 PRODUCTS

2.1 PACKAGED OUTDOOR HVAC EQUIPMENT – GAS FIRED, DX COOLING

2.1.1 General

- .1 Packaged rooftop units cooling, heating capacities, and efficiencies are AHRI Certified within scope of AHRI Standard 210-240 for **4 to 25** Tons and ANSI Z21.47 and 10 CFR Part 431 pertaining to Commercial Warm Air Furnaces (all gas heating units).
- .2 Approved Manufacturers
 - .1 Carrier (basis of design)
 - .2 Trane
 - .3 Lennox
- .3 Carrier is the manufacturer selected for the basis of design. In the event that the



Contractor and/or Sub-contractor opts for an alternative Approved Manufacturer, they shall be responsible for covering the Consultant costs to assess whether the current structure can accommodate the weight of the package outdoor HVAC equipment. Additionally, any necessary structural modifications to support the equipment's weight shall be borne by the Contractor and/or Sub-contractor.

- .4 Rooftop unit shall be factory assembled, internally wired, fully charged with R-410A, and 100 percent run tested to check cooling operation, fan and blower rotation, and control sequence before leaving the factory.
- .5 All units, 4-25T shall have field convertible airflow.
- .6 Internal wiring must be colored and numbered for simplified identification.
- .7 Controls operating range shall be between 0°F and 125°F in cooling mode.

2.1.2 Unit Casing

- .1 Unit shall only be stored or positioned in the upright position.
- .2 Unit cabinet shall be constructed of galvanized steel and shall be bonderized and coated with a pre-painted baked enamel finish on all externally exposed surfaces.
- .3 Unit cabinet exterior paint shall be: film thickness, (dry) 0.003 inches minimum, gloss. (per ASTM D523, 60°F/16°C): 60, Hardness: H-2H Pencil hardness
- .4 Evaporator fan compartment interior cabinet insulation shall conform to AHRI Standards 210/240 and or 340/360 minimum exterior sweat criteria. Interior surfaces shall be insulated with a minimum 1/2 in. thick, 1 lb density, flexible fiberglass insulation, neoprene coated on the air side. Aluminum foil-faced fiberglass insulation shall be used in the gas heat compartment.
- .5 Base of unit shall have a minimum of 4 locations for thru-the-base gas and electrical connections (factory-installed or field-installed), standard.
- .6 Base Rail:
 - Unit shall have base rails on a minimum of 2 sides.
 - Holes shall be provided in the base rails for rigging shackles to facilitate maneuvering and overhead rigging.
 - Holes shall be provided in the base rail for moving the rooftop by fork truck.
 - Base rail shall be a minimum of 16 gauge thickness.
- .7 Condensate Pan and Connections:
 - Shall be a sloped condensate drain pan made of a corrosion resistant material.
 - Shall comply with ASHRAE Standard 62.
 - Shall use a 3/4 in. 14 NPT drain connection, possible either through the bottom or side of the drain pan. Connection shall be made per manufacturer's recommendations.
- .8 Top Panel:
 - Shall be a single piece top panel on all sizes.
- .9 Gas Connections:
 - All gas piping connecting to unit gas valve shall enter the unit cabinet at a single location on side of unit (horizontal plane).



- Standard unit shall have a thru-the-base gas-line location using a raised, embossed portion of the unit basepan.
- Optional, factory approved, water-tight connection method must be used for thru-the-base gas connections.
- No basepan penetration, other than those authorized by the manufacturer, is permitted.

.10 Electrical Connections:

- All unit power wiring shall enter unit cabinet at a single, factory prepared, knockout location.
- Thru-the-base capability:
- Standard unit shall have a thru-the-base electrical location(s) using a raised, embossed portion of the unit basepan.
- Optional, factory approved, water-tight connection method must be used for thru-the-base electrical connections.
- No basepan penetration, other than those authorized by the manufacturer, is permitted.

.11 Component Access Panels (standard):

- Cabinet panels shall be easily removable for servicing.
- Unit shall have one factory installed, tool-less, removable, filter access panel.
- Panels covering control box, indoor fan, indoor fan motor, gas components (where applicable), and compressors shall have molded composite handles.
- Handles shall be UV modified, composite. They shall be permanently attached and recessed into the panel.
- Screws on the vertical portion of all removable access panel shall engage into heat resistant, molded composite collars.
- Collars shall be removable and easily replaceable using manufacturer recommended parts.

2.1.3 Air Filters

- .1 Standard throwaway filters.
- .2 2" MERV 13 pleated filters.

2.1.4 Fans and Motors

- .1 Direct Drive Evaporator fan motor:
 - .1 Shall be a ECM motor design.
 - .2 Shall have permanently lubricated bearings.
 - .3 Shall have inherent automatic-reset thermal overload protection.
 - .4 Shall have slow ramp up to speed capabilities.
 - .5 Shall require no fan/motor belts for operation, adjustments and or initial fan speed setup.
 - .6 Fan DC voltage set up on Unit Control Board can eliminate the need of removal of blower access door, required on conventional belt drive systems.
 - .7 Shall be internally protected from electrical phase reversal and loss.
- .2 Evaporator Fan:



-
- .1 Shall be easily set with dedicated selection switch and adjustment pot on unit control board.
 - .2 On sizes 04-06 single speed indoor fan operation provided and on 07 size model with 2 stage cooling capacity control, the indoor fan speed is automatically controlled to meet the code-compliant 66% low fan speed and 100% at full fan speed operation.
 - .3 Blower fan shall be a Vane Axial fan design with 75% less moving parts than a conventional belt drive system.
 - .4 Shall be constructed of a cast aluminum stator and high impact composite material on rotor and air inlet casing.
 - .5 Shall be a patented design with a corrosion resistant material and dynamically balanced.
 - .6 Shall have slow ramp up to speed capabilities to help reduce sound and comfort issues typically associated with single speed belt drive systems.
 - .7 Shall be a slide out design with 2 screw removal.
- .3 Shall include an easily accessible Unit Control Board to conveniently and safely provide connection points for vital control functions such as: smoke detectors, phase monitor, gas controller, economizer, thermostat, DDC control options, and low- and high-pressure switches. Controller shall also provide an intuitive means to adjust the indoor fan speed through a simple switch and pot adjustment design.
 - .4 Condenser Fans and Motors:
 - .1 Shall be a totally enclosed motor.
 - .2 Shall use permanently lubricated bearings.
 - .3 Shall have inherent thermal overload protection with an automatic reset feature.
 - .4 Shall use a shaft-down design on all sizes.
 - .5 Condenser Fans:
 - .6 Shall be a direct-driven propeller type fan constructed of high impact composite material.
 - .7 Shall have high impact composite blades completely formed into one piece without blade fasteners or connectors and shall be dynamically balanced.

2.1.5 Gas Fired Heating Section

- .1 General.
 - .1 Heat exchanger shall be an induced draft design. Positive pressure heat exchanger designs shall not be allowed.
 - .2 Shall incorporate a direct-spark ignition system and redundant main gas valve.
 - .3 Gas supply pressure at the inlet to the rooftop unit gas valve must match that required by the manufacturer.
- .2 The heat exchanger shall be controlled by an integrated gas controller (IGC) microprocessor.
 - .1 IGC board shall notify users of fault using an LED (light-emitting diode).
 - .2 The LED shall be visible without removing the control box access panel.
 - .3 IGC board shall contain algorithms that modify evaporator fan operation to prevent future cycling on high temperature limit switch.
 - .4 Unit shall be equipped with anti-cycle protection with one short cycle on unit flame rollout switch or 4 continuous short cycles on the high temperature limit switch. Fault indication shall be made using an LED.



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- .3 Stainless Steel Heat Exchanger Construction:
 - .1 Use energy saving, direct-spark ignition system.
 - .2 Use a redundant main gas valve.
 - .3 Burners shall be of the in-shot type constructed of aluminum-coated steel.
 - .4 All gas piping shall enter the unit cabinet at a single location on side of unit (horizontal plane).
 - .5 The optional stainless steel heat exchanger shall be of the tubular-section type, constructed of a minimum of 20-gauge type 409 stainless steel.
 - .6 Type 409 stainless steel shall be used in heat exchanger tubes and vestibule plate.
 - .7 Complete stainless steel heat exchanger allows for greater application flexibility.

2.1.6 Evaporator Coil - Standard Aluminum Fin-Copper Tube Coils

- .1 Standard evaporator and condenser coils shall have aluminum lanced plate fins mechanically bonded to seamless internally grooved copper tubes with all joints brazed.
- .2 Evaporator coils shall be leak tested to 150 psig, pressure tested to 450 psig, and qualified to UL 1995 burst test at 1775 psig.
- .3 Condenser coils shall be leak tested to 150 psig, pressure tested to 650 psig, and qualified to UL 1995 burst test at 1980 psig.

2.1.7 Refrigeration System

- .1 Refrigerant circuit shall include the following control, safety, and maintenance features:
 - .1 Fixed orifice metering system on 04-06 models and TXV on 07 size models shall include a multiple feed distribution system that optimizes coil performance.
 - .2 Refrigerant filter drier — Solid core design.
 - .3 Service gauge connections on suction and discharge lines.
 - .4 Pressure gauge access through a specially designed access port in the top panel of the unit.
- .2 There shall be gauge line access port in the skin of the rooftop, covered by a black, removable plug.
 - .1 The plug shall be easy to remove and replace.
 - .2 When the plug is removed, the gauge access port shall enable maintenance personnel to route their pressure gauge lines.
 - .3 This gauge access port shall facilitate correct and accurate condenser pressure readings by enabling the reading with the compressor access panel on.
 - .4 The plug shall be made of a leak proof, UV-resistant, composite material.
- .3 Compressors:
 - .1 Unit shall use fully hermetic, scroll compressor for each independent refrigeration circuit.
 - .2 Compressor motors shall be cooled by refrigerant gas passing through motor windings.
 - .3 Compressors shall be internally protected from high discharge temperature conditions.
 - .4 Compressors shall be protected from an over-temperature and over-ampereage conditions by an internal, motor overload device.
 - .5 Compressor shall be factory mounted on rubber grommets.
 - .6 Compressor motors shall have internal line break thermal, current overload and high



pressure differential protection.

- .7 Crankcase heaters shall not be required for normal operating range, unless required by compressor manufacturer due to refrigerant charge limits.
- .8 Compressor on 04-06 models shall be of a single stage cooling capacity design and 07 models shall be a 2 stage cooling capacity design.

2.1.8 Exhaust/Return Section

- .1 Power exhaust shall be used in conjunction with an integrated economizer
- .2 Independent modules for vertical or horizontal return configurations shall be available.
- .3 Horizontal power exhaust is shall be mounted in return ductwork.
- .4 Hower exhaust shall be controlled by economizer controller operation. Exhaust fans shall be energized when dampers open past the 0 to 100% adjustable setpoint on the economizer control.

2.1.9 Outdoor Air Section

- .1 Units shall be available with or without barometric relief.
- .2 Barometric relief shall provide a pressure operated damper that shall be gravity closing.
- .3 Barometric relief shall prohibit entrance of outside air during the equipment "off" cycle.
- .4 Optional Low Leak economizer damper shall be provided.
- .5 Motorized outside air damper, once set, when indoor fan starts, outdoor air dampers shall open to set position. When indoor fan shuts down, damper shall close to the full closed position.
- .6 Provide spring return motor for outside air damper closure during unit shut down or power interruption.
- .7 Provide microprocessor unit-mounted control which when used with an electronic zone sensor provides proportional integral room control. This UCM shall perform all unit functions by making all heating, cooling and ventilating decisions through resident software logic.
- .8 Provide factory-installed indoor evaporator defrost control to prevent compressor slugging by interrupting compressor operation.
- .9 Provide a anti-cycle timing and minimum on/off between stages timing in the microprocessor.

2.1.10 System Control

- .1 Unit shall be complete with terminal strip control for BAS control of unit's functions including DX cooling staging, gas heating modulation, supply/power exhaust fans control and damper control. Refer to control schematics and sequences of operation for more information.

2.1.11 Roof Curb Adaptor

- .1 Contractor shall provide custom made roof curb adaptor to allow installation of new unit on the existing curb, in the specific location indicated on the drawings.
- .2 Construction - 16-gauge perimeter made of zinc coated steel with supply and return air gasketing and wood nailer strips. Ship knocked down and provided with instructions for easy assembly.
- .3 Curb adapter shall be manufactured in accordance with the National Roofing



Contractors Association guidelines.

3 EXECUTION

3.1 EXAMINATION

- .1 The contractor shall verify that the roof is ready to receive work and opening dimensions are correct.
- .2 The contractor shall verify that the proper power supply is available.

3.2 INSTALLATION

- .1 Contractor shall install in accordance with manufacturer's instructions.
- .2 Mount units on factory-built roof mounting frame providing watertight enclosure to protect ductwork and utility services. Install roof mounting curb level.
- .3 Coordinate installation with electrical and structural drawings.
- .4 Provide condensate trap in accordance with drawing details.
- .5 Coordinate final location of the unit on site, maintain minimum 3m clearance between all intakes and exhausts.
- .6 Provide natural gas piping in accordance with CAN CSA B149.1, provide regulator assembly, unions, isolation valves, dirt pocket. Paint entire surface of all piping included underneath. Provide adequate support of all natural gas piping.
- .7 Provide BAS integration in accordance with drawing schematics and sequencing in accordance with Division 25 specifications. Controls contractor to provide all sensors, wiring and devices to accomplish the design intent.

END OF SECTION



BA 1 GENERAL

1.1 SUMMARY

- .1 Section Includes:
 - .1 General requirements for Building Automation System (BAS), also referred to as Energy Monitoring and Control System (EMCS) within these specifications.

1.2 REFERENCE STANDARDS

- .1 American National Standards Institute (ANSI)/The Instrumentation, Systems and Automation Society (ISA).
 - .1 ANSI/ISA 5.5, Graphic Symbols for Process Displays.
- .2 American National Standards Institute (ANSI)/ Institute of Electrical and Electronics Engineers (IEEE).
 - .1 ANSI/IEEE 260.1, American National Standard Letter Symbols Units of Measurement (SI Units, Customary Inch-Pound Units, and Certain Other Units).
- .3 American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE).
 - .1 ASHRAE STD 135, BACNET - Data Communication Protocol for Building Automation and Control Network.
 - .2 Ashrae Guideline 13, Specifying Building Automation Systems.
- .4 CSA Group (CSA).
 - .1 CAN/CSA-Z234.1, Canadian Metric Practice Guide.
- .5 Consumer Electronics Association (CEA).
 - .1 CEA-709.1, Control Network Protocol Specification.
- .6 Electrical and Electronic Manufacturers Association (EEMAC).
 - .1 EEMAC 2Y-1, Light Grey Colour for Indoor Switch Gear.
- .7 National Fire Protection Association (NFPA)
 - .1 NFPA 70, National Electrical Code
 - .2 NFPA 90A, Standard For The Installation Of Air Conditioning And Ventilating Systems
 - .3 NFPA 92A and 92B Smoke Purge/Control Equipment



1.3 DEFINITIONS

- .1 Point: may be logical or physical.
 - .1 Logical points: values calculated by system such as setpoints, totals, counts, derived corrections and may include, but not limited to result of and statements in CDL's.
 - .2 Physical points: inputs or outputs which have hardware wired to controllers which are measuring physical properties, or providing status conditions of contacts or relays which provide interaction with related equipment (stop, start) and valve or damper actuators.
- .2 Point Name: composed of two parts, point identifier and point expansion.
 - .1 Point identifier: comprised of three descriptors, "area" descriptor, "system" descriptor and "point" descriptor, for which database to provide [25] character field for each point identifier. "System" is system that point is located on.
 - .1 Area descriptor: building or part of building where point is located.
 - .2 System descriptor: system that point is located on.
 - .3 Point descriptor: physical or logical point description. For point identifier "area", "system" and "point" will be shortforms or acronyms. Database must provide 25 character field for each point identifier.
 - .2 Point expansion: comprised of three fields, one for each descriptor. Expanded form of shortform or acronym used in "area", "system" and "point" descriptors is placed into appropriate point expansion field. Database must provide [32] character field for each point expansion.
 - .3 Bilingual systems to include additional point identifier expansion fields of equal capacity for each point name for second language.
 - .1 System to support use of numbers and readable characters including blanks, periods or underscores to enhance user readability for each of the above strings.
- .3 Point Object Type: points fall into following object types:
 - .1 AI (analog input).
 - .2 AO (analog output).
 - .3 DI (digital input).
 - .4 DO (digital output).
 - .5 Pulse inputs.
- .4 Symbols and engineering unit abbreviations utilized in displays: to ANSI/ISA S5.5.



.1 Printouts: to ANSI/IEEE 260.1.

1.4 ABBREVIATIONS AND ACRONYMS

AIT - Agreement on International Trade

AO - Analog Output

ASHRAE - American Society of Heating, Refrigeration and Air Conditioning Engineers

AWG – American Wire Gauge

BACnet - Building Automation and Control Network

BAS (also referred to as BAS, EMCS) – Building Automation System

BC(s) - Building Controller(s)

BECC - Building Environmental Control Centre

CAD - Computer Aided Design

CDL - Control Description Logic

CDS - Control Design Schematic

COSV - Change of State or Value

COV – Change of Value

CPU - Central Processing Unit

DAC – Digital to Analog Controller

DDC – Direct Digital Control

DI - Digital Input

DO - Digital Output

DP - Differential Pressure

ECU - Equipment Control Unit

EMCS - Energy Monitoring and Control System

FZ - Freezestat

GUI – Graphical User Interface

HOA – Hand-Off-Auto

HVAC - Heating, Ventilation, Air Conditioning



IDE - Interface Device Equipment

I/O - Input/Output

IOM – Installation and Operational Manual

ISA - Industry Standard Architecture

LAN - Local Area Network

LCD – Liquid Crystal Display

LED – Light Emitting Diode

LCU - Local Control Unit

MAD – Mixed Air Damper

MCC – Motor Control Centre

MCU - Master Control Unit

NAFTA - North American Free Trade Agreement

NC - Normally Closed

NIC – Not in Contract

NO - Normally Open

OAD – Outdoor Air Temperature

OAT – Outdoor Air Temperature

OS - Operating System

O&M - Operation and Maintenance

OWS - Operator Work Station

PC - Personal Computer

PCI - Peripheral Control Interface

PCMCIA - Personal Computer Micro-Card Interface Adapter

PID - Proportional, Integral and Derivative

RAD – Return Air Damper

RAM - Random Access Memory

SP - Static Pressure



ROM - Read Only Memory

TCU - Terminal Control Unit

USB - Universal Serial Bus

UPS - Uninterruptible Power Supply

VAV - Variable Air Volume

WAN – Wide Area Network

1.5 SYSTEM DESCRIPTION

- .1 The existing facility BMS system is installed by Modern Niagara.
- .2 All BMS integration work shall be completed by Modern Niagara.
- .3 The BMS work shall consist of the provision of all labor, materials, tools, equipment, software, software licenses, software configurations and database entries, interfaces, wiring, tubing, installation, labeling, engineering, calibration, documentation, samples, submittals, testing, commissioning, training services, permits and licenses, transportation, shipping, handling, administration, supervision, management, insurance, temporary protection, cleaning, cutting and patching, warranties, services, and items, even though these may not be specifically mentioned in these Division documents which are required for the complete, fully functional and commissioned BMS.
- .4 Provide a complete, neat and workmanlike installation. Use only manufacturer employees or subcontractors who are skilled, experienced, trained, and familiar with the specific equipment, software, standards and configurations to be provided for this Project.
- .5 Manage and coordinate the BMS work in a timely manner in consideration of the Project schedules. Coordinate with the associated work of other trades so as not to impede or delay the work of associated trades.
- .6 Design Requirements:
 - .1 Design and provide conduit and wiring linking elements of system.
 - .2 Supply sufficient programmable controllers of types to meet project requirements. Quantity and points contents as reviewed by Consultant prior to installation.
 - .3 Location of controllers as reviewed by Owner and Consultant prior to installation.
 - .4 Provide utility power to EMCS and emergency power to EMCS as indicated.
 - .5 Provide hardwire interlocks with equipment for all safeties and where indicated.
 - .6 Metric references: in accordance with CAN/CSA Z234.1.



- .7 Contractor shall be responsible for coordination with Owner's IT department for all required provisions and tie-ins.
- .7 Operational Requirements - BAS as provided shall incorporate, at minimum, the following integrated features, functions and services:
 - .1 Provision of GUI incorporating representation of equipment components, sequences of operations, alarm management and trending of parameters.
 - .2 Trending of parameters shall include monitoring, archiving, accessing, and reporting functions.
 - .3 Energy management.
 - .4 Standard applications for terminal HVAC systems
 - .5 Enterprise-wide information and control access
 - .6 Offsite monitoring and management access
 - .7 Fault Detection and Fault Triage
- .8 Language Operating Requirements:
 - .1 Provide English operator selectable access codes.
 - .2 Use non-linguistic symbols for displays on graphic terminals wherever possible. 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 OS 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-definitions).
 - .2 Graphic "display" functions, point commands to turn systems on or off, manually override automatic control of specified hardware points. To be in English at specified OWS and to be able to operate one terminal in English and second in French. Point name expansions in both languages.



- .3 Reporting function such as trend log, trend graphics, alarm report logs, energy report logs, maintenance generated logs.

1.6 PRELIMINARY SHOP DRAWING SUBMITTAL

- .1 Submit preliminary shop drawings within (10) 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, signal levels, pressures where new EMCS ties into existing control equipment.
 - .3 Spare point capacity of each controller by number and type.
 - .4 Controller locations.
 - .5 Auxiliary control cabinet locations.
 - .6 Single line diagrams showing cable routings, conduit sizes, spare conduit capacity between control centre, field controllers and systems being controlled.
 - .7 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).
 - .8 Dampers: sketches showing module assembly, interconnecting hardware, operator locations, operator spring range, pilot range, required torque, actual torque.
 - .9 Flow measuring stations: complete schedule listing designation, service, point ID, manufacturer, model, size, velocity at design flow rate, manufacturer, model and range of velocity transmitter.
 - .10 Sensors, relays, transducers.
 - .11 Sequences of operation for all systems and equipment including all setpoints, alarms, delays.
 - .12 GUI samples for each system and piece of equipment.

1.7 DETAILED SHOP DRAWING REVIEW

- .1 Submit detailed shop drawings within (15) working days after award of contract and before start of installation and include following:



- .1 Corrected and updated versions of submissions made during preliminary review.
- .2 Wiring diagrams, interlocks.
- .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:
 - .6 Sensing element type and location.
 - .7 Transmitter type and range.
 - .8 Associated field wiring schematics, schedules and terminations.
 - .9 Complete Point Name Lists.
 - .10 Setpoints, curves or graphs and alarm limits (high and low, 3 types critical, cautionary and maintenance), signal range.
 - .11 Software and programming details associated with each point.
 - .12 Manufacturer's recommended installation instructions and procedures.
 - .13 Input and output signal levels or pressures where new system ties into existing control equipment.
 - .14 Control schematics, narrative description, sequences of operations fully showing and describing automatic and manual procedures required to achieve proper operation of project, including under complete failure of BAS.
 - .15 Graphic system schematic displays of air and water systems with point identifiers and textual description of system, and typical floor plans as specified.
 - .16 Complete system sequences of operations including companion English language explanations on same sheet but with different font and italics. Sequences to contain specified energy optimization programs.
 - .17 Listing and example of specified reports.
 - .18 Listing of time of day schedules.
 - .19 Mark up to-scale construction drawing to detail control room showing location of equipment and operator work space.
 - .20 Type and size of memory with statement of spare memory capacity.
 - .21 Full description of software programs provided.



.22 Sample of "Operating Instructions Manual" to be used for training purposes.

1.8 QUALITY ASSURANCE

- .1 Controls Vendor shall have local office within 50 km of project staffed by trained personnel capable of providing instruction, routine maintenance and emergency service on systems. Support shall be available on a 24 hour / 7 days per week basis.
- .2 Provide record of successful previous installations submitting tender showing experience with similar installations utilizing computer-based systems.
- .3 Have access to local supplies of essential parts and provide 7-year guarantee of availability of spare parts after obsolescence.
- .4 Ensure qualified supervisory personnel continuously direct and monitor Work and attend site meetings.
- .5 The Building Automation System architecture shall be comprised of the products from a manufacturer regularly engaged in the production of Building Automation Systems. All equipment shall be equipped with the latest versions of firmware and operational software shall be the latest version at the time of the project.
- .6 The Building Automation System Contractor shall be the primary manufacturer-owned branch office that is regularly engaged in the engineering, programming, installation and service of total integrated Building Automation Systems.
- .7 The BAS Contractor shall be a recognized national manufacturer, installer and service provider of BAS.
- .8 The BAS Contractor shall have a branch facility within a 100-km radius of the job site supplying complete maintenance and support services on a 24 hour, 7-day-a-week basis.
- .9 As evidence and assurance of the contractor's ability to support the Owner's system with service and parts, the contractor must have been in the BAS business for at least the last ten (10) years and have successfully completed total projects of at least 10 times the value of this contract in each of the preceding five years.
- .10 The BACnet/IP internetwork shall be based upon the Manufacturer's standard integrated hardware and software product design intent and in accordance with Manufacturer's installation and application documentation.

1.9 SCOPE OF SERVICES

- .1 The Controls Vendor shall supply and install a complete Direct Digital Control (DDC) Building Automation System (BAS) as required to accomplish the Sequences of Operation for all HVAC Systems and other building-level equipment and systems, including but not limited to:



- .1 Packaged Roof Top Units (RTU's)
- .2 Exhaust Fans
- .3 Domestic Water Heater
- .2 Provide all required sensors, control devices, field controllers, wiring in conduit, relays, etc. for a fully functioning system. All materials shall be new, unless otherwise specified. Test and verify existing devices where noted for re-use to ensure proper operating order and accuracy of measurement.
- .3 Provide required sequencing, alarming and trending as described within these specifications.
- .4 Update front end graphics to reflect all modifications.
- .5 Test, verify and commission all systems.
- .6 Coordinate with TAB contractor for setting of control devices and min/max limits.
- .7 Demonstrate operation of all systems to Consultant and Owner.
- .8 Provide required training of Owner's Facility Team.
- .9 Prepare closeout manuals, update master control binder to reflect all deleted, revised or added systems.

1.10 WARRANTY

- .1 All labour, materials, software furnished under this contract shall be warranted free from all defects for a period of one (1) year following final completion and project acceptance. Final completion and acceptance is achieved once project commissioning activities have concluded and satisfactory system's installation and operation was demonstrated.
- .2 Any failures or issues associated with any aspects of the control system during the warranty period shall be adjusted, repaired or replaced in their entirety at no additional cost to Owner.
- .3 The contractor shall respond to warranty service request within (24) hours of the request

1.11 AS-BUILT DOCUMENTATION

- .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 General information to include:
 - .1 Project information including project name, building name, location.
 - .2 Names, addresses, telephone numbers of each sub-contractor having installed equipment, local representative for each item of equipment, each system.
 - .3 Changes to Contract Documents as well as addenda and contract extras.
 - .4 Routing of conduit, wiring and control air lines associated with BAS installation.
 - .5 Locations of all sensors (differential pressure, static pressure, temperature, humidity, etc) to be indicated on plans.
 - .6 Listing of alarm messages.
 - .7 Installed software, versions and licences.
 - .8 Warranty information.
 - .9 Sequences of operation for each system and equipment.
 - .10 Control schematics for each system.
 - .11 System architecture diagram including list of all controllers, components, peripheral devices.
 - .12 Point to point verification report for each system and equipment. Include point type, name, tag/ID, units of measure, initial test value, final test value.
 - .13 Floor plans with locations of all field mounted devices, controllers.
 - .14 Wiring diagrams.
 - .15 List of occupancy schedules for each zone, space, system.
 - .16 List of default setpoints for each system, terminal unit, etc.
 - .17 Panel/circuit breaker number for sources of normal/emergency power.
 - .18 Test procedures and reports: provide records of start-up procedures, test procedures, checkout tests and final commissioning reports.
 - .19 Basic system design and full documentation on system configuration.
 - .20 Manufacturer's data sheets and IOM for all materials.
 - .21 Schedule of control valves and dampers.
 - .22 ESA Certificates of Inspection.
 - .23 Commissioning Reports.



- .5 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 or planned for implementation in automatic mode.
- .6 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.
- .7 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.
- .8 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.
- .9 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.
- .10 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.
- .11 Submit manuals for final review by Consultant and Commissioning Authority.

1.13 GENERAL REQUIREMENTS

- .1 Contractor shall co-operate fully with the Owner, Consultant, and all contractors, sub-contractors and other persons working on the site.
- .2 Contractor shall complete installation in accordance with the latest editions of the Building Code, Electrical Safety Code, C.S.A., or other Codes or governing authorities of competent jurisdiction. In case of discrepancies with this or the manufacturer's specifications, the Contractor shall notify the Consultant immediately.
- .3 Obtain and pay for permits (note: Building Permit obtained by owner) and inspections required for work performed including all required ESA submissions and applications. Provide Certificate(s) of Acceptance from the Authorities Inspection Department, upon completion of work.
- .4 Submit required Documents and shop drawings to authorities having jurisdiction in order to obtain approval for the Work. Copies of Contract Drawings and Specifications may be used for this purpose. Prepare any additional information, details, and drawings which these authorities may require.
- .5 Contractor must comply with all requirements of the Occupational Health & Safety Act.
- .6 In order to meet the requirements of substantial completion the Contractor must complete the following:



- .1 Installation and successful testing of all control system devices.
- .2 Overall system test demonstrating complete integration and operation with the existing equipment.
- .3 Overall system test demonstrating system operation and coordination.
- .4 Submission of all coordination and permit documentation for the Consultant's review.
- .5 Submission of all record and As-Built documentation.
- .6 Correction of any deficiencies associated with BAS work.
- .7 Remove existing controls not re used or not required and turn over to Owner, where required.

1.14 MATERIALS AND EQUIPMENT

- .1 All materials and equipment shall be completely new and unused products of only the most recent manufacturer model or version number, CSA certified, and manufactured to the Standards specified.
- .2 Where there is no alternative to supplying equipment which is not CSA certified, obtain special approval from the local Inspection Department.
- .3 No damaged, chipped or marked equipment or materials will be accepted and must not be installed.

1.15 SITE RESPONSIBILITIES

- .1 Maintain work areas to be free of construction debris and waste. The disposal of all materials shall be the responsibility of the Contractor.
- .2 Make all necessary arrangements to transport materials and equipment to and within the site. The Contractor shall be responsible for arranging for the use of any hoists, lifts, pulleys, winches, cranes or service elevators.
- .3 Contractor is responsible for complete storage, handling, delivery, and installation of all materials used in the performance of the work.

1.16 TESTING AND COMMISSIONING

- .1 Provide testing and commissioning as per Testing and Commissioning Plan to be reviewed and approved by the Consultant and Project Manager for all items and their related components.
- .2 Supply all required equipment maintenance and operations manuals, for owner's staff use.
- .3 Provide all required software for monitoring, annunciation and control/dispatch applications.



- .4 Contactor shall supply all labour, materials and tools to demonstrate operation of all systems and equipment at various load and seasonal conditions.

1.17 INTENT

- .1 It is the intent of these drawings and specifications that the Contractor provide complete and operational systems as required.
- .2 Where differences occur, the maximum condition shall be given.
- .3 Any miscellaneous items, hardware, devices, wiring, etc., not specifically described, but required for the operation of the system, must be provided and included as part of the Bid.

1.18 CODES AND STANDARDS

- .1 Work, materials, and equipment shall comply with the rules and regulations of all codes and ordinances of local, state and federal authorities. As a minimum, the installation shall comply with the current editions in effect 30 days prior to receipt of bids of the following codes:
 - .1 Ontario Building Code (OBC)
 - .2 National Electric Code (NEC)
 - .3 International Building Code (IBC)
 - .4 International Mechanical Code (IMC)
 - .5 Underwriters Laboratories: Products shall be UL-916-PAZX listed.
 - .6 ANSI/ASHRAE Standard 135-2001 (BACnet)
 - .7 Electrical Safety Code (ESA)
 - .8 CSA
 - .9 ULC
 - .10 NFPA
 - .11 OHSA
- .2 Comply with Electrical Bulletins in force at time of Bid submission. While not identified and specified by number in this Division, they are to be considered as forming part of related Standards.

1.19 SEQUENCING

- .1 Provide all required sequencing and BAS integration as specified in Section 25 05 01 - BAS Sequences of Operation and in accordance with the control diagrams/schematics on



drawings.

2 PRODUCTS

N/A

3 EXECUTION

3.1 GENERAL

- .1 Provide all required labour and materials including sensors, control devices, input/output modules, relays, controllers, control panels, wiring for a fully functioning system.
- .2 Install all equipment and devices in accordance with manufacturer's recommendations and applicable codes and regulations.
- .3 Fully commission all aspects of controls work, provide point-to-point verification reports for all points, pre-commissioning test sheets and provide assistance and demonstration during commissioning phase.
- .4 Provide blue ceiling labels at all VAV locations. Minimum size is 50mm dia.
- .5 Provide access to VAV box including cutting and patching of drywall/plaster ceiling or removal and reinstatement of the acoustic ceiling tile system. Provide new ceiling tiles following installation for areas with acoustic tile system. Repair drywall/plaster ceiling and provide 400x400mm fire rated access panel for future access to VAV and components in areas with drywall/plaster ceilings. Coordinate work with mechanical contractor.

3.2 WIRING

- .1 All conduit, wiring, accessories and wiring connections required for the installation of the BAS, as herein specified, shall be provided by the BAS Contractor unless specifically shown on the Electrical Drawings under Division 24 Electrical. All wiring shall comply with the requirements of applicable portions of Division 24 and all local and national electric codes, unless specified otherwise in this section.
- .2 All BAS wiring materials and installation methods shall comply with BAS manufacturer recommendations.
- .3 The sizing, type and provision of cable, conduit, cable trays, and raceways shall be the design responsibility of the BAS Contractor. If complications arise, however, due to the incorrect selection of cable, cable trays, raceways and/or conduit by the BAS Contractor,



the Contractor shall be responsible for all costs incurred in replacing the selected components.

.4 Class 2 Wiring

.1 All Class 2 (24 VAC or less) wiring shall be installed in conduit unless otherwise specified.

.2 Conduit is not required for Class 2 wiring in concealed accessible locations. Class 2 wiring not installed in conduit shall be supported every 5' from the building structure utilizing metal hangers designed for this application. Wiring shall be installed parallel to the building structural lines. All wiring shall be installed in accordance with local code requirements.

.3 Class 2 signal wiring and 24 VAC power can be run in the same conduit. Power wiring 120VAC and greater cannot share the same conduit with Class 2 signal wiring.

.4 Provide for complete grounding of all applicable signal and communications cables, panels and equipment so as to ensure system integrity of operation. Ground cabling and conduit at the panel terminations. Avoid grounding loops.

.5 BAS Line Voltage Power Source

.1 120-volt AC circuits used for the BAS shall be taken from panel boards and circuit breakers provided by Division 26.

.2 Circuits used for the BAS shall be dedicated to the BAS and shall not be used for any other purposes.

.3 DDC terminal unit controllers may use AC power from motor power circuits.

.6 BAS Raceway

.1 All wiring shall be installed in conduit or raceway except as noted elsewhere in this specification. Minimum control wiring conduit size 1/2".

.2 Where it is not possible to conceal raceways in finished locations, surface raceway (Wiremold) may be used as approved by the Architect.

.3 All conduits and raceways shall be installed level, plumb, at right angles to the building lines and shall follow the contours of the surface to which they are attached.

.4 Flexible Metal Conduit shall be used for vibration isolation and shall be limited to 3 feet in length when terminating to vibrating equipment. Flexible Metal Conduit may be used within partition walls. Flexible Metal Conduit shall be UL listed.

.7 Penetrations

.1 Provide fire stopping for all penetrations used by dedicated BAS conduits and



raceways.

- .2 All openings in fire proofed or fire stopped components shall be closed by using approved fire resistive sealant.
 - .3 All wiring passing through penetrations, including walls shall be in conduit or enclosed raceway.
 - .4 Penetrations of floor slabs shall be by core drilling. All penetrations shall be plumb, true, and square.
- .8 BAS Identification Standards
- .1 Node Identification. All nodes shall be identified by a permanent label fastened to the enclosure. Labels shall be suitable for the node location.
 - .2 Cable types specified in Item A shall be color coded for easy identification and troubleshooting.
- .9 BAS Panel Installation
- .1 The BAS panels and cabinets shall be located as indicated at an elevation of not less than 2 feet from the bottom edge of the panel to the finished floor. Each cabinet shall be anchored per the manufacturer's recommendations.
 - .2 The BAS contractor shall be responsible for coordinating panel locations with other trades and electrical and mechanical contractors.
- .10 Input Devices
- .1 All Input devices shall be installed per the manufacturer recommendation.
 - .2 Locate components of the BAS in accessible local control panels wherever possible.

END OF SECTION



THE SEQUENCES ARE PROVIDED FOR THE REFERENCE ONLY, CONTRACTOR TO MAINTAIN EXISTING SEQUENCES OF OPERATION FROM THE REMOVED UNITS. UPDATE GRAPHICS TO MATCH THE NEW UNITS.

BAS: SEQUENCES OF OPERATION:

1. ROOF TOP UNITS

Terminal Strip Control

- Equipment shall be provided with built-in safety controls and terminal strip for interface with and control by BAS.
- BAS to control the following functions:
 - Control supply and exhaust fans
 - Modulate damper actuators.
 - Enable, disable and stage cooling.
 - Gas burner staging or modulation.
- Unit shall operate subject to internal safeties, which should override BAS command through terminal strip.

Run Conditions – Scheduled:

The unit shall run according to a user definable time schedule in the following modes:

- Occupied Mode: The unit shall maintain
 - 24°C (adj.) cooling setpoint
 - 21°C (adj.) heating setpoint.
- Unoccupied Mode (night setback): The unit shall maintain
 - 28°C (adj.) cooling setpoint.
 - 18°C (adj.) heating setpoint.

Alarms shall be provided as follows:



- Low Zone Temperature: A zone shall generate an alarm when its temperature drops below 10°C (adj.) for 30 minutes.

Zone Temperature Adjust:

The occupant shall be able to adjust the heating and cooling setpoints locally by +/- 1°C.

Zone Unoccupied Override:

A timed local override control shall allow an occupant to override the schedule and place the unit into an occupied mode for 60 minutes (adj.). At the expiration of this time, control of the unit shall automatically return to the schedule.

Zone Optimal Start:

The unit shall use an optimal start algorithm for morning start-up. This algorithm shall minimize the unoccupied warm-up or cool-down period while still achieving comfort conditions by the start of scheduled occupied period.

Supply Fan:

The supply fan shall run anytime the unit is commanded to run. To prevent short cycling, the supply fan shall have a user definable (adj.) minimum runtime. Supply fan speed shall be modulated to maintain duct static pressure setpoint – setpoint shall be established by TAB contractor and programmed by BAS Contractor.

Alarms shall be provided as follows:

- Supply Fan Status: Mismatch between the fan command and the fan status for 30 minutes.

Discharge Air Temperature Control:

The discharge air temperature setpoint shall be reset using the table below:

Average Zone Temperature Discharge Air Temperature Setpoint



21°C

18°C

24°C

12°C

Additionally, the discharge air setpoint will be reset based on a weighted sum of heating and cooling requests.

Every zone heating request shall add 0.2°C (adj.) to the discharge air setpoint and every zone cooling request shall deduct 0.1°C (adj.) from the discharge air setpoint.

The discharge air setpoint shall be limited to a maximum of 21°C (adj.) and a minimum of 11.5°C (adj.).

Discharge Air Temperature Monitoring:

The controller shall monitor the discharge air temperature.

Alarms shall be provided as follows:

- Low Discharge Air Temperature: If the discharge air temperature is less than 5°C (adj.) for 5 minutes.
- High Discharge Air Temperature: If the discharge air temperature is more than 49°C (adj.) for 5 minutes.

Gas Heating Control:

Gas heating shall be enabled as required to maintain discharge air temperature setpoint.

Heating shall be enabled whenever:

- The discharge air temperature is below heating setpoint.
- AND the outdoor air temperature is less than 15°C (adj.).
- AND the supply fan status is ON.

DX Cooling Control:

DX cooling shall be enabled as required to maintain discharge air temperature setpoint.

Cooling shall be enabled whenever:

- The discharge air temperature is above cooling setpoint.
- AND the outdoor air temperature is more than 15°C (adj.)
- AND the supply fan status is ON.

Economizer:

The outside air dampers shall be controlled by the rooftop unit's onboard controls.

Points:

Point Descriptor	Hardware Points				Software Points					Show on Graphic
	AI	AO	BI	BO	AV	BV	MV	Trend	Alarm	
Zone Temperature	x							x	x	x
Warmer/Cooler Adjust	x									x
Zone Temporary Occupancy						x		x		x
Discharge Air Temperature	x							x	x	x
Supply Fan Command		x						x		x
Supply Fan Status	x						x	x	x	x
Occupied Schedule							x	x		x
Occupancy Override							x			x
Occupied Heating Setpoint					x					x
Occupied Cooling Setpoint					x					x
Unoccupied Heating Setpoint					x					x



Point Descriptor	Hardware Points				Software Points					Show on Graphic
	AI	AO	BI	BO	AV	BV	MV	Trend	Alarm	
Unoccupied Cooling Setpoint					x					x
Heating Command				x				x		x
Cooling Command				x				x		x
Outdoor Air Temperature					x			x		x
Warmup/Cooldown Command							x	x		x
AHU State							x	x		x
Cooling OA-T Lockout Setpoint					x					x
Heating OA-T Lockout Setpoint					x					x
No Heat Alarm			x						x	x



Electrical Specification Issued for Tender

Project Name:

MAVIS S. MECH. & ROOF RENEWAL, CITY OF MISSISSAUGA
3185 MAVIS RD, MISSISSAUGA, ON. L5C 1T7

Project Number:

CH23-022

Date:

July 05, 2024

SECTION	NAME
26 05 00	Common Work Results for Electrical
26 05 21	Wires and Cables (0-1000V)
26 05 26	Grounding and Bonding
26 05 29	Hangers and Supports
26 05 31	Splitters, Junction, Pull Boxes and Cabinets
26 05 32	Outlet Boxes, Conduit Boxes and Fittings
26 05 34	Conduit, Fitting and Fastening
26 27 26	Wiring Devices
26 24 16	Panelboards breaker type
26 28 13	Fuses – Low Voltage
26 28 23	Disconnect Switches – Fused and Non-Fused
26 50 00	Lighting

END OF SECTION

- 1 GENERAL**
- 1.1 REFERENCES**
 - .1 Conform to the requirements of Division 1, which applies to and forms part of all sections of the work.
- 1.2 SUBMITTALS**
 - .1 Submit shop drawings for products under all sections.
- 1.3 REGULATION**
 - .1 All work shall be performed in accordance with the latest codes, rules, regulations, by-laws and requirements of all authorities having jurisdiction except where the requirements of the drawings and specifications exceed the codes, rules, regulations, by-laws and requirements of the authorities having jurisdiction. Supplementary mandatory Specifications and requirements to be used in conjunction with project include but are not limited to following:
 - .1 Illuminating Engineering Society (IES);
 - .2 CSA C22.1 – Canadian Electrical Code, Part 1, latest edition
 - .3 Ontario Building Code, latest edition (OBC);
 - .4 Ontario Electrical Safety Code, latest edition (OESC);
 - .5 Technical Standards and Safety Authority (TSSA);
 - .6 Underwriters' Laboratories of Canada (ULC);
 - .7 Material Safety Data Sheets by product manufacturers;
 - .8 codes, standards, and regulations of local governing authorities having jurisdiction;
 - .2 These specifications are supplementary to the requirements above.
 - .3 Drawings and specifications should not conflict with the above regulations but where there are apparent discrepancies the contractor shall notify the Engineer's Representative.
- 1.4 PERMITS, AND FEES**
 - .1 Make submissions to obtain all permits. Include for and pay for all fees and arrange for all reviews required for the work of this division.
 - .2 If required by code, plans and specifications have been previously submitted to the Authority Having Jurisdiction.
 - .3 Furnish certificates of Acceptance from the Authority Having Jurisdiction and include them in the Operation and Maintenance manual.
- 1.5 SAFETY**
 - .1 Protect exposed live equipment during construction for personnel safety.
 - .2 Shield and mark all live parts "LIVE 120 VOLTS", or with appropriate voltage in English.
- 1.6 FIRE STOPS**

- .1 Provide fire stops in accordance with front end, and Division 1 documents and as described herein. Contractor to coordinate fire stops with General Contractor. All paints, coatings, sealants and adhesives shall meet the VOC limits in accordance with the LEED Specification sections. Submit documentation as a shop drawing for review by the LEED Representative prior to ordering

1.7 **COORDINATION**

- .1 Be responsible for and perform specific coordination of various low voltage systems supplied by Electrical Divisions and also with systems supplied by other Divisions of Work.

1.8 **HOISTING**

- .1 Electrical Contractor will be responsible for the hoisting of all the equipment in the contract. Contractor to coordinate with General Contractor for use of the general hoisting facilities. If hoist facilities are inadequate then subcontractors must provide their own. Subcontractors must inform general contractors in writing of requirements before tender closing date. Any hoisting required in addition to that provided by the General, will be included in the bid price.

1.9 **SHOP DRAWINGS**

- .1 Submit electronic copies of shop drawings
- .2 Each shop drawing or product data sheet is to be properly identified with project name and product drawing or specification reference. Shop drawing or product data sheet dimensions are to match dimension type on drawings.
- .3 Where any item of equipment is required by Code or Standard or By-Law to meet a specific energy efficiency level, or any other specific requirement, ensure this requirement is clearly indicated on submission.
- .4 Obtain shop drawings for submission from product manufacturer's authorized representatives and supplemented with additional items specified herein.

1.10 **OPENINGS**

- .1 Supply opening sizes and locations to CH Engineering to allow verification of their effect on design, and for inclusion on structural drawings where appropriate.
- .2 No openings are permitted through completed structure without written approval of CH Engineering. Show required openings on a copy of structural drawings. Identify exact locations, elevations, and size of proposed openings and submit to CH Engineering for review, well in advance of doing work.
- .3 Prior to leaving site at end of each day, walk through areas of work and check for any openings, penetrations, holes, and/or voids created under scope of work of project, and ensure that any openings created under scope of work have been closed off, fire-stopped and smoke-sealed. Unless directed by Owner and coordinated with CH Engineering, do not leave any openings unprotected and unfinished overnight.

1.11 **CLEANING AND WASTE DISPOSAL**

- .1 Clean all electrical equipment that has been exposed to construction dust and dirt.
- .2 Contractor to clean all electrical equipment, inside and out, prior to turn over to Owner. Equipment is subject to review by Engineer's Representative and/or Owner.

- .3 Contractor is responsible to remove their own waste from the site. All reusable materials shall be recycled.

1.12 **SPRINKLERS**

- .1 All electrical equipment shall be suitable for installation in a sprinkler environment and enclosures are to be CSA Type-2 sprinkler proof.

1.13 **TEMPORARY LIGHT AND POWER**

- .1 Temporary light and power for construction shall be provided, metered, and maintained by the electrical trade, as directed by the General Contractor; but each trade shall provide all extension cords, lamps, etc., required to complete their work.
- .2 All temporary lights to be fluorescent or LED. Provide adequate lighting to meet all health and safety standards.

1.14 **CUTTING AND PATCHING:**

- .1 Provide all cutting, patching, and painting required to perform the electrical work.
- .2 Where X-ray scanning is required, it shall be performed by a qualified technician. Include all costs in the contract.

1.15 **PLYWOOD BACKBOARD**

- .1 Provide plywood backboard as indicated on the drawing.
- .2 Plywood to be securely fixed to the building structure.
- .3 Plywood to be ¾", void free, good one side, mounted with good side exposed.
- .4 Plywood to be class A fire retardant, FSC certified.

1.16 **SLEEVES & HOLES**

- .1 Provide all necessary sleeves, and holes for routing conduit through walls, ceilings, and floors as required.
- .2 Repair all holes and sleeves to 'As found condition' using proper material to match wall/floor finishes, types, and ratings
- .3 All cutting, patching, sleeves, and grouting is to be done by fully qualified craftsmen of that respective trade. All costs are to be included in the tender.

1.17 **IDENTIFICATION**

- .1 Provide limacoid nameplates on all power distribution equipment.
- .2 Provide typed written directories for new and existing panels. Confirm existing identification and correct where necessary.
- .3 Clearly mark all new circuiting at the exciting/new junction box above the ceiling to indicate the routing of branch circuit.

1.18 **INTERRUPTION OF SERVICES**

- .1 Modifications to existing electrical equipment, which will require shutdown, must be coordinated with the Owner and will only be permitted on weekdays from afterhours and on weekends. Any work not associated with live equipment can be done during normal working hours. Work considered disruptive to the normal operation of the building will be done after normal business hours. Exact times to be co-ordinated with Owner.
- .2 Contractor to provide a minimum of 5 days notice to the owner for the shutdown work.
- .3 The Contractor is responsible for co-ordination and isolating of all existing services at all voltage levels required for the disconnections and connections to existing buildings. This includes shutting down and isolating existing low and medium voltage services.
- .4 The Contractor is responsible for any damages caused to existing systems when making connections.
- .5 The Contractor is to keep shutdowns of existing buildings to a minimum by scheduling the work and providing the required number of personnel to keep the shutdown to a minimum. This Contractor is to include for as many multiple teams of electricians as is feasible to keep the shutdown work to a minimum.

1.19 **COST BREAK DOWN - CONTEMPLATED CHANGE NOTICE**

- .1 Contractor shall provide the Engineer's Representative with a detailed cost analysis of the contemplated change indicating material cost, and labor involved.
- .2 The detailed cost breakdown is to list material and labor separately for each item on the proposed change. The labor rate shall follow National Electrical Contractors Association (NECA) labour unit under column one. Complete "labour adjustment chart" per NECA if a different labour rate is required.
- .3 The following shall not be included in the cost of the work but are covered by the hourly labor rate:
 - .1 The costs of the Contractor's Project Manager, clerical and administrative personnel, and executive personnel.
 - .2 Temporary service, including, but not limited to lighting, and power. Etc.
 - .3 Transportation, parking, travel, and overnight room expenses.
 - .4 Insurance premiums, licenses, and permits.
 - .5 Printing cost.
 - .6 The cost of clean-up and disposal of waste material.
- .4 In computing accounts for extras and credits for any Proposed Change, all credits shall be deducted from the total sum of the extras before mark-ups or charges for overhead and profit are added.
- .5 The maximum percentage fee for mark-ups shall be as stated in the Division 0/1 specifications. Otherwise, it shall not exceed 10%.
- .6 Where a proposed change order includes both credits and extras, overhead and permitted mark-ups apply to the net extra or credits, if any, of the entire change.

1.20 **AS-BUILT DRAWINGS**

- .1 Final as-built drawings to include all revisions made to the drawings during construction, including all approved changes. The as-built drawings are to also include the routing of all feeders except for branch circuits, all junction boxes to be shown, drawing legend to be updated to include all symbols and lines used to show as-built conditions, quantity of wires in each conduit, and circuit numbers of wires in each conduit. Include slab layout drawings in as-built drawing package.
- .2 Before applying for a Certificate of Substantial Performance of the Work, Submit "as-built" site drawing prints to CH Engineering for review.
- .3 Contractor shall produce the final AS built drawing in CAD. If required, the engineer can transfer the AS built information from the mark up to the CAD in the amount of \$1,000.00 paid by the electrical contractor.

1.21 **OPERATING AND MAINTENANCE MANUALS**

- .1 Submit draft copy to CH Engineering for review. Incorporate any CH Engineering's comments in preparation final manuals. At the minimum, it shall include the following:
 - .1 front cover: project name label; wording – "Electrical Systems Operating and Maintenance Manual"; and date;
 - .2 contact of Contractor, and Subcontractor names, street addresses, telephone and fax numbers, and e-mail addresses;
 - .3 equipment manufacturer's authorized contact person name, telephone number and company website;
 - .4 Table of Contents sheet, and corresponding index tab sheets;
 - .5 copy of each reviewed shop drawings.
 - .6 equipment and system start-up data, test reports, final verification and commissioning reports.
 - .7 inspection certificates issued by regulatory authorities;
 - .8 copies of additional and revised panelboard directories;
 - .9 warranties;
- .2 Operating and maintenance instructions are to relate to job specific equipment supplied under this project and related to Owner's building. Language used in manuals is to contain simple practical operating terms and language easy for in-house maintenance staff to understand how to operate and maintain each system.
- .3 Before applying for a Certificate of Substantial Performance of the Work, assemble one copy of O & M Manual and submit to CH Engineering for review prior to assembling remaining copies. Incorporate CH Engineering's comments into final submission.

1.22 **PROJECT CLOSE OUT SUBMITTALS**

- .1 Prior to application for Substantial Performance of the Work, submit required items and documentation specified, including following:
 - .1 Operating and Maintenance Manuals;
 - .2 as-built record drawings and associated data;
 - .3 extended warranties for equipment as specified;

.4 operating test certificates;

.5 final commissioning report;

2 PRODUCTS

.1 Not used.

3 EXECUTION

.1 Not used.

END OF SECTION

1 GENERAL

1.1 RELATED REQUIREMENTS

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

1.2 REFERENCES

- .1 Ontario Electrical Safety Code (OESC).
- .2 Ontario Building Code (OBC)
- .3 CSA-C22.2 No. 0.3, Test Methods for Electrical Wires and Cables.
- .4 CSA-C22.2 – All section related to cables,

2 PRODUCTS

2.1 GENERAL LOW VOLTAGE POWER CABLES

- .1 CSA approved, ULC labelled and certified. Unless otherwise noted, conductors to be copper in general and be suitable for applications as noted in governing local electrical code.
- .2 "RW90" CSA certified, single copper conductor to CSA C22.2 No. 38, 600/1000 volts, maximum 90°C (194°F) conductor temperature, -40°C (-40°F) minimum installation temperature, X-link polyethylene (XLPE) insulation, colour coded.
- .3 "T90 Nylon", CSA certified, single copper conductor to CSA C22.2 No. 75, 600 volts, maximum 90°C (194°F) dry conductor temperature, -10°C (-14°F) minimum installation temperature, PVC insulated, nylon covered.
- .4 "AC90" flexible armoured cable with "RW90" conductors and bare copper ground conductor and overall interlocked aluminium tape armour, to CSA C22.2 No. 51 (R2004).
- .5 "AC90 ISO-BX" flexible armoured cable with "RW90" conductors with low temperature Exelene insulation and two additional solid copper bonding conductors (one bare, one insulated) and overall interlocked aluminium tape armour, to CSA C22.2 No. 51(R2004).

2.2 CONNECTORS

- .1 Armoured cable connectors must be proper squeeze type connectors and plastic anti-short bushings at terminations.
- .2 Connectors for conductors connecting to devices as per local governing electrical requirements, CSA certified, 600 volts, rated pressure type connectors.
- .3 For conductors sized 3/0 and greater, provide long barrel double crimp, 2 hole compression type lug connectors, unless otherwise noted.

2.3 LOW VOLTAGE TECK CABLES

- .1 Provide cables as follows:
 - .1 certified to CAN/CSA C22.2 No.131, Type TECK 90 Cable;
 - .2 rated for outdoor, weather resistant and wet locations applications;
 - .3 600/1000 V rated;

- .4 Conductor: Bare, Soft drawn, Class B Compact or Compressed Stranded Copper conductors per ASTM;
- .5 insulation: chemically cross linked thermosetting polyethylene (XLPE);
- .6 bonding conductor (1/C Cable): Soft drawn bare copper;
- .7 inner jacket: sunlight resistant PVC jacket tightly applied over assembly, to prevent slipping of core in a vertical position;
- .8 armour: flexible interlocked aluminum armour, over inner jacket for mechanical protection;
- .9 overall PVC jacket rated -40°C (-40°F).
- .10 barrier tape over shield.
- .2 Acceptable manufacturers are:
 - .1 Nexans;
 - .2 Or approved as equal.

3 EXECUTION

3.1 PROJECT CONDITIONS

- .1 If identified in documents, verify that field measurements and conditions are as identified.
- .2 Determine exact routing and lengths on site.

3.2 CO-ORDINATION

- .1 Co-ordinate work with work provided under other electrical work and work of other trades.
- .2 Determine cable routing to avoid interference with other work.

3.3 INSTALLATION OF CONDUCTORS

- .1 Provide required conductors. Ensure fire rated conductors are provided for applications as required by local governing codes, standards and local governing authorities.
- .2 In applications where multiple conductors in conduit are being run, provide a trapeze configuration of metal C-channels and threaded rod hangers to support cable/conduit from ceiling slab. Wall mounted cable/conduit brackets and ring type conduit hangers may also be permitted in applications approved by CH Engineering. Provide required cable support system accessories which are not specified herein or shown on drawings but are required for proper installation.
- .3 Conductors, unless otherwise noted, to be as follows:
 - .1 for connections to electric heating coils in supply air ductwork systems, and for connections to other electric heating equipment where use of 90 degrees C. rated conductors are recommended by heating equipment manufacturer - "RW90";
 - .2 climate controlled areas branch circuit wiring in accessible ceiling spaces and within stud wall construction consisting of drops down to luminaries and drops down stud walls to devices and in furniture systems - "AC90" flexible armoured cable ("BX") (maximum 6m (20') run permitted);

- .3 for climate controlled areas wiring except as noted above or specified elsewhere in Specification or as noted on drawings - "T90 Nylon" or "RW90".
- .4 Support flexible armoured cable in ceiling spaces and in stud wall construction with steel 2 hole cable straps to "Code" requirements. Flexible armoured cables must run in a neat manner parallel to building lines. Utilize centralized conduit runs to maintain maximum permitted runs of flexible armoured cables as specified. Provide insulating grommet at cut ends of flexible armoured cable to protect conductor insulation.
- .5 Generally, conductor sizes are indicated on drawings. Such sizes are minimum requirements and must be increased, where required, to suit the length of run and voltage drop in accordance with Ontario Electrical Safety Code. The electrical contractor shall upsize the conduit and wiring as required to meet the OESC voltage drop requirement and include all costs in the tender bid.
- .6 Do not use conductors smaller than No. 12 AWG in systems over 30 volts, unless otherwise noted. Do not use conductors smaller than No. 6 AWG for exterior luminaire wiring unless otherwise noted.
- .7 When pulling wires into conduit use lubricant and ensure that wires are kept straight and are not twisted or abraded.
- .8 Neatly secure exposed wire in apparatus enclosures with approved supports or ties.
- .9 Install low voltage conductors in conduits, unless otherwise noted within Documents.

3.4 **INSTALLATION OF TECK CABLES**

- .1 Provide cables as required for specific applications. Handle, install, and terminate in accordance with manufacturer's recommendations and instructions and as herein specified.
- .2 When pulling cable, apply pulling tension to conductor not in sheath of cable. Limit cable pulling tension to as recommended by cable manufacturer.
- .3 Terminate cable in equipment with lugs and termination kits as per cable manufacturer's instructions.
- .4 Installation of cable splices and terminations to be made by personnel skilled in this type of work.
- .5 Ground shielding as per cable manufacturer's instructions.
- .6 Take necessary precautions when handling cable on reel to ensure that no damage will result in uncoiling process.

END OF SECTION

1 GENERAL

1.1 RELATED REQUIREMENTS

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

1.2 REFERENCES

- .1 CSA C22.2 No.41 – Grounding and Bonding of Equipment, latest edition
- .2 Ontario electrical safety code, latest edition.
- .3 Ontario building code, latest edition.
- .4 CSA C22.1 – Canadian Electrical Code, latest edition.

2 PRODUCTS

2.1 BASIC MATERIALS

- .1 Ground Conductors: Solid copper, insulated and bare to suit application and code requirements; and bond conductors.
- .2 Ground Connections:
 - .1 When making ground and bonding connections, apply a corrosion inhibitor to contact surfaces. Use corrosion inhibitor appropriate for protecting a connection between metals used.
- .3 Miscellaneous ancillary components to complete grounding and bonding work to requirements of local governing electrical authority and codes.

3 EXECUTION

3.1 GENERAL GROUNDING AND BONDING REQUIREMENTS

- .1 Provide required grounding and bonding work in accordance with drawings, local governing electrical authority, governing authorities having jurisdiction, and local governing electrical inspection authority.
- .2 Ground and bond all metal enclosure equipment, as well as other metal parts such as mechanical pipes, water/gas pipes, ducts, door frames, fences, etc. to the perimeter ground bus. Provide minimum No. 3/0 insulated ground wire.
- .3 Ground conductors are to be insulated copper wire connected with approved fittings in accordance with the local governing electrical code.
- .4 Install bonding connections to typical equipment included in, but not necessarily limited to, the following list: frames of motors, starters, control panels, building steel work, elevators, distribution panels, and outdoor lighting.
- .5 Ground conductors not sized on drawings are to be sized in accordance with local governing electrical authority requirements.
- .6 Provide separate, insulated bonding conductors within each feeder and branch circuit raceway.

END OF SECTION

1 GENERAL

1.1 RELATED REQUIREMENTS

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

2 PRODUCTS

2.1 MATERIALS

- .1 Provide "U" type support Strut as manufactured by Unistrut.

3 EXECUTION

3.1 INSTALLATION

- .1 The Contractor to supply anchor bolts and base diagrams of equipment showing exact location for anchor bolts.
- .2 It shall be the responsibility of the electrical division to supply the Contractor with anchor bolts and base diagrams of equipment showing the exact location of anchor bolts.
- .3 All drilling for hangers, rod inserts and work of similar nature shall be done by this Division.
- .4 Auxiliary structural members shall be provided under the electrical section concerned where conduits or equipment must be suspended between the joists or beams of the structure, or where required to replace individual hanger to allow for installation on new services. Submit details for review as requested.
- .5 Depending on the type of structure, hangers shall be either clamped to steel beams or joists, or attached to approved concrete inserts.
- .6 Approved type expansion shields and bolts may be used for conduit up to 100 mm diameter where the pre-setting of concrete inserts is not practical. Submit Shop Drawings.
- .7 Suspending one hanger from another shall not be permitted.
- .8 All hangers, supports, brackets and other devices used outside the building wall shall be galvanized. If galvanized components cannot be used submit samples of proposed substitutes for review before installation.

END OF SECTION

1 GENERAL

1.1 RELATED REQUIREMENTS

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

1.2 REFERENCE

- .1 Ontario Electrical Safety Code, latest edition.
- .2 Ontario Building Code, latest edition. Ontario Electrical Sa
- .3 CSA C22.1 – Canadian Electrical Code, Part 1, latest edition.

2 PRODUCTS

2.1 SPLITTER

- .1 Sheet metal enclosure, welded corners and formed hinged cover suitable for locking in closed position. Provide CSA Type 1 enclosures in non-sprinklered environments and CSA Type 4/12 in sprinklered environments.
- .2 Main and branch lugs to match required size and number of incoming and outgoing conductors as indicated.

2.2 JUNCTION AND PULL BOXES

- .1 Welded steel construction with screw-on flat covers for surface mounting.
- .2 Covers with 25 mm minimum extension all around, for flush-mounted pull and junction boxes.

3 EXECUTION

3.1 INSTALLATION

- .1 Welded steel construction with screw-on flat covers for surface mounting.
- .2 Junction boxes and pull boxes shall be suitable for surface mounting and be of welded steel construction with screw-on flat covers.
- .3 For flush-mounted pull and junction boxes, provide covers with 27mm (1") minimum extension all around.
- .4 Install junction and pull boxes in inconspicuous but accessible locations.
- .5 A minimum of one pull box shall be installed for:
 - .1 every 100 ft.(30m) of conduit.
 - .2 Maximum 360 degree of combined bends

END OF SECTION

1 GENERAL

1.1 RELATED REQUIREMENTS

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

1.2 REFERENCE

- .1 Ontario Electrical Safety Code, latest Edition.
- .2 CSA C22.1-Canadian Electrical Code, Part 1, latest edition.
- .3 Ontario Building Code.

2 PRODUCTS

2.1 OUTLET AND CONDUIT BOXES GENERAL

- .1 Size boxes in accordance with the electrical code.
- .2 Square or larger outlet boxes as required for special devices.
- .3 Gang boxes where wiring devices are grouped.
- .4 Blank cover plates for boxes without wiring devices.

2.2 SHEET STEEL OUTLET BOX

- .1 Electro-galvanized steel single and multi-gang flush device boxes for flush installation, minimum size 75 mm x 50 mm x 38 mm or as indicated. 100 mm square outlet boxes when more than one conduit enters one side with extension and plaster rings as required.
- .2 Provide cast FS aluminum boxes with factory-threaded hubs and mounting feet for surface wiring of switches and receptacles connected to rigid conduit.
- .3 Provide electro-galvanized steel utility boxes for surface mounted boxes connected to surface-mounted EMT conduit, minimum size 100 mm x 54 mm x 48 mm.
- .4 Square or octagonal outlet boxes for lighting fixture outlets.

2.3 MASONRY BOXES

- .1 Electro-galvanized steel masonry single and multi-gang boxes for devices flush mounted in exposed block walls.

2.4 FITTINGS

- .1 Bushing and connectors with nylon insulated throats.
- .2 Knock-out fillers to prevent entry of debris.
- .3 Conduit outlet bodies for conduit up to 35 mm and pull boxes for larger conduits.
- .4 Double locknuts and insulated bushings on sheet metal boxes.

2.5 FLOOR BOXES

- .1 Provide surfaced mounted floor box/poke-thru floor box per the manufacturer indicated on the drawing.

3 EXECUTION

3.1 INSTALLATION

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

END OF SECTION

1 GENERAL

1.1 RELATED REQUIREMENTS

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

1.2 REFERENCE

- .1 CSA C22.2 – all applicable sections for conduits, conduit boxes, and fittings.

2 PRODUCTS

2.1 CONDUITS

- .1 Electrical metallic tubing (EMT)
- .2 Rigid Conduit
- .3 Rigid PVC conduit
- .4 Flexible metal conduit
- .5 Non-metallic tubing.

2.2 CONDUIT FITTINGS AND FASTENINGS

- .1 Fittings: manufactured for use with conduit specified. Coating: same as conduit.
- .2 Factory 90 degree elbow where 90 bends are required for 1" and larger conduits when a hydraulic bender is not used.
- .3 Connectors, and couplings for EMT conduit are to be set-screw steel type. Below the level of suspended ceilings, in a sprinklered environment, provide watertight fittings and "O" rings on all conduit runs and when conduit is terminated at any piece of electrical equipment.
- .4 Provide plastic bushings for all connectors, rigid nipples and rigid conduit 32mm or larger.
- .5 One-hole steel straps to secure surface conduits NPS 2 and smaller. Two-hole steel straps for conduits larger than NPS 2.
- .6 Beam clamps to secure conduits to exposed steel work.
- .7 Channel type supports for two or more conduits at 1 m oc.
- .8 Hot dipped galvanized threaded rods, 6 mm dia. minimum, to support suspended channels.

3 EXECUTION

3.1 INSTALLATION

- .1 Provide all conduits up to and including 102mm (4") size, as EMT thin wall with steel set screw couplings and connectors.
- .2 Provide flexible metal conduit for connections to motors and transformers.
- .3 Install conduits to conserve headroom, parallel and perpendicular to building lines. do not caddie clip conduits to ceiling hangers.
- .4 All empty conduits shall be complete with nylon fish wire.

- .5 All data/communication conduits shall be installed complete with plastic bushings at each end.
- .6 Conduits for communication shall be EMT min 21mm (3/4").
- .7 No more than two (2) - 90 deg. bends shall be installed between any two adjacent pull boxes. size all conduits based on RW 90xlpe wiring only
- .8 Size all conduits for max. 40% fill, including dedicated insulated ground wire.
- .9 Conduits exposed to the weather, in wet locations, subject to mechanical damage or in any hazardous locations, shall be rigid metal conduit.
- .10 Rigid metal conduit entering boxes in wet locations shall be secured with steel bullet hub connectors, nylon insulated with neoprene 'o' ring.
- .11 All conduits must be securely fastened with approved clips and screws in partitions and caddy clip in ceiling space.
- .12 Couplings and connects shall be raintight for exterior installation and set screw type or interior installation.
- .13 All conduits shall be installed to take care of expansion and approved expansion joint shall be installed where required whether indicated or not.
- .14 Use liquid-tight flexible metal conduit for connection to motors or vibrating equipment in damp, wet, or corrosive locations. Use only liquid-tight fittings when using liquid-tight flexible metal conduit.
- .15 Provide sleeves for all new conduit passing through floor and roof slabs, beams, concrete walls and slab to slab partitions, etc.
- .16 Where cables and conduits pass through partitions and through floors that are not fire-rated, provide an air-tight seal around the cables and conduits.
- .17 For all coring work, conduct x-ray scan, and review with the base building structural engineers representative. Upon approval, the coring work shall takes place on the weekend. Minimize cutting of rebar when core drilling.

END OF SECTION

1 GENERAL

1.1 RELATED REQUIREMENTS

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

1.2 SUBMITTALS

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

2 PRODUCTS

2.1 PANELBOARDS

- .1 Panelboards to be equipped with one (1) continuous bus bar per phase. Each bus bar to have sequentially phased branch circuit connectors limited to bolt-on branch circuit breakers. Bussing to be fully rated and of plated copper construction.
- .2 Panelboards are to be complete with:
 - .1 CSA type 2 sprinkler-proof enclosure.
 - .2 Suitable for bolt on breakers
 - .3 dead-front construction to shield user from energized parts;
 - .4 hinged door with concealed fasteners, concealed hinge, chrome plated door latch and keyed alike lock with key;
 - .5 a steel frame holder and circuit directory card protected by clear acetate and secured to back of door, and Mylar circuit breaker identification strips;
 - .6 drip shield for surface mounted panelboards;
 - .7 copper neutral bars;
 - .8 200% sized neutrals for panels equipped with SPD units and for panels as scheduled;
 - .9 solidly bonded equipment copper ground bar;
 - .10 high strength, set screw type, anti-turning wire connectors;
 - .11 filler plates covering unused mounting space;
- .3 Panels, doors and trim are to be factory painted with ANSI grey enamel finish.

2.2 MANUFACTURERS

- .1 New panel shall match the base building panel manufacturer – Siemens.

3 EXECUTION

3.1 INSTALLATION OF PANELBOARDS

- .1 Provide factory-assembled branch circuit panelboards. Ensure adequate clearance is met as per code requirements and as required for access for operation and maintenance.
- .2 Ground and bond equipment as per local governing electrical code and inspection authority requirements.

- .3 Identify panelboard breakers in a permanent manner, and complete typed panelboard circuit directories identifying circuit number.

END OF SECTION

1 GENERAL

1.1 RELATED REQUIREMENTS

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

1.2 REFERENCE

- .1 CSA C22.2 – all applicable sections for conduits, conduit boxes, and fittings.

2 PRODUCTS

2.1 SWITCHES

- .1 Switches to be CSA approved, ULC listed, and labeled devices. Refer to the drawing for detail.

2.2 FACEPLATES

- .1 Sheet steel utility box cover for wiring devices installed in surface-mounted utility boxes.
- .2 Provide stainless steel cover plates, suitable for the respective device, for all devices mounted in flush-mounted outlet boxes located in finished areas.
- .3 Sheet metal cover plates for wiring devices mounted in surface-mounted FS or FD type conduit boxes.

3 EXECUTION

3.1 INSTALLATION OF SWITCHES

- .1 Provide switches and install them in electrical outlet boxes. Size electrical boxes to suit device requirements as per the device manufacturer's recommendations. Properly ground device to box and ground system as per code requirements and manufacturer's instructions.

3.2 INSTALLATION OF FACEPLATES

- .1 Provide each switch and receptacle with a faceplate with an opening or openings suitable for the device it conceals and covers openings around boxes. Secure faceplates to device frames with screws to match faceplates.

END OF SECTION

1 GENERAL

1.1 RELATED REQUIREMENTS

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

1.2 SUBMITTALS

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

2 PRODUCTS

2.1 FUSES TYPE

- .1 Class J fuses.
 - .1 Type J1, time delay, capable of carrying 500% of its rated current for 10 s minimum.
- .2 Fuses for motor
 - .1 All fuses for the motor are to be time delay fuses.

2.2 MANUFACTURERS

- .1 The following are acceptable manufacturers
 - .1 Cooper-Bussman
 - .2 Mersen

3 EXECUTION

3.1 INSTALLATION

- .1 Contractor shall ensure the fuses meet the physical mounting devices before installing the fuses.
- .2 Install fuse in the mounting devices.

END OF SECTION

1 GENERAL

1.1 RELATED REQUIREMENTS

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

1.2 SUBMITTALS

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

2 PRODUCTS

2.1 DISCONNECT SWITCHES

- .1 All Fusible and non-fused disconnect switches shall be NEMA 3R sprinkler-proof.
- .2 Fuse-holders: suitable without adaptors, for the type and size of fuse indicated.
- .3 Quick-make, quick-break action.
- .4 ON-OFF switch position indication on switch enclosure cover.

2.2 MANUFACTURERS

- .1 Disconnect switch shall match base building equipment – Siemens.

3 EXECUTION

3.1 INSTALLATION

- .1 Install the fused disconnect switch as per the location shown on the drawing. Ensure minimum clearance is met per electrical safety codes.

END OF SECTION

1 GENERAL

1.1 RELATED REQUIREMENTS

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

1.2 SUBMITTALS

- .1 Submit shop drawings for products of this Section.

1.3 WARRANTY

- .1 Warranty requirements are as follows:
 - .1 unless otherwise noted, LED and LED drivers for a period of five (5) years from date of acceptance of Work by Owner for its intended use;

2 PRODUCTS

2.1 LUMINAIRES

- .1 Provide luminaires as specified.
- .2 Dimensions for coves, valances, and strips as shown on drawings are for bidding purposes only. Job measure for exact dimensions of louvres, lenses and strips.
- .3 Dimensions for linear and continuous linear LED as shown on drawings are for bidding purposes only. Job measure for exact dimensions requirements to suit installation location.

2.2 LEDS AND DRIVERS

- .1 General features include:
 - .1 CSA approved, ULC listed and labelled;
 - .2 Operating temperature: range through -20°C (-4°F) to 50°C (122°F);
 - .3 With rapid and changing development of LED technology, provide most technically proven and most advanced and successfully tested LED technology at time of installation;
 - .4 Be 100% compatible with connected dimmer controls to provide dimming down to 1%.
- .2 Light emitting diodes (LEDs) features to include:
 - .1 LEDs to be selected from same colour bin size for consistency in chromaticity and meet ANSI C78 377A as a minimum;
 - .2 generally, colour temperature range to be from 2700 K to 6500 K; specific temperature requirements to be identified on Schedule of Luminaires;
 - .3 minimum CRI of 80 ;
 - .4 rated life (based on 70% lumen depreciation level) from 50,000 to 70,000 hours.
- .3 Driver (ballast) features to include:
 - .1 Operate from 60 Hz input source of 120 VAC with sustained variations of $\pm 10\%$ (voltage and frequency) with no damage to driver;
 - .2 Output regulated to $\pm 5\%$ across load range;

.3 Power factor greater than 0.90;

3 EXECUTION

3.1 INSTALLATION

- .1 Provide luminaires as required. Obtain required training from manufacturer's representative on any special installation procedures. Install products in accordance with manufacturer's instructions to suit specific installation requirements.
- .2 Before placing luminaire orders:
 - .1 verify quantity requirements;
 - .2 thoroughly review existing site conduit.
 - .3 ensure that required mounting assemblies, frames, rings and similar features are included;
- .3 Include for assembly and mounting of luminaires, complete with:
 - .1 wiring and connections;
 - .2 fittings and hangers;
 - .3 box covers;
 - .4 other accessories required for a complete, safe and fully operational assembly.
- .4 Mount surface ceiling luminaires perfectly level or plumb, tightly to ceiling without showing a space or light leak between frame and ceiling.
- .5 Protect wiring with tape or tubing at all points where abrasion may occur. Conceal wiring within fixture construction except where design or mounting dictates otherwise.
- .6 Splices:
 - .1 Minimize number of splices.
 - .2 Make with approved mechanical insulated steel spring type connectors, suitable for temperature and voltage conditions to which splices are to be subjected.
 - .3 Splices are not to be made unless properly terminated in accessible identified junction boxes.
- .7 Do not tighten wing nuts, bolts, or screws that allow fixture adjustment for recessed adjustable fixtures.
- .8 Comply with requirements of local governing electrical code regarding support of luminaires in suspended ceilings.
- .9 Connect luminaires to power circuits and controls as required. Refer to drawings notes and schedules. Include for both normal and emergency power circuits as required.
- .10 Ground and bond luminaires as per local governing electrical code requirements.
- .11 Prior to turn over of Work to Owner, clean luminaires in manner recommended by manufacturer and to satisfaction of the consultant.

END OF SECTION



Hazardous Building Materials Assessment (Pre-construction)

Roof Replacement Project
3185 Mavis Road,
Mississauga, Ontario

Prepared for:

City of Mississauga
300 City Centre Drive
Mississauga, Ontario, L5B 3C1

June 4, 2024

Pinchin File: 342395.000



Issued to: City of Mississauga
Issued on: June 4, 2024
Pinchin File: 342395.000
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EXECUTIVE SUMMARY

City of Mississauga (Client) retained Pinchin Ltd. (Pinchin) to conduct a hazardous building materials assessment at the Mavis Works Yard South Building located at 3185 Mavis Road, Mississauga, Ontario. Pinchin performed the assessment on May 16, 2024.

The objective of the assessment was to identify specified hazardous building materials in preparation for an upcoming roof replacement project. The scope of work will be limited to the replacement of south section of the roof system (including flashings), as indicated on the drawing provided by the Client via email on May 2, 2024.

SUMMARY OF FINDINGS

The following is a summary of significant findings; refer to the body of the report for detailed findings:

Asbestos: Asbestos-containing were not confirmed to be present at the assessed roof section.

Silica: Crystalline silica is present in concrete and other materials such as masonry.

Mercury: Mercury vapour is not present in lamp tubes.

Polychlorinated Biphenyls (PCBs): PCBs are not present.

Mould and Water Damage: Visible mould and water damage was not observed.

SUMMARY OF RECOMMENDATIONS

The following is a summary of significant recommendations; refer to the body of the report for detailed recommendations.

1. Do not disturb suspected hazardous building materials discovered during the planned work, which have not been identified in this report and arrange for further evaluation and testing.
2. Follow appropriate safe work procedures when handling or disturbing asbestos, lead, silica, and mould.

This Executive Summary is subject to the same standard limitations as contained in the report and must be read in conjunction with the entire report.



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1.0 INTRODUCTION AND SCOPE

City of Mississauga (Client) retained Pinchin Ltd. (Pinchin) to conduct a hazardous building materials assessment at Mavis Works Yard South Building located at 3185 Mavis Road, Mississauga, Ontario.

Pinchin performed the assessment on May 16, 2024. The surveyor was unaccompanied during the assessment. The assessed area was vacant at the time of the assessment.

The objective of the assessment was to identify specified hazardous building materials in preparation for an upcoming roof replacement project. The scope of work will be limited to the replacement of south section of the roof system (including flashings), as indicated on the drawing provided by the Client via email on May 2, 2024.

1.1 Scope of Assessment

The **assessed area** is limited to the portion of the building to be renovated, as described by the Client, and identified in the drawings in Appendix I.

The assessment was performed to establish the type of specified hazardous building materials, locations and approximate quantities incorporated in the structure and its finishes.

For the purpose of the assessment and this report, hazardous building materials are defined as follows:

- Asbestos
- Lead
- Silica
- Mercury
- Polychlorinated Biphenyls (PCBs)
- Mould

The following Designated Substances are not typically found in building materials in a composition/state that is hazardous and were not included in this assessment:

- Arsenic
- Acrylonitrile
- Benzene
- Coke oven emissions
- Ethylene oxide
- Isocyanates
- Vinyl chloride monomer



2.0 METHODOLOGY

Pinchin conducted a room-by-room assessment to identify the hazardous building materials as defined in the scope.

The assessment included limited demolition roofing materials to view concealed conditions at representative areas as permitted by the current building use.

Demolition of exterior building finishes, masonry walls (chases, shafts etc.), and structural surrounds was not conducted.

Limited demolition of masonry block walls (core holes) was not conducted to investigate for loose fill vermiculite insulation.

For further details on the methodology including test methods, refer to Appendix III.

3.0 BACKGROUND INFORMATION

3.1 Building Description

Description Item	Details
Use	Office and Work Yard
Number of Floors	The building is 2 storeys.
Total Area	The total area of the building is 57,000 square feet. The assessed area is approx. 10,000 square feet.
Year of Construction	The building was constructed in 1956 with major renovations in 1989.
Structure	Structure Steel, Concrete
Exterior Cladding	Pre-cast concrete
HVAC	Rooftop AC
Roof	Built-up Roofing
Flooring	NA
Interior Walls	NA
Ceilings	NA

3.2 Existing Reports

Pinchin previously prepared the following reports, which have been reviewed as part of this assessment:

- “Hazardous Building Materials Assessment (Management), Mavis Works Yard South – Office – MW1, 3185 Mavis Road, Mississauga, Ontario” dated August 2, 2023, Pinchin File Number 325772

4.0 FINDINGS

The following section summarizes the findings of the assessment and provides a general description of the hazardous building materials identified.

Any quantities listed in this report are estimated based on visual approximations only and are subject to variation.

4.1 Asbestos

4.1.1 Pipe Insulation

Pipes in the assessed area are either uninsulated or insulated with non-asbestos fiberglass or other non-asbestos insulation such as mineral fibre or elastomeric foam insulation.



Pipe uninsulated, South roof section.

4.1.2 Duct Insulation and Mastic

Ducts are either uninsulated or insulated with non-asbestos fiberglass (foil-faced or canvas jacketing).

4.1.3 Mechanical Equipment Insulation

Mechanical equipment (Rooftop AC) is either uninsulated or insulated with non-asbestos fiberglass.



Roof top AC uninsulated, South roof section.

4.1.4 Roofing Products

The materials associated with the built-up roof do not contain asbestos (samples S0001A-C).

Tar and caulking are present on flashings and vent shafts on the roof does not contain asbestos (samples S0002A-C and S0003A-C).



Built-up roof materials, south roof section.



Caulking, south roof section.



Tar, south roof section.

4.1.5 Excluded Materials

The following is a list of materials which may contain asbestos and was excluded from the assessment.

These materials are presumed to contain asbestos until otherwise proven by sampling and analysis:

- Electrical components
- Mechanical packing, ropes, and gaskets
- Duct mastics
- Vibration dampers on HVAC equipment

4.2 Lead

4.2.1 Lead Products and Applications

Lead products were not found during the assessment.

4.2.2 *Excluded Lead Materials*

Lead is known to be present in several materials which were not assessed or sampled. The following materials, where found, should be presumed to contain lead.

- Electrical components, including wiring connectors, grounding conductors, and solder
- Solder on pipe connections

4.3 **Silica**

Crystalline silica is assumed to be a component of the following materials where present in the building.

- Concrete
- Masonry and mortar

4.4 **Mercury**

4.4.1 *Lamps*

Mercury vapour is not present in fluorescent lamp tubes.

4.4.2 *Mercury-Containing Devices*

Mercury-containing devices were not found during the assessment.

4.5 **Polychlorinated Biphenyls**

4.5.1 *Caulking and Sealants*

Caulking is present at base of the roof vent (samples P0001) and contains <0.1 mg/kg PCBs. The material is a non-PCB solid based on the threshold (50 mg/kg).



Caulking, South roof section.

4.5.2 *Transformers*

Transformers were not found during the assessment.



4.6 Mould and Water Damage

Visible mould growth and water damage was not found during the assessment.

5.0 RECOMMENDATIONS

5.1 General

1. If suspected hazardous building materials are discovered during the planned work, which are not identified in this report, do not disturb, and arrange for further testing and evaluation.
2. Provide this report to the contractor prior to bidding or commencing work.

5.2 Assessed Area Renovation Work

The following recommendations are made regarding renovation involving the hazardous materials identified.

5.2.1 Lead

Lead-containing items should be recycled when taken out of service.

5.2.2 Silica

Construction disturbance of silica-containing products may result in excessive exposures to airborne silica, especially if performed indoors and dry. Cutting, grinding, drilling or demolition of materials containing silica should be completed only with proper respiratory protection and other worker safety precautions that comply with applicable regulations and guidelines.

5.2.3 Mercury

Do not break lamps or separate liquid mercury from components. Recycle and reclaim mercury from fluorescent lamps when taken out of service. Mercury is classified as a hazardous waste and must be disposed of in accordance with applicable regulations.

6.0 TERMS AND LIMITATIONS

This work was performed subject to the Terms and Limitations presented or referenced in the proposal for this project.



Information provided by Pinchin is intended for Client use only. Pinchin will not provide results or information to any party unless disclosure by Pinchin is required by law. Any use by a third party of reports or documents authored by Pinchin or any reliance by a third party on or decisions made by a third party based on the findings described in said documents, is the sole responsibility of such third parties. Pinchin accepts no responsibility for damages suffered by any third party as a result of decisions made or actions conducted. No other warranties are implied or expressed.

7.0 REFERENCES

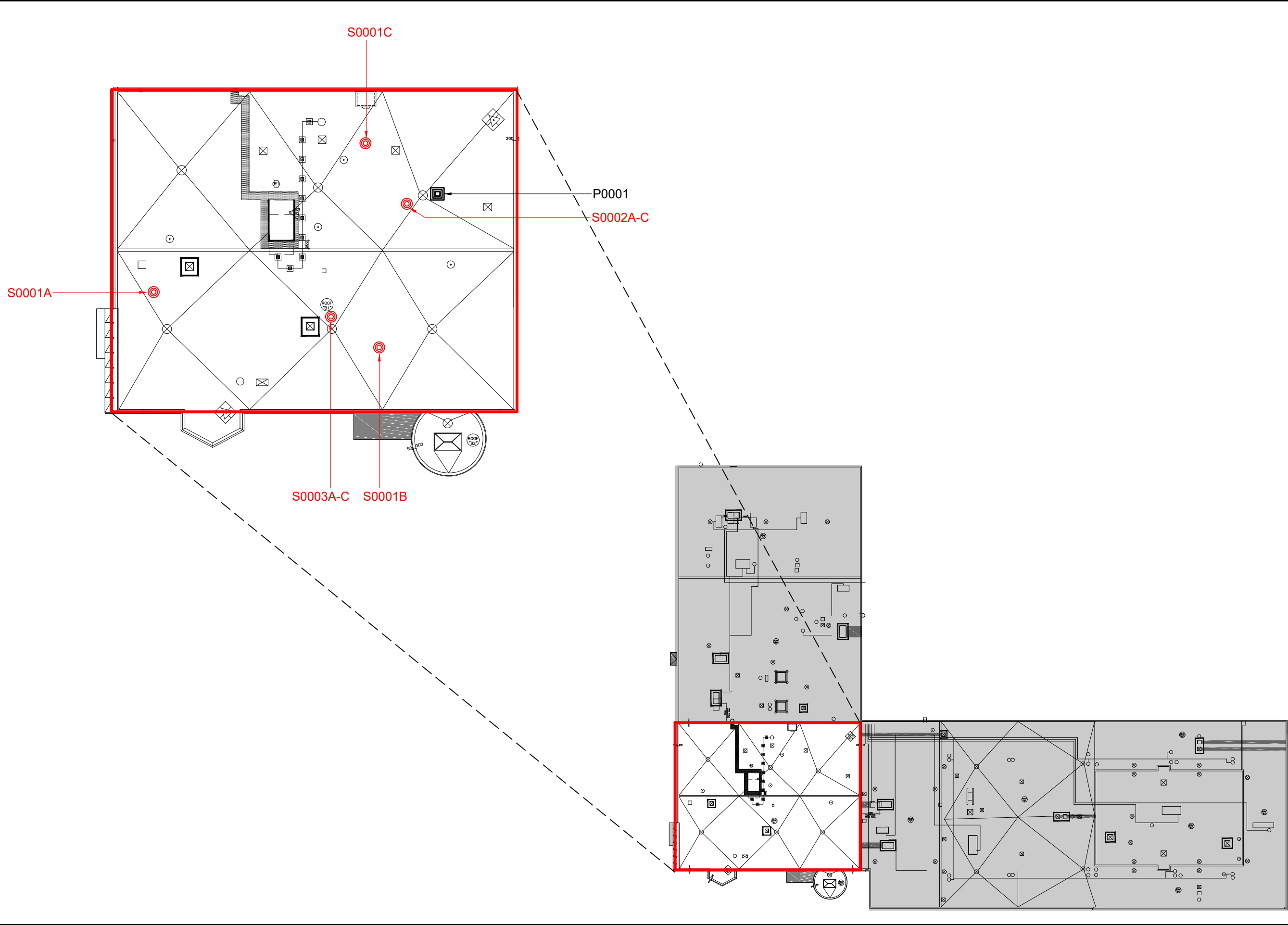
The following legislation and documents were referenced in completing the assessment and this report:

1. Asbestos on Construction Projects and in Buildings and Repair Operations, Ontario Regulation 278/05.
2. Designated Substances, Ontario Regulation 490/09.
3. Lead on Construction Projects, Ministry of Labour Guidance Document.
4. The Environmental Abatement Council of Canada (EACC) Lead Guideline for Construction, Renovation, Maintenance or Repair.
5. Ministry of the Environment Regulation, R.R.O. 1990 Reg. 347 as amended.
6. Ministry of the Environment Regulation, R.R.O. 1990 Reg. 362 as amended.
7. Silica on Construction Projects, Ministry of Labour Guidance Document.
8. Alert – Mould in Workplace Buildings, Ontario Ministry of Labour.
9. PCB Regulations, SOR/2008-273, Canadian Environmental Protection Act.
10. Surface Coating Materials Regulations, SOR/2016-193, Canada Consumer Product Safety Act.
11. Consolidated Transportation of Dangerous Goods Regulations, including Amendment SOR/2019-101, Transportation of Dangerous Goods Act.
12. Mould Guidelines for the Canadian Construction Industry, Standard Construction Document CCA 82 – 2004 (Revised 2018), Canadian Construction Association.
13. Canada Occupational Health and Safety Regulation, SOR/86-304
14. Technical Guideline to Asbestos Exposure Management Programs.

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Template: Master Report for Hazardous Materials Assessment (Pre-Construction), HAZ, April 3, 2024

APPENDIX I
Drawings



- LEGEND**
- SURVEY BOUNDARY/ASSESSED AREA
 - OUTSIDE ASSESSMENT SCOPE
 - ASBESTOS BULK SAMPLE
 - PCB BULK SAMPLE

NOT ALL KNOWN OR SUSPECTED HAZARDOUS BUILDING MATERIALS MAY BE DEPICTED ON THE DRAWING. REFER TO THE HAZARDOUS BUILDING MATERIALS ASSESSMENT REPORT FOR A COMPLETE LIST OF KNOWN AND SUSPECTED HAZARDOUS BUILDING MATERIALS.

LEGEND IS COLOUR DEPENDENT. NON-COLOUR COPIES MAY ALTER INTERPRETATION.

BASE PLAN PROVIDED BY CLIENT.



PROJECT NAME:
HAZARDOUS BUILDING MATERIALS ASSESSMENT (PRE-CONSTRUCTION)

CLIENT NAME:
CITY OF MISSISSAUGA

PROJECT LOCATION:
**3185 MAVIS ROAD
 MISSISSAUGA, ONTARIO**

FIGURE NAME:
GROUND FLOOR

PROJECT NUMBER: 342395.000	SCALE: NOT TO SCALE
DRAWN BY: DP	REVIEWED BY: AK
DATE: MAY 2024	FIGURE NUMBER: 1 OF 1

APPENDIX II-A
Asbestos Analytical Certificates



Pinchin Ltd. Asbestos Laboratory *Certificate of Analysis*

Project No.: 0342395.000
Prepared For: A. Khan

Lab Reference No.: b314106
Analyst(s): T. Ly

Date Received: May 17, 2024
Date Analyzed: May 28, 2024
Samples Submitted: 3
Phases Analyzed: 34

The Pinchin Ltd. Mississauga asbestos laboratory is accredited by the National Institute of Standards and Technology, National Voluntary Laboratory Accreditation Program (NVLAP Lab Code 101270-0) for the 'EPA – 40 CFR Appendix E to Subpart E of Part 763, Interim Method of the Determination of Asbestos in Bulk Insulation Samples,' and the 'EPA 600/R-93/116: Method for the Determination of Asbestos in Bulk Building Materials'; and meets all requirements of ISO/IEC 17025:2017. The Pinchin asbestos laboratory uses the aforementioned methods of analysis for all bulk materials. Please be advised that bulk materials do not include debris, dust, and tape-lift samples, and the analysis and reporting of these materials does not conform with Pinchin Ltd.'s NVLAP accreditation.

Bulk samples are checked visually and scanned under a stereomicroscope. Slides are prepared and observed under a Polarized Light Microscope (PLM) at magnifications of 40X, 100X or 400X as appropriate. Asbestos fibres are identified by a combination of morphology, colour, refractive index, extinction, sign of elongation, birefringence and dispersion staining colours. A visual estimate is made of the percentage of asbestos present. A reported concentration of less than (<) the regulatory threshold indicates the presence of confirmed asbestos in trace quantities, limited to only a few fibres or fibre bundles in an entire sample. This method complies with provincial regulatory requirements where applicable. Multiple phases within a sample are analyzed and reported separately.

All bulk samples submitted to this laboratory for asbestos analysis are retained for a minimum of three months. Samples may be retrieved, upon request, for re-examination at any time during that period.

This report relates only to the items tested.

This report relates only to the items tested and is valid only when signed with a protected, authorized, electronic signature. This report may not be reproduced, except in full, without the written approval of Pinchin Ltd. The client may not use this report to claim product endorsement by NVLAP or any agency of the U.S. Government. Internal verification studies, quality assurance / control data and laboratory documentation on measurement uncertainty are available upon request.



Pinchin Ltd. Asbestos Laboratory Certificate of Analysis

Project No.: 0342395.000
Prepared For: A. Khan

Lab Reference No.: b314106
Date Analyzed: May 28, 2024

BULK SAMPLE ANALYSIS

SAMPLE IDENTIFICATION	SAMPLE DESCRIPTION	% COMPOSITION (VISUAL ESTIMATE)	
		ASBESTOS	OTHER
S0001A Roof, Roofing material, Mavis South Roof	12 Phases:		
	a) Homogeneous, black, tar on brown paper.	None Detected	Tar and other Non-Fibrous Material > 75%
	b) Homogeneous, brown, paper with tar and reinforcement.	None Detected	Cellulose 50-75% Man-Made Vitreous Fibres 10-25% Tar and other Non-Fibrous Material 10-25%
	c) Homogeneous, grey, paper.	None Detected	Cellulose > 75% Man-Made Vitreous Fibres 5-10% Non-Fibrous Material 5-10%
	d) Homogeneous, black, tar on foam.	None Detected	Tar and other Non-Fibrous Material > 75%
	e) Non-homogeneous, black and grey, paper.	None Detected	Cellulose > 75% Man-Made Vitreous Fibres 0.5-5% Tar and other Non-Fibrous Material 10-25%
	f) Homogeneous, black, tar between foam and cellulose block.	None Detected	Tar and other Non-Fibrous Material > 75%
	g) Non-homogeneous, black, tar on cellulose blocks.	None Detected	Tar and other Non-Fibrous Material > 75%
	h) Homogeneous, black, tar-impregnated, fibrous material.	None Detected	Cellulose 25-50% Tar and other Non-Fibrous Material 50-75%
	i) Homogeneous, black, shiny, crumbly, tar material.	None Detected	Tar and other Non-Fibrous Material > 75%
	j) Homogeneous, black, soft, tar material with fibres.	None Detected	Man-Made Vitreous Fibres 5-10% Tar and other Non-Fibrous Material > 75%
	k) Homogeneous, tar-impregnated, compressed, fibrous material.	None Detected	Synthetic Fibres 25-50% Tar and other Non-Fibrous Material 50-75%
l) Homogeneous, black, tar with stones.	None Detected	Tar and other Non-Fibrous Material > 75%	
Comments:	Due to the condition of the sample, the order of phases reported may not reflect the actual order in situ. Cellulose and foam are present on the surface of this sample.		



Pinchin Ltd. Asbestos Laboratory Certificate of Analysis

Project No.: 0342395.000
Prepared For: A. Khan

Lab Reference No.: b314106
Date Analyzed: May 28, 2024

BULK SAMPLE ANALYSIS

SAMPLE IDENTIFICATION	SAMPLE DESCRIPTION	% COMPOSITION (VISUAL ESTIMATE)	
		ASBESTOS	OTHER
S0001B Roof, Roofing material, Mavis South Roof	9 Phases:		
	a) Homogeneous, grey, paper.	None Detected	Cellulose > 75% Man-Made Vitreous Fibres 5-10% Non-Fibrous Material 5-10%
	b) Homogeneous, black, tar between foam and cellulose block.	None Detected	Tar and other Non-Fibrous Material > 75%
	c) Homogeneous, black, tar in between cellulose block.	None Detected	Tar and other Non-Fibrous Material > 75%
	d) Homogeneous, black, tar-impregnated, fibrous material.	None Detected	Cellulose 25-50% Tar and other Non-Fibrous Material 50-75%
	e) Homogeneous, black, shiny, crumbly, tar material.	None Detected	Tar and other Non-Fibrous Material > 75%
	f) Homogeneous, black, soft, tar material with fibres.	None Detected	Man-Made Vitreous Fibres 5-10% Tar and other Non-Fibrous Material > 75%
	g) Homogeneous, tar-impregnated, compressed, fibrous material.	None Detected	Synthetic Fibres 25-50% Tar and other Non-Fibrous Material 50-75%
	h) Homogeneous, black, tar with stones.	None Detected	Tar and other Non-Fibrous Material > 75%
	i) Homogeneous, black, tar on loose cellulose block.	None Detected	Tar and other Non-Fibrous Material > 75%
Comments:	Due to the condition of the sample, the order of phases reported may not reflect the actual order in situ. Cellulose and foam are present on the surface of this sample.		



Pinchin Ltd. Asbestos Laboratory Certificate of Analysis

Project No.: 0342395.000
Prepared For: A. Khan

Lab Reference No.: b314106
Date Analyzed: May 28, 2024

BULK SAMPLE ANALYSIS

SAMPLE IDENTIFICATION	SAMPLE DESCRIPTION	% COMPOSITION (VISUAL ESTIMATE)	
		ASBESTOS	OTHER
S0001C Roof, Roofing material, Mavis South Roof	13 Phases: a) Homogeneous, black, tar on brown paper.	None Detected	Tar and other Non-Fibrous Material > 75%
	b) Homogeneous, brown, layered, paper with tar and reinforcement.	None Detected	Cellulose 50-75% Man-Made Vitreous Fibres 5-10% Tar and other Non-Fibrous 25-50%
	c) Homogeneous, black, tar on foam.	None Detected	Tar and other Non-Fibrous Material > 75%
	d) Homogeneous, grey, paper.	None Detected	Cellulose > 75% Man-Made Vitreous Fibres 5-10% Non-Fibrous Material 5-10%
	e) Non-homogeneous, black and grey, paper.	None Detected	Cellulose > 75% Man-Made Vitreous Fibres 0.5-5% Tar and other Non-Fibrous 10-25%
	f) Homogeneous, black, tar between foam and cellulose block.	None Detected	Tar and other Non-Fibrous Material > 75%
	g) Homogeneous, black, tar-impregnated, fibrous material between foam and cellulose block.	None Detected	Cellulose 25-50% Tar and other Non-Fibrous Material 50-75%
	h) Homogeneous, black, tar-impregnated, fibrous material in between cellulose block.	None Detected	Cellulose 25-50% Tar and other Non-Fibrous Material 50-75%
	i) Homogeneous, black, tar-impregnated, fibrous material.	None Detected	Cellulose 25-50% Tar and other Non-Fibrous 50-75%
	j) Homogeneous, black, shiny, crumbly, tar material.	None Detected	Tar and other Non-Fibrous Material > 75%
	k) Homogeneous, black, soft, tar material with fibres.	None Detected	Man-Made Vitreous Fibres 5-10% Tar and other Non-Fibrous > 75%
	l) Homogeneous, tar-impregnated, compressed, fibrous material.	None Detected	Synthetic Fibres 25-50% Tar and other Non-Fibrous 50-75%
	m) Homogeneous, black, tar with stones.	None Detected	Material Tar and other Non-Fibrous > 75%
Comments:	Due to the condition of the sample, the order of phases reported may not reflect the actual order in situ. Cellulose and foam are present on the surface of this sample.		

Reviewed by:

Digitally signed by
Pinchin Ltd.
Date: 2024.05.28
09:54:44-04'00'

Reporting Analyst:

Digitally signed by
Pinchin Ltd.
Date: 2024.05.28
09:54:36-04'00'

Sample Prefix	Sample No.	Sample Suffix	Sample Description/Location (Mandatory)

Pinchin Stan, save COC to project file and include hard copy with samples.
PWL, PLEL, LGGPP; Include a hard copy with samples and email to **asbestossamples@pinchin.com** (Asbestos Samples Submissions in Global Address Book)



Pinchin Ltd. Asbestos Laboratory *Certificate of Analysis*

Project No.: 0342395.000
Prepared For: A. Khan

Lab Reference No.: b314107
Analyst(s): J. Dacquel

Date Received: May 17, 2024 **Samples Submitted:** 6
Date Analyzed: May 27, 2024 **Phases Analyzed:** 9

The Pinchin Ltd. Mississauga asbestos laboratory is accredited by the National Institute of Standards and Technology, National Voluntary Laboratory Accreditation Program (NVLAP Lab Code 101270-0) for the 'EPA – 40 CFR Appendix E to Subpart E of Part 763, Interim Method of the Determination of Asbestos in Bulk Insulation Samples,' and the 'EPA 600/R-93/116: Method for the Determination of Asbestos in Bulk Building Materials'; and meets all requirements of ISO/IEC 17025:2017. The Pinchin asbestos laboratory uses the aforementioned methods of analysis for all bulk materials. Please be advised that bulk materials do not include debris, dust, and tape-lift samples, and the analysis and reporting of these materials does not conform with Pinchin Ltd.'s NVLAP accreditation.

Bulk samples are checked visually and scanned under a stereomicroscope. Slides are prepared and observed under a Polarized Light Microscope (PLM) at magnifications of 40X, 100X or 400X as appropriate. Asbestos fibres are identified by a combination of morphology, colour, refractive index, extinction, sign of elongation, birefringence and dispersion staining colours. A visual estimate is made of the percentage of asbestos present. A reported concentration of less than (<) the regulatory threshold indicates the presence of confirmed asbestos in trace quantities, limited to only a few fibres or fibre bundles in an entire sample. This method complies with provincial regulatory requirements where applicable. Multiple phases within a sample are analyzed and reported separately.

All bulk samples submitted to this laboratory for asbestos analysis are retained for a minimum of three months. Samples may be retrieved, upon request, for re-examination at any time during that period.

This report relates only to the items tested.

This report relates only to the items tested and is valid only when signed with a protected, authorized, electronic signature. This report may not be reproduced, except in full, without the written approval of Pinchin Ltd. The client may not use this report to claim product endorsement by NVLAP or any agency of the U.S. Government. Internal verification studies, quality assurance / control data and laboratory documentation on measurement uncertainty are available upon request.



Pinchin Ltd. Asbestos Laboratory Certificate of Analysis

Project No.: 0342395.000
Prepared For: A. Khan

Lab Reference No.: b314107
Date Analyzed: May 27, 2024

BULK SAMPLE ANALYSIS

SAMPLE IDENTIFICATION	SAMPLE DESCRIPTION	% COMPOSITION (VISUAL ESTIMATE)	
		ASBESTOS	OTHER
S0002A Roof, Caulking, Mavis South Roof	2 Phases: a) Homogeneous, brown, caulking material.	None Detected	Non-Fibrous Material > 75%
	b) Homogeneous, black, tar material.	None Detected	Tar and other non-fibrous > 75%
S0002B Roof, Caulking, Mavis South Roof	2 Phases: a) Homogeneous, brown, caulking material.	None Detected	Non-Fibrous Material > 75%
	b) Homogeneous, black, tar material.	None Detected	Tar and other non-fibrous > 75%
S0002C Roof, Caulking, Mavis South Roof	2 Phases: a) Homogeneous, brown, caulking material.	None Detected	Non-Fibrous Material > 75%
	b) Homogeneous, black, tar material.	None Detected	Tar and other non-fibrous > 75%
S0003A Roof, Tar, Mavis South Roof	Homogeneous, black, tar material.	None Detected	Tar and other non-fibrous > 75%
S0003B Roof, Tar, Mavis South Roof	Homogeneous, black, tar material.	None Detected	Tar and other non-fibrous > 75%
S0003C Roof, Tar, Mavis South Roof	Homogeneous, black, tar material.	None Detected	Tar and other non-fibrous > 75%

Reviewed by:

Digitally signed by
Pinchin Ltd.
Date: 2024.05.27
17:57:41-04'00'

Reporting Analyst:

Digitally signed by
Pinchin Ltd.
Date: 2024.05.27
17:57:59-04'00'

Analyzed by: *[Signature]*
 Reviewed by: *[Signature]*
 Report Sent by: *[Signature]* (9)

**Pinchin Ltd. - Asbestos Laboratory
 Internal Asbestos Bulk Sample Chain of Custody**

Client Name:		Project Address:	ON
Portfolio/Building No:		Pinchin File:	342087 342895 per email
Submitted by:	Ahmed Khan	Email:	akhan@pinchin
CC Results to:		CC Email:	gmackay@pinchin arakic (per email)
Date Submitted:	May 16 2024	Required by:	Month Day 2020
# of Samples:	6 SPLIT 2/2	Priority:	Select
Year of Building Construction (Mandatory, Years ONLY):			
Do NOT Stop on Positive (Sample Numbers):			
Pinchin Group Company (Mandatory Field):			Pinchin
HMIS2 Building Reference #:			134050/202441663903247

To be Completed by Lab Personnel Only:

Lab Reference #:	b314107 CH	Time:	24 hour clock
Received by:	5.17.2024 KB	Date:	Month Day Year
Name(s) of Analyst(s):	<i>[Signature]</i>		MAY 27, 2024

Sample Prefix	Sample No.	Sample Suffix	Sample Description/Location (Mandatory)
S	0002	A	Roof,Caulking,Mavis South Roof a)ND b)ND
S	0002	B	Roof,Caulking,Mavis South Roof a)ND b)ND
S	0002	C	Roof,Caulking,Mavis South Roof a)ND b)ND
S	0003	A	Roof,Tar,Mavis South Roof ND
S	0003	B	Roof,Tar,Mavis South Roof ND
S	0003	C	Roof,Tar,Mavis South Roof ND

APPENDIX II-B
PCB Analytical Certificates



Your Project #: 342395
Your C.O.C. #: N/A

Attention: Ahmed Khan

Pinchin Ltd
2360 Meadowpine Blvd
Unit # 2
Mississauga, ON
CANADA L5N 6S2

Report Date: 2024/05/27
Report #: R8165192
Version: 1 - Final

CERTIFICATE OF ANALYSIS

BUREAU VERITAS JOB #: C4F0882

Received: 2024/05/21, 09:51

Sample Matrix: Solid
#Samples Received: 1

Analyses	Quantity	Date	Date	Laboratory Method	Analytical Method
		Extracted	Analyzed		
Polychlorinated Biphenyl in Solids (1)	1	2024/05/24	2024/05/25	CAM SOP-00309	EPA 8082A m

Remarks:

Bureau Veritas is accredited to ISO/IEC 17025 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Bureau Veritas are based upon recognized Provincial, Federal or US method compendia such as CCME, EPA, APHA or the Quebec Ministry of Environment.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Bureau Veritas' profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Bureau Veritas in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported; unless indicated otherwise, associated sample data are not blank corrected. Where applicable, unless otherwise noted, Measurement Uncertainty has not been accounted for when stating conformity to the referenced standard.

Bureau Veritas liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. Bureau Veritas has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by Bureau Veritas, unless otherwise agreed in writing. Bureau Veritas is not responsible for the accuracy or any data impacts, that result from the information provided by the customer or their agent.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.

Results relate to samples tested. When sampling is not conducted by Bureau Veritas, results relate to the supplied samples tested.

This Certificate shall not be reproduced except in full, without the written approval of the laboratory.

Reference Method suffix "m" indicates test methods incorporate validated modifications from specific reference methods to improve performance.

* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.

(1) Analysis was conducted according to Bureau Veritas method CAM SOP-00309 and modified where applicable based on the sample matrix. This test is not Standards Council of Canada accredited for this matrix.



Your Project #: 342395
Your C.O.C. #: N/A

Attention: Ahmed Khan

Pinchin Ltd
2360 Meadowpine Blvd
Unit # 2
Mississauga, ON
CANADA L5N 6S2

Report Date: 2024/05/27
Report #: R8165192
Version: 1 - Final

CERTIFICATE OF ANALYSIS

BUREAU VERITAS JOB #: C4F0882

Received: 2024/05/21, 09:51

Encryption Key

Nilushi Mahathantila
Project Manager
27 May 2024 13:47:28

Please direct all questions regarding this Certificate of Analysis to:

Nilushi Mahathantila, Project Manager
Email: Nilushi.Mahathantila@bureauveritas.com
Phone# (905) 817-5700

=====

This report has been generated and distributed using a secure automated process.

Bureau Veritas has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per ISO/IEC 17025, signing the reports. For Service Group specific validation, please refer to the Validation Signatures page if included, otherwise available by request. For Department specific Analyst/Supervisor validation names, please refer to the Test Summary section if included, otherwise available by request. This report is authorized by Rodney Major, General Manager responsible for Ontario Environmental Laboratory operations.



POLYCHLORINATED BIPHENYLS BY GC-ECD (SOLID)

Bureau Veritas ID		ZFH837		
Sampling Date				
COC Number		N/A		
	UNITS	P0001, CAULKING, MAVIS SOUTH ROOF	RDL	QC Batch
PCBs				
Aroclor 1262	ug/g	<0.1	0.1	9410972
Aroclor 1016	ug/g	<0.1	0.1	9410972
Aroclor 1221	ug/g	<0.1	0.1	9410972
Aroclor 1232	ug/g	<0.1	0.1	9410972
Aroclor 1242	ug/g	<0.1	0.1	9410972
Aroclor 1248	ug/g	<0.1	0.1	9410972
Aroclor 1254	ug/g	<0.1	0.1	9410972
Aroclor 1260	ug/g	<0.1	0.1	9410972
Aroclor 1268	ug/g	<0.1	0.1	9410972
Total PCB	ug/g	<0.1	0.1	9410972
Surrogate Recovery (%)				
Decachlorobiphenyl	%	85		9410972
RDL = Reportable Detection Limit				
QC Batch = Quality Control Batch				



Bureau Veritas Job #: C4F0882
Report Date: 2024/05/27

Pinchin Ltd
Client Project #: 342395
Sampler Initials: AK

TEST SUMMARY

Bureau Veritas ID: ZFH837
Sample ID: P0001, CAULKING,MAVIS SOUTH ROOF
Matrix: Solid

Collected:
Shipped:
Received: 2024/05/21

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Polychlorinated Biphenyl in Solids	GC/ECD	9410972	2024/05/24	2024/05/25	Farag Mansour



Bureau Veritas Job #: C4F0882
Report Date: 2024/05/27

Pinchin Ltd
Client Project #: 342395
Sampler Initials: AK

GENERAL COMMENTS

Sample ZFH837 [P0001, CAULKING, MAVIS SOUTH ROOF] : PCB analysis: Values were calculated on a wet weight basis.

Results relate only to the items tested.



QUALITY ASSURANCE REPORT

QC Batch	Parameter	Date	Matrix Spike		SPIKED BLANK		Method Blank		RPD	
			% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits
9410972	Decachlorobiphenyl	2024/05/25	95	30 - 130	96	30 - 130	104	%		
9410972	Aroclor 1016	2024/05/25					<0.1	ug/g		
9410972	Aroclor 1221	2024/05/25					<0.1	ug/g		
9410972	Aroclor 1232	2024/05/25					<0.1	ug/g		
9410972	Aroclor 1242	2024/05/25					<0.1	ug/g		
9410972	Aroclor 1248	2024/05/25					<0.1	ug/g		
9410972	Aroclor 1254	2024/05/25					<0.1	ug/g		
9410972	Aroclor 1260	2024/05/25	87	30 - 130	92	30 - 130	<0.1	ug/g	11	50
9410972	Aroclor 1262	2024/05/25					<0.1	ug/g		
9410972	Aroclor 1268	2024/05/25					<0.1	ug/g		
9410972	Total PCB	2024/05/25	87	30 - 130	92	30 - 130	<0.1	ug/g	11	50

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

Surrogate: A pure or isotopically labeled compound whose behavior mirrors the analytes of interest. Used to evaluate extraction efficiency.



Bureau Veritas Job #: C4F0882
Report Date: 2024/05/27

Pinchin Ltd
Client Project #: 342395
Sampler Initials: AK

VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by:

Anastasia Hamanov, Scientific Specialist



Bureau Veritas has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per ISO/IEC 17025, signing the reports. For Service Group specific validation, please refer to the Validation Signatures page if included, otherwise available by request. For Department specific Analyst/Supervisor validation names, please refer to the Test Summary section if included, otherwise available by request. This report is authorized by Rodney Major, General Manager responsible for Ontario Environmental Laboratory operations.



6740 Campbell Road, Mississauga, Ontario L5N 2L8
 Phone: 905-617-6700 Fax: 905-617-6779 Toll Free: 800-563-6366
 CAN FCD-01391/6

CHAIN OF CUSTODY RECORD

Page of

Invoice Information		Report Information (if differs from invoice)				Project Information (where applicable)				Turnaround Time (TAT) Applied	
Company Name: <u>Pinehon Ltd.</u>		Company Name: _____				Quotation #: _____				<input checked="" type="checkbox"/> Regular TAT (5-7 days) Most analyses	
Contact Name: <u>Ahmed Khan</u>		Contact Name: _____				P.O. #/ A/F #: _____				PLEASE PROVIDE ADVANCE NOTICE FOR RUSH PROJECTS	
Address: _____		Address: _____				Project #: <u>342935</u>				Rush TAT (Surcharges will be applied)	
Phone: _____ Fax: _____		Phone: _____ Fax: _____				Site Location: _____				<input type="checkbox"/> 1 Day <input type="checkbox"/> 2 Days <input type="checkbox"/> 3-4 Days	
Email: <u>akhan@pinehon.com</u>		Email: _____				Site #: _____				Date Required: _____	
VSL (VOLATILE) DRINKING WATER OR WATER INTENDED FOR HUMAN CONSUMPTION MAY ONLY BE SAMPLED ON THE BUREAU VERITAS QA QMS QUALITY CONTROL CHAIN OF CUSTODY		Sampled By: <u>Ahmed Khan</u>				Site Location Province: <u>ON</u>				Batch Confirmation #: _____	
Regulation 153 <input type="checkbox"/> Table 1 <input type="checkbox"/> Res/Park <input type="checkbox"/> Med/Place <input type="checkbox"/> Table 2 <input type="checkbox"/> Ind/Comm <input type="checkbox"/> Course <input type="checkbox"/> Table 3 <input type="checkbox"/> Agri/Other <input type="checkbox"/> Table _____ FOR RSC (PLEASE CIRCLE) Y / N		Other Regulations <input type="checkbox"/> CCME <input type="checkbox"/> Sanitary Sewer Bylaw <input type="checkbox"/> MISA <input type="checkbox"/> Storm Sewer Bylaw <input type="checkbox"/> FWGO <input type="checkbox"/> Region _____ <input type="checkbox"/> Other (Specify) _____ <input type="checkbox"/> REG 558 (MIN. 3 DAY TAT REQUIRED) <input type="checkbox"/> REG 406 Table _____				Analyte Requested # OF CONTAINERS SUBMITTED FIELD INTENDED (SOLIDS) Metals / Ag / Cris BTEX/PAHs PCBs PB-AH POCs USE 222 METALS & INORGANICS USE 105 ORGANOMETALS USE 158 METALS USE 111, 127/105 METALS (MS-MS) Lead (Pb) in PVCs PCBs HOLD-DO NOT ANALYZE				LABORATORY USE ONLY CUSTODY SEAL Y / N Present Intact COOLING MEDIA PRESENT: Y / N COMMENTS	
Include Criteria on Certificate of Analysis: Y / N		SAMPLES MUST BE KEPT COOL (<10 °C) FROM TIME OF SAMPLING UNTIL DELIVERY TO BUREAU VERITAS		SAMPLE IDENTIFICATION		DATE SAMPLED (YYYY/MM/DD)		TIME SAMPLED (HH:MM)		MATERIAL	
POODL, Caulking, Minis South roof				BULK							
RELEASED BY: (Signature/Print)		DATE: (YYYY/MM/DD)		TIME: (HH:MM)		RECEIVED BY: (Signature/Print)		DATE: (YYYY/MM/DD)		TIME: (HH:MM)	
						 Ahmed Khan		 UG57			

Unless otherwise agreed to in writing, work submitted on this Chain of Custody is subject to Bureau Veritas' standard Terms and Conditions. Signing of this Chain of Custody document is acknowledgment and acceptance of our terms available at <https://www.bvna.com/coc-terms-and-conditions>



NONT-2024-05-2118

APPENDIX III
Methodology



1.0 GENERAL

An investigation was conducted to identify the type of Hazardous Building Materials incorporated in the structure and its finishes.

Information regarding the location and condition of hazardous building materials encountered and visually estimated quantities were recorded. The locations of any samples collected were recorded on small-scale plans. As-built drawings and previous reports were referenced where provided.

Sample collection was conducted in accordance with our Standard Operating Procedures.

1.1 Asbestos

The investigation for asbestos included friable and non-friable asbestos-containing materials (ACM). A friable material is a material that when dry can be crumbled, pulverized, or powdered by hand pressure, or a material that has already become crushed, pulverized, or powdered.

A separate set of samples was collected of each type of homogenous material suspected to contain asbestos. A homogenous material is defined by the US EPA as material that is uniform in texture and appearance, was installed at one time, and is unlikely to consist of more than one type or formulation of material. The homogeneous materials were determined by visual examination and available information on the phases of construction and prior renovations.

Samples were collected at a rate that is in compliance with the requirements of local regulations and guidelines. The sampling strategy was also based on known ban dates and phase out dates of the use of asbestos; sampling of certain building materials is not conducted after specific construction dates. In addition, to be conservative, several years past these dates are added to account for some uncertainty in the exact start / finish date of construction and associated usage of ACM. In some cases, manufactured products such as asbestos cement pipe were visually identified without sample confirmation.

The asbestos analysis of select materials was completed using a stop-positive approach. Only one result meeting the regulated criteria was required to determine that a material is asbestos containing, but all samples must be analyzed to conclusively determine that a material is non-asbestos. The laboratory stopped analyzing samples from a homogeneous material once a result equal to or greater than the regulated criteria is detected in any of the samples of that material. All samples of a homogeneous material were analyzed if no asbestos is detected. In some cases, all samples were analyzed in the sample set regardless of result.

The analysis was performed in accordance with Test Method EPA/600/R-93/116: Method for the Determination of Asbestos in Bulk Building Materials, July 1993.

Analytical results were compared to the following criteria:

Jurisdiction*	Friable	Non-Friable
Ontario	0.5%	0.5%
Federal	1%	1%

* If there is a conflict between federal and provincial criteria, the more stringent will apply.

Where building materials are described in the report as “non-asbestos” or “does not contain asbestos”, this means that either no asbestos was detected by the analytical method utilized in any of the multiple samples or, if detected, it is below the lower limit of an asbestos-containing material in the applicable regulation. Additionally, these terms are used for materials which historically are known to not include asbestos in their manufacturing.

Asbestos materials were evaluated in order to make recommendations regarding any remedial work. The priority for remedial action was based on several factors:

- Friability (friable or non-friable)
- Condition (good, fair, poor, debris)
- Accessibility (ranking from accessible to all building users to inaccessible)
- Visibility (whether the material is obscured by other building components)
- Efficiency of the work (for example, if damaged ACM is being removed in an area, it may be most practical to remove all ACM in the area even if it is in good condition)

1.2 Lead

Samples of distinctive paint finishes, and surface coatings present in more than a limited application, where removal of the paint is possible were collected. The samples were collected by scraping the painted finish to include base and covering applications.

Analysis for lead in paints or surface coatings was performed in accordance with EPA Method No. 3050B/Method No. 7420; flame atomic absorption.

Analytical results were compared to the following criteria.

Jurisdiction*	Units (%)	Units (ppm) / (mg/kg)
Ontario	0.1	1,000
Federal	0.009	90

* If there is a conflict between federal and provincial criteria, the more stringent will apply.

Other lead building products (e.g. batteries, lead sheeting, flashing) were identified by visual observation only.

1.3 Silica

Building materials known to contain crystalline silica (e.g. concrete, cement, tile, brick, masonry, mortar) were identified by visual inspection only. Pinchin did not perform sampling of these materials for laboratory analysis of crystalline silica content.

1.4 Mercury

Building materials, products, or equipment (e.g. thermostats, barometers, pressure gauges, lamp tubes), suspected to contain mercury were identified by visual inspection only. Dismantling of equipment suspected of containing mercury was not performed. Sampling of these materials for laboratory analysis of mercury content was not performed.

1.5 Polychlorinated Biphenyls

The potential for light ballast and oil filled transformers to contain PCBs was based on the age of the building, a review of maintenance records, and examination of labels or nameplates on equipment, where present and accessible. The information was compared to known ban dates of PCBs and Environment Canada publications.

Dry type transformers were presumed to be free of dielectric fluids and hence non-PCB.

Fluids (mineral oil, hydraulic, Aroclor or Askarel) in transformers or other equipment were not sampled for PCB content.

Caulking, sealants, or paints were sampled and submitted for PCB analysis following EPA 3550C/8082A.

Sample results are compared to the criteria of 50 mg/kg for solids as stated in the PCB Regulation, SOR/2008-273.

1.6 Visible Mould

The presence of mould or water damage was determined by visual inspection of exposed building surfaces. If any mould growth or water damage was concealed within building cavities it was not addressed in this assessment.



TRI-TECH PINNACLE

Roof Condition Report - 3185 Mavis Road, Mississauga, ON

Prepared For:

Paul Didur Architect Inc.
Paul Didur
222 Islington Avenue, Suite 260,
Etobicoke, Ontario M8V 3W7

Prepared By:

Tri-Tech Pinnacle Group Inc.
73 Industrial Parkway North, Unit #3
Aurora, ON, L4G 4C4 Tel: (905) 503-1300

Inspection Date:

11/23/2023

Report Number:

231364

Technical Representative:

Terry Challis

Reviewed By:

James White



METHOD OF INSPECTION:

On November 23rd of 2023, a visual review was carried out on roof level D (only) installed at 3185 Mavis Road in Mississauga, ON. The roof membrane and flashings were visually examined, where available. Every effort was made to observe all roof components. A pictorial presentation of the various conditions of interest on the roof surface is included at the end of the report. All comments made in this report are based on the Inspector's professional opinion.

EXECUTIVE SUMMARY:

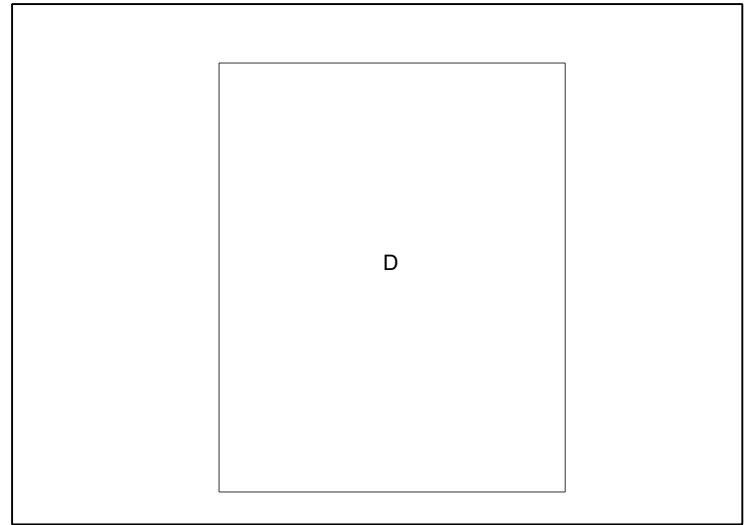
Roof level D: Multi-ply Roofing Felts in Asphalt (BUR)

- Roof level appears to be approximately 10 years old and appears to be in good condition overall.
- Open pitch pans, deteriorated sealant at the perimeter metal flashings, corrosion and one open furnace stack were the defects noted during this assessment.
- Core cuts were completed in two areas and no wet insulation was noted in these areas.
- With continued maintenance, recommended repairs and annual inspections this roof level should last full serviceable life expectancy of 20-25 years.

** Please note rest of the facility was not reviewed at this time.

Roof Condition Report

Overview

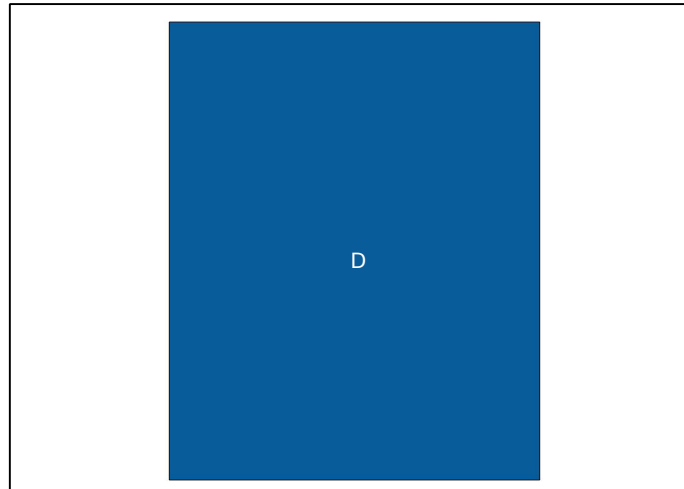


Building / Roof Level	Condition	Area (SF) (Approx.)	Roof System	Estimated Install Date
3185 Mavis Rd. / D	Good	8,740	BUR	2013

Roof Condition Report

Roof: D

Building: 3185 Mavis Rd.



Roof System: BUR
Estimated Install Date: 2013
Condition Index: Good
Roof Access: Exterior Ladder
Approx. Roof Sq. Ft.: 8,740
Height: 20'

Assessment: This roof level is approximately 10 years old and appears to be in good condition. With continued maintenance and annual inspections, this roof level should reach its full serviceable life expectancy.

Roof Core



Core Sample 1

The core cut was taken (at the high spot) to verify the roof condition and composition in this particular location on the roof. The roofing assembly is:

- Pea gravel in asphalt
- 4 Ply BUR
- 2" Fibreboard Insulation (2 layers of 1")
- 2.5" Polyisocyanurate Insulation (1" Base)
- 2 Ply # 15 Roofing Felts
- 0.5" Dens Deck
- Metal Deck



Core Sample 1a

Close up of the felts.

The roofing assembly is:

- Pea gravel in asphalt
- 4 Ply BUR
- 2" Fibreboard Insulation (2 layers of 1")
- 2.5" Polyisocyanurate Insulation (1" Base)
- 2 Ply # 15 Roofing Felts
- 0.5" Dens Deck
- Metal Deck



Core Sample 2

A second core cut was taken (at the roof drain) to verify the roof condition and composition in this particular location on the roof. The roofing assembly is:

- Pea gravel in asphalt
- 4 Ply BUR
- 1" Fibreboard Insulation (2 layers of 0.5")
- 1" Polyisocyanurate Insulation
- 2 Ply # 15 Roofing Felts
- 0.5" Densdeck
- Metal Deck



Core Sample 2a

Close up of the felts.

The roofing assembly is:

- Pea gravel in asphalt
- 4 Ply BUR
- 1" Fibreboard Insulation (2 layers of 0.5")
- 1" Polyisocyanurate Insulation
- 2 Ply # 15 Roofing Felts
- 0.5" Dens Deck
- Metal Deck

Roof Condition Report

Deficiencies & Overviews



Condition: Pitch pan sealant
Severity: High
Quantity: 1

The mastic is low and/or open in several gas line pitch pans. This condition may be allowing water to enter into the roofing assembly and/or building.



Condition: Pitch pan sealant 1
Severity: High
Quantity: 1

Another gas line pitch pan with low sealant.

Roof Condition Report



Condition: Pitch pan sealant 2
Severity: High
Quantity: 1

Another open gas line pitch pan.



Condition: Sealant failure
Severity: High
Quantity: 1

The sealant at the top of perimeter metal counterflashing is open, possibly allowing water to channel behind the counterflashing.

Roof Condition Report



Condition: Sealant failure 1
Severity: High
Quantity: 1

Close-up of the open sealant at the perimeter metal flashings.



Condition: Sealant failure 2
Severity: High
Quantity: 1

More open sealant at the perimeter metal flashings.

Roof Condition Report



→
Condition: Corrosion
Severity: Medium
Quantity: 1

View of the corroded fan unit.



↑
Condition: Fan unit
Severity: Medium
Quantity: 1

Open and deteriorated flex connection was noted at the fan unit.



Condition: Fan unit 1
Severity: Medium
Quantity: 1

Close-up of the open and deteriorated flex connection at the fan unit.



Condition: Sealant failure at stack
Severity: Medium
Quantity: 1

The sealant used to seal this furnace stack rain collar is open and deteriorated. This condition may be allowing water to enter the roofing assembly and/or building.

Roof Condition Report



Condition: Expansion Joint

Quantity: 1

View of the expansion joint.



Condition: Field view

Quantity: 1

Another view of the roof level.

Roof Condition Report



Condition: Perimeter

Quantity: 1

Perimeter metal detail.

Proposed Work

Date	Activity	Allocation	Urgency	Budget Cost \$
2023	Repair	Expense	High	5,000

- Aluminize the corroded units
 - Top up the gas line pitch pans with compatible sealant
 - Apply new sealant at the perimeter metal flashings, where open and deteriorated
 - Apply new sealant at the furnace stack rain collar, where open and deteriorated
 - Install a new sealed flex connector at the fan unit
-

Roof Condition Report

Total Capital Budgets

Building / Roof	2023	2024	2025	2026	2027
3185 Mavis Rd. / D	0	0	0	0	0
Totals \$	0	0	0	0	0

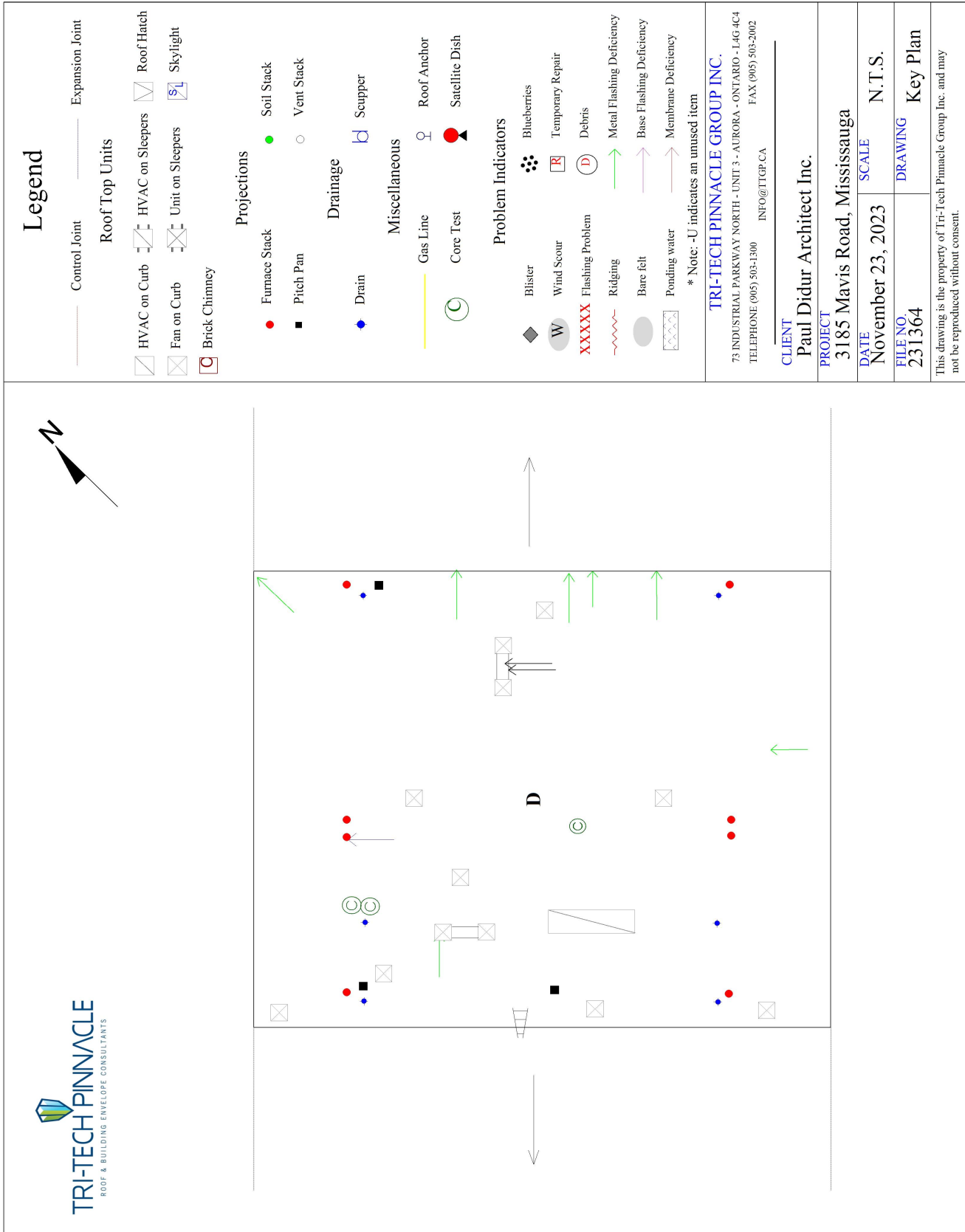
Yearly Maintenance & Expenses Budget

Building / Roof	2023	2024	2025	2026	2027
3185 Mavis Rd. / D	5,000	0	0	0	0
Totals \$	5,000	0	0	0	0

Budget Totals

Building / Roof	2023	2024	2025	2026	2027
3185 Mavis Rd. / D	5,000	0	0	0	0
Totals \$	5,000	0	0	0	0

Roof Condition Report



Legend

- Control Joint
 - Expansion Joint
 - Roof Top Units**
 - HVAC on Curb
 - HVAC on Sleepers
 - Roof Hatch
 - Fan on Curb
 - Unit on Sleepers
 - Skylight
 - Brick Chimney
 - Projections**
 - Furnace Stack
 - Soil Stack
 - Pitch Pan
 - Vent Stack
 - Drainage**
 - Drain
 - Scupper
 - Miscellaneous**
 - Gas Line
 - Roof Anchor
 - Core Test
 - Satellite Dish
 - Problem Indicators**
 - Blister
 - Blueberries
 - Wind Scour
 - Temporary Repair
 - Flashing Problem
 - Debris
 - Rtdging
 - Metal Flashing Deficiency
 - Bare felt
 - Base Flashing Deficiency
 - Ponding water
 - Membrane Deficiency
- * Note: -U indicates an unused item

TRI-TECH PINNACLE GROUP INC.
 73 INDUSTRIAL PARKWAY NORTH - UNIT 3 - AURORA - ONTARIO - L4G 4C4
 TELEPHONE (905) 503-1300 INFO@TTGP.CA FAX (905) 503-2002

CLIENT
 Paul Didur Architect Inc.

PROJECT
 3185 Mavis Road, Mississauga

DATE November 23, 2023 **SCALE** N.T.S.
FILE NO. 231364 **DRAWING** Key Plan

This drawing is the property of Tri-Tech Pinnacle Group Inc. and may not be reproduced without consent.



Prepared For:

MAVIS WORKS - MISSISSAUGA, ON - Main Entry Door Renovations

RAY Grotke
CITY OF MISSISSAUGA
300 CITY CENTRE DR
MISSISSAUGA, ON , L5B 3C1
905-615-3200 ext.5763
raymond.grotke@mississauga.ca

Prepared By:

Securitas Technology Canada Corporation
2495 Meadowpine,
Mississauga ON L5N6C3
Phone : 416.213.7570
3800 Tabs Drive
Uniontown, OH 44685
Gerry Hegarty
COMMERCIAL SECURITY ACCOUNT MANAGER

gerry.hegarty@securitas.com

Project Site:

MAVIS WORKS
3185 MAVIS RD
MISSISSAUGA, ON, L5C 1T7
905-615-3200 ext.5763

CITY OF MISSISSAUGA

MAVIS SOUTH – 3185 MAVIS ROAD

ENTRY DOOR RENOVATION / REPLACEMENT PROJECT

SECURITAS TO ATTEND PRIOR TO DOOR REMOVAL TO REMOVE ALL SECURITY DEVICES FROM DOORS.

WE WILL DISCONNECT CABLES AND LEAVE FOR THE CONTRACTOR TO REMOVE, ALONG WITH ANY CONDUIT.

GC TO PROVIDE ALL NEW ¾" CONDUIT, WHERE REQUIRED, WITH PULL-STRINGS FROM EACH ENTRY DOOR BACK TO SECURITY ACCESS CONTROL PANEL.

SECURITAS TO SUPPLY AND INSTALL NEW SECURITY CABLES FROM ACCESS PANEL BACK TO SECURITY DEVICES AT EACH DOOR.

AS PER THE CLIENT (CITY OF MISSISSAUGA), THE FOLLOWING IS TO BE PROVIDED BY THE GC AND SECURITAS:

GC to provide:

- Conduits for card readers and associated devices
- All Door Hardware, compatible with Medeco X4 cylinders
- New door contacts – supply & install
- New Electric Strikes – supply & install

Securitas to provide:

- Cables for card readers and associated devices
- Access control devices, Card reader, PIR-TREX (reuse existing)
- CX12 relay for Door Card reader door with new Door Operator

ADO and push buttons by others.

All door hardware and associated devices by others, including locksets, electric strikes and keying.

All work quoted for completion during regular business hours.

Conduit, flex, cable trays and fire stop by others.

1 Proposal Schedules:

1.1 Material Schedule:

Material Line Items

Manufacturer	Part Number	Qty	Unit Price	Total Price
Camden	CX-12PLUS	1	\$91.12	\$91.12
8-Mode Relay Door Interface				
Paige	2S1680P6R5	1	\$787.58	\$787.58
ACCESS CABLE 18/4C+22/3PR OAS+22/4C+22/2C YELLOW CMP 500'				

Group Subtotal: \$878.70

Material Schedule Subtotal: \$878.70

Labour Schedule

Categories	Hours	Hourly Rate	Extended Sell
Project Supervision	4.00	142.50	\$570.00
Data Entry	1.00	142.50	\$142.50
CAD	2.00	142.50	\$285.00

Labour Schedule Subtotal: \$997.50

Subcontracting & Cable Schedule

Categories	Qty	Unit	Price
SUBCONTRACTOR INSTALLATION LABOUR			\$2,532.00
SECURITY MATERIALS			\$165.00

Additional Cables and Locks:

SubContracting & Cable Schedule Subtotal: \$2,697.00

2 Purchase Investment Summary:

Pricing Breakdown

Material Schedule:	\$878.70
Labour Schedule:	\$997.50
Subcontracting & Cable Schedule:	\$2,697.00
	Total: \$4,573.20

*Prices quoted do not include Sales or Use tax. Applicable Sales and Use tax will be added to the quoted prices.

Estimated HST:\$594.52

Billing Terms:

100% Upon entry of order by Order Management. Payment Terms: Due Upon Receipt.

This proposal is valid for 30 days

Thank you for the opportunity to provide this proposal. Please sign, date and return the proposal in its entirety to

EMail: gerry.hegarty@securitas.com

Please issue any Purchase Order or other contract documents to Securitas Technology Canada Corporation

Client Expected Completion Date: 07-08-2024

This Agreement shall not become binding on Securitas Technology Canada Corporation until approved and accepted by Securitas Technology Canada Corporation management as provided below.

Seller:

Buyer:

Securitas Technology Canada Corporation

CITY OF MISSISSAUGA

Company

Trade, partnership or corporate name if different from above.

6275 Millcreek Drive

300 CITY CENTRE DR

Mississauga ONL5N 7K6

MISSISSAUGA ON L5B 3C1

Address

Address

Gerry Hegarty, COMMERCIAL SECURITY ACCOUNT MANAGER RAY Grotke

Account Representative Name & Title

Name & Title

Securitas Technology Canada Management

Authorized Signature Date

Securitas Technology Canada Management Signature Date



Proposal Terms and Conditions

1. **GENERAL** - This document and all pages or other items attached hereto, (hereinafter called the Document, Contract, Agreement or Proposal) will constitute a contract between Securitas Technology Canada Corporation (hereinafter "STCC") and the Buyer (as listed on the attached) when accepted by STCC. If the Buyer issues an order instead of executing this Document and said order references this Document, then this Document shall be deemed to have been signed by the Buyer and any of the terms or provisions of the Buyer's order which are in any way inconsistent with or in addition to the terms and conditions in this contract shall not be binding on either party unless accepted in writing by STCC's authorized representatives. Buyer acknowledges and agrees that it has read, understands and agrees to all of the terms and conditions in this Document and agrees to purchase, license, or lease all of the equipment and/or services described herein at the prices and payment terms contained herein. STCC's Proposal is valid for a period of thirty (30) days from the date of the Proposal. In the event the Proposal includes a Software Support Agreement ("SSA"), this Document shall remain in force for one (1) year from the effective date of the applicable SSA.

2. **DELIVERY** - Delivery quoted was based on the best information available from the manufacturers and/or STCC's current inventory at the time of Proposal. STCC is not responsible for any delays in shipments from manufacturers or changes in STCC's inventory level between time of Proposal and receipt of order or signed Contract from the Buyer. Delivery and/or completion dates are based upon prompt receipt of any and all necessary documents from Buyer. Shipments are scheduled after acceptance of an order in accordance with Buyer's requirements. Unless specifically stated to the contrary, however, where existing priorities and schedules prevent strict compliance with requested delivery dates, orders are entered as close as possible to the requested date and Buyer is advised of deviations, if any, in the shipping or completion schedule. STCC reserves the right to make delivery in installments. STCC shall not be liable for delays or failure in delivery, manufacture or completion or for any other default by reason of any occurrence or contingency beyond its reasonable control. **IN SUCH EVENT, BUYER AGREES THAT NO REMEDY (INCLUDING, BUT NOT LIMITED TO, INCIDENTAL OR CONSEQUENTIAL DAMAGES FOR LOST PROFITS, LOST SALES, INJURY TO PERSON OR PROPERTY OR ANY OTHER CAUSE) SHALL BE AVAILABLE TO IT.** All shipments will be FOB point of origin. Freight charges will be at Buyer's expense and will be added to the price contained herein.

3. **ACCEPTANCE, TRANSFER OF TITLE, RISK OF LOSS, AND DELIVERY AND INSTALLATION DATES.** This Section 3 applies to all items other than services provided to Buyer. **A. ACCEPTANCE:** Buyer shall be deemed to have accepted the items provided hereunder according to the following: (i) For delivery and installation orders for equipment ("D&I Orders"), Buyer's acceptance will occur upon substantial completion of installation of the item or beneficial use. At STCC's request, Buyer will execute a written acknowledgment of the installation date(s) for all of the items transferred under such D&I Order; or (ii) For shipped Orders, Buyer's acceptance will occur upon delivery of the equipment and/or software to Buyer, which for purposes of acceptance will be deemed to have occurred when the items are shipped from STCC's shipping point to a Buyer's location, which for software may occur by physical shipment, electronic delivery or notice to Buyer that the software is available for download. **B. TRANSFER OF TITLE AND RISK OF LOSS:** Title, risk of loss, and the right to use the equipment will pass to Buyer upon Buyer's acceptance thereof according to Subsection A above. Notwithstanding the foregoing, under no circumstances will title to any software be transferred hereunder.

4. **PRICES** - The prices stated are exclusive of any transportation charges (except as covered in Section 2 above), insurance, and federal, provincial, municipal, territorial or other government tax, including but not limited to sales, use, excise, harmonized, value-added or other similar taxes, now or hereinafter imposed upon the production, storage, sale, transportation or use of the products described herein. Such taxes or other

charges applied directly to the sale hereunder shall be paid by the Buyer, or in lieu thereof the Buyer shall provide an exemption certificate acceptable to the authorities. By ruling of New York State and New York City sales tax authorities, all lease payments are fully taxable, as they include rental and use of the equipment, use of loaner equipment, parts, etc.

5. **PAYMENT** - Unless otherwise specifically stated to the contrary in the Proposal, the terms of payment are as follows, without notice, demand, reduction or set-off: **A. EQUIPMENT AND INSTALLATION**—Thirty percent (30%) is due at time of order acceptance (equipment will not be ordered and work will not begin until deposit is received), with the balance due in monthly progress payments covering equipment received and labor performed Net ten (10) days from invoice date. **B. RECURRING SERVICES** – Billed in advance. **OVERDUE INVOICES** - If Buyer fails to pay or dispute in writing any amount when due and such failure continues for thirty (30) days or more, Buyer shall pay interest at the rate of one and one half percent (1.5%) per month or the maximum rate permitted by law, (whichever is less) on the entire unpaid balance for each month or portion thereof that payment is late.

6. **INSTALLATION** - Buyer is to provide 110V AC at all outdoor camera locations, monitoring and/or control locations, and/or other locations specified. Where possible, STCC utilizes low voltage equipment; as a result, wiring is not required (by code) to be placed inside conduit. Any conduit required by Buyer is at additional cost. If air plenum ceilings exist, code requires the use of conduit or plenum approved cable. The installation price in the Proposal is based on non-air plenum ceilings (i.e., no conduit or plenum approved cable), unless otherwise stated herein. If conduit or plenum approved cable is required, it will be at Buyer's expense, above and beyond installation price quoted. Unless otherwise indicated in the Proposal, Buyer is to provide trenching where necessary for cable runs. If aerial runs are required and Buyer-owned poles are available, STCC will utilize them when possible and permissible. Public utility poles cannot be used as they are proprietary to the public utility companies. Any poles necessary to complete aerial runs will be provided and set by Buyer at Buyer's expense, unless otherwise stated in Proposal. STCC's Proposal for installation includes all cable, connectors, ties and other necessary hardware, unless otherwise stated in Proposal or covered herein. Buyer understands and agrees that no subcontract labor, materials, and/or special equipment (i.e., skylift bucket truck) are included in Proposal unless so stated and, if necessary, will be at the Buyer's additional expense. Unless otherwise indicated in Proposal, all installation work will be performed by non-union technical personnel. If Buyer-provided lighting is insufficient for an adequate video picture, Buyer will provide additional lighting at Buyer's own expense.

7. **DRAWINGS, PROPRIETARY INFORMATION** – **A. Drawings.** Buyer shall provide STCC with an electronic version of drawings for the performance of the Services. Buyer shall provide STCC to-scale AUTOCAD drawings in electronic format. If Buyer cannot provide these drawings, an additional charge may accrue for STCC to create drawings necessary for the completion of the Services. **PROPRIETARY INFORMATION.** Any drawings, specifications, equipment lists, and all information provided by STCC herein (partial or complete) as instruments of service are and shall remain the property of STCC whether the project for which they are made is executed or not. Drawings, specifications, equipment lists, etc. shall be returned to STCC on demand or at the end of the project unless specifically purchased from STCC or authorized in writing by STCC. They are not to be used on other projects or extensions to this project, or to obtain other bids, except by agreement in writing and with appropriate compensation to STCC. They are not to be reproduced in whole or part without written consent.

8. **AUDIO/VIDEO EQUIPMENT** - If the equipment purchased or leased from STCC contains audio monitoring or video equipment, state



and federal law requires public notice of the use of this equipment. Buyer will use such equipment in accordance with all applicable laws.

9. **BONDING** - Unless otherwise agreed upon and included in writing in the proposal, STCC will not provide a performance or bid bond in connection with the equipment or services covered in this Contract.

10. **OWNERSHIP OF SOFTWARE AND HARDWARE CONTAINING SOFTWARE** - Any computer application program and/or documentation (collectively "Software") that is provided by STCC under this agreement is owned by STCC or one of its original equipment manufacturers and is protected by United States and international copyright laws and international treaty provisions. Any breach of this agreement will automatically terminate Buyer's right to use this Software, and Buyer is obligated to immediately return such Software to STCC. Buyer may not copy the Software for any reason other than per the dictates of any end user software license agreement. Buyer may not reverse-engineer, disassemble, decompile or attempt to discover the source code of any Software. Buyer acknowledges that any breach of this section shall result in irreparable injury to STCC for which the amount of damages would be unascertainable. Therefore, STCC may, in addition to pursuing any and all remedies provided by law, seek an injunction against Buyer from any court having jurisdiction, restraining any violation of this section.

11. **TERMINATION AND CHANGE MANAGEMENT** – A. A contract may be terminated by the Buyer only if agreed to in writing by STCC. If STCC agrees to termination, it will be subject to additional conditions and termination charges as follows: If any equipment covered by the Proposal has been delivered and/or installed, payment for said equipment and/or installation will be due in full. If equipment has yet to be delivered, the Proposal may be terminated only if agreed to by the manufacturer and Buyer shall pay either a 25%-of-retail-price restocking charge or manufacturer's percentage restocking applied to the retail price, whichever is higher, plus all freight charges. Buyer also shall pay on demand any other associated charges necessary to protect STCC from loss. B. Change Management. Either party may initiate a change by advising the other party in writing of the change believed to be necessary. As soon thereafter as practicable, STCC shall prepare and forward to Buyer a cost estimate for the adjustment to the price, and a schedule impact of the change, and any effect on STCC's ability to comply with any of its obligations under this Agreement, including warranties and guarantees. Buyer shall advise STCC in writing of its approval or disapproval of the change. If Buyer approves the change, STCC shall perform the Services as changed. If Buyer disapproves, the proposed change may be referred to senior management of the Parties.

12. **LIMITED WARRANTY AND INDEMNIFICATION** – Buyer acknowledges that STCC has not represented, warranted, or guaranteed that the equipment sold or leased herein will prevent any loss by burglary, hold-up, fire, or otherwise, or that the equipment will in all cases provide the protection for which it is installed or intended. Nor has STCC made any representations, guarantees, or warranties to third parties that the equipment will prevent any such loss or provide them with protection. The parties agree that STCC is only selling or leasing equipment and is not undertaking to be an insurer for the Buyer or any third parties against loss, injury, or damage that may result to the person or property of the Buyer or to the person or property of others. Buyer agrees to assume all risk for loss, injury, or damage to the person or property of Buyer arising from or pertaining to the use, possession, operation, or installation of the equipment. Buyer also agrees to indemnify STCC and hold STCC harmless from any and all claims, costs, expenses, damages, and liabilities of third parties, including attorney's fees, arising from or pertaining to the use, possession, operation, or installation of equipment. Buyer further agrees to defend, protect, and indemnify STCC for any damage or loss suffered by STCC as a result of Buyer's breach of any term or condition herein. The Buyer's agreement to indemnify and hold STCC harmless will continue for as long as the equipment is in use and extends to all claims of third parties, including claims based on intentional conduct, active or passive negligence, or strict or product liability on the part of the STCC, its

agents, servants, or employees. STCC warrants that the equipment provided will conform to its associated documentation under normal use and operating conditions for a period of ninety (90) days from the date of acceptance. If, during this warranty period, any of the equipment or parts are defective or malfunction, they will be repaired or replaced, at STCC's sole option, free of charge. Warranty repair is done 8am – 5 pm Monday through Friday, excluding holidays. This warranty will not apply if the damage or malfunction occurs, through no fault of STCC, while the system is in the possession of the Buyer, or because the system has been adjusted, added to, altered, abused, misused or tampered with by the Buyer, or otherwise operated or used contrary to the operating instructions. If inspection by STCC fails to disclose any defect covered by this limited equipment warranty, the equipment will be repaired or replaced at Buyer's expense and STCC's regular service charges will apply. STCC is not the manufacturer or developer of any equipment, software, or products sold, leased, or provided hereunder, nor is it the designer of record of any system installed hereunder. STCC's design efforts are limited to providing the intended results of the design efforts of others. STCC will indemnify and hold harmless the Buyer from any judgments obtained by third parties based on claims of bodily injury to third parties, or direct damage to the tangible property of third parties, to the extent caused by the wrongful or negligent acts of STCC, its officers, directors, agents or employees and occurring while STCC employees are performing service on equipment at Buyer's site.

13. **DISCLAIMER OF WARRANTIES** - WITH THE EXCEPTION OF THE WARRANTIES SET FORTH HEREIN, STCC MAKES NO OTHER WARRANTIES, EXPRESS, IMPLIED OR STATUTORY, INCLUDING ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, THAT THE SYSTEM OR SERVICE SUPPLIED MAY NOT BE COMPROMISED, OR THAT THE SYSTEM OR SERVICE WILL IN ALL CASES PROVIDE THE PROTECTION FOR WHICH IT IS INTENDED. IN NO EVENT WILL STCC, ITS EMPLOYEES, AGENTS OR REPRESENTATIVES BE RESPONSIBLE FOR CONSEQUENTIAL, SPECIAL OR INCIDENTAL DAMAGES OF ANY NATURE WHATSOEVER. STCC MAKES NO WARRANTIES CONCERNING ANY EQUIPMENT OR DEVICES ATTACHED TO BUYER'S SYSTEM UNLESS SUCH EQUIPMENT OR DEVICES WERE ORIGINALLY PURCHASED AND INSTALLED UNDER THIS AGREEMENT.

14. **INFRINGEMENT INDEMNIFICATION** - If STCC has received from the manufacturers of the Software and/or systems STCC installed hereunder an agreement to indemnify and/or defend any claim or suit or proceeding brought against STCC based on a claim that the sale, use or transfer of any system is an infringement of any third party's patent or property rights, then STCC shall indemnify Buyer and defend Buyer against all such claims to the extent (and only to the extent) such an indemnity and/or defense is provided by the pertinent (system) manufacturers.

15. **LIMITED LIABILITY** - UNDER NO CIRCUMSTANCES SHALL EITHER PARTY BE LIABLE IN ANY WAY FOR INDIRECT, SPECIAL, INCIDENTAL OR CONSEQUENTIAL DAMAGES, INCLUDING BUT NOT LIMITED TO LOST BUSINESS OR PROFITS, WHETHER OR NOT FORESEEABLE AND WHETHER OR NOT BASED IN BREACH OF WARRANTY, CONTRACT, OR NEGLIGENCE OR OTHERWISE IN CONNECTION WITH THE MANUFACTURE, USE OR SALE OF THE PRODUCTS OR SERVICES PROVIDED HEREUNDER. NOTWITHSTANDING THE FOREGOING IF FOR ANY REASON EITHER PARTY IS FOUND TO BE LIABLE, IN NO EVENT SHALL SUCH PARTY'S LIABILITY EXCEED THE GREATER OF THE AMOUNT PAID UNDER THIS AGREEMENT OR \$75,000.

16. **OTHER - Governing Law:** Where Buyer is located in the Province of Quebec, it shall be interpreted, enforced and governed under the laws of the Province of Quebec without regard to application of conflicts of laws principles that would require the application of any other law. Where this Agreement is thus governed by laws of the Province of Quebec, any action regarding this Agreement or otherwise brought against STCC



by or on behalf of any party to this Agreement, its agents, assigns, subsidiaries, and/or executors shall be maintained in a court in Montreal, Quebec. Where this Agreement is entered into with a Buyer located in a Canadian territory or province other than the Province of Quebec, it shall be interpreted, enforced and governed under the laws of the Province of Ontario without regard to application of conflicts of laws principles that would require the application of any other law. Where this Agreement is thus governed by laws of the Province of Ontario, any action regarding this Agreement or otherwise brought against STCC by or on behalf of any party to this Agreement, its agents, assigns, subsidiaries, and/or executors shall be maintained in a court in Toronto, Ontario. If any provision of this Agreement is declared by any arbitrator or court of competent jurisdiction to be invalid for any reason, such invalidity shall not affect the remaining provisions which shall be fully severable and the Agreement shall be construed and enforced as if such invalid provisions had never been included. For tracking of equipment covered by leases and service contracts as well as tracking of warranty on purchased equipment STCC may attach an STCC sticker and/or bar code label to the equipment prior to delivery. If the equipment is not covered by a lease or service contract and you do not want the stickers attached, STCC must be advised at time of ordering. Buyer represents that it is not subject to any economic or trade sanctions and will immediately notify STCC if it becomes subject to such sanctions, in which event STCC shall be entitled to immediately terminate this Agreement. English Language: The parties confirm that it is their wish that this Agreement, as well as all other documents relating hereto, including all notices, have been and shall be drawn up in the English language only. Les parties aux présentes confirment leur volonté que cette convention, de même que tous les documents, y compris tout avis, qui s'y rattachent, soient rédigés en langue anglaise

SHALL CONTROL. This Document constitutes the entire agreement between the parties with respect to the subject matter hereof, and supersedes all prior agreements with respect thereto, whether written or oral. This Document may only be modified in a writing executed by both parties.

17. PERSONAL INFORMATION. In the course of providing the services, STCC, its affiliates and/or an unaffiliated service provider may process and/or store information provided by or relating to Buyer, which information may include personal information about Buyer's employees and customers, outside of Canada. Such information would be subject to the laws of the foreign jurisdiction and in certain circumstances foreign courts, law enforcement agencies or regulatory agencies may be entitled to access such information. Buyer is responsible for obtaining any necessary consents required by applicable privacy protection laws in order to permit such processing and/or storage as required in connection with the performance of the services.

18. ELECTRONIC SIGNATURE LAW - The parties agree that Buyer's request in any form to receive items, whether by fax, e-mail or other tangible or nontangible means, shall be sufficient to subject any such items delivered pursuant to such request or otherwise produced or delivered to Buyer, to the terms of this Document. Any requirement of a further signed writing to make such a request a binding obligation of Buyer, or to subject any such Items is expressly waived by Buyer. The parties agree that application of a cursive or facsimile signature and transmittal of an electronic copy of this Document or other ordering document shall be sufficient to bind each party to the terms of this Document, and that an electronic reproduction of this agreement or other ordering documents shall be given the same legal effect as a written document signed by a party. THIS PROPOSAL IS PROVIDED TO BUYER IN RESPONSE TO BUYER'S REQUEST FOR EQUIPMENT AND/OR SERVICES FROM STCC AND IS SUBJECT TO ANY LIMITATIONS SPECIFIED BY BUYER (e.g. BUDGET CONSTRAINTS, LIMITED AREAS OF COVERAGE, ETC.). BUYER UNDERSTANDS AND AGREES THAT NO WARRANTY OR GUARANTEE CAN BE MADE THAT A SECURITY SYSTEM WILL PROVIDE COMPLETE PROTECTION FROM ANY LOSS BY BURGLARY, HOLDUP, FIRE, OR OTHERWISE, AND NO SUCH GUARANTEE OR WARRANTY IS PROVIDED HEREIN. THE STCC TERMS AND CONDITIONS (THE "TERMS AND CONDITIONS") ARE ATTACHED TO THIS PROPOSAL AND ARE INCORPORATED HEREIN BY THIS REFERENCE, AND BUYER HAS READ THE SAME AND THE REMAINING PARTS OF THIS PROPOSAL. IN CASE OF ANY CONFLICT BETWEEN ANY PROCEEDING PORTION OF THIS PROPOSAL AND THE TERMS AND CONDITIONS, THE TERMS AND CONDITIONS

July 18 2024

Paul Didur Architect Inc.
222 Islington Avenue, Suite 260
Toronto, Ontario
M8V 3W7

Attention: Paul Didur

Dear Paul:

Re: 3185 Mavis Road; Garage Wall Deterioration
Our Project No. 24029

As per our proposal, we visited the site June 6th, 2024 to review the truck wash bay at the east end of the above facility to review apparent wall damage observed by the owner. We met with you and Margarita Stephen from the City of Mississauga to perform a walkthrough examination of the building area of concern. We returned to the site June 26th, 2024 to review two test pit excavations performed on our recommendation: one along each wall. Attached is Structural Drawing S-5 of the building area with the wash bay highlighted.

The occupancy of this bay has been purpose built as a washing facility for the city maintenance vehicles since the time of construction, approximately 36 years. The bay has an overhead door at each end for drive through access and a continuous trench drain down the centre. Washing is done using high pressure handheld wands. There is no automatic washing equipment. See attached photo 2886.

The roof structural framing consists of a steel roof deck supported on 14”(350mm) deep open web joists. The joists are supported on 12” (290mm) CMU block walls on each side of the bay. From the test pit observations, we noted the exterior wall has concrete foundation walls (attached photo 3050) and the interior wall has CMU hollow unit foundation walls (attached photo 3038).

The observed damage is as follows

- major deterioration of the exposed face shell of the first course above the floor slab of the block walls along the full length of each wall (attached photo2869)
- lessor deterioration of the exposed face shell of the second course above the floor slab of the block walls along the full length of each wall (attached photo2869)
- the depth of deterioration has not penetrated through the full block thickness of the exterior wall (attached photo 2863)
- the depth of deterioration has penetrated through the full block thickness of the interior wall along much of its length (photo 2879)

Our recommended course of action for repair would be as follows:

- saw-cut and remove the existing slab on grade in the wash bay for a width of 600mm along the inside face of both interior and exterior walls
- remove the first course of block in lengths of 1200mm in a staggered sequential manner for both walls
- extend removal to the second course of block where necessary
- at the interior wall, fill the block wall below to the footing with concrete grout
- for both walls replace the removed block courses at the slab level with solid 290mm CMU units
- for second course superficial damage (less than 6mm in depth) scrape and remove the pitted material from block face
- parge the interior face of the exterior wall and both faces of the interior wall a latex based water resistant grout from the first block course to the fourth block course above the floor

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- apply a water and chemical resistant finish as specified by the architect
- proof roll the subgrade where the slab on grade had been removed, drill and grout dowels into the saw-cut slab edges and repour the concrete slab

If requested, we will be pleased to provide structural drawings and details for implementation of the recommendations described above.

We trust the above is satisfactory.

Yours truly,

**HAMANN ENGINEERING
STRUCTURAL CONSULTANTS LTD.**



S.D. Hamann, P.Eng





PHOTO 2886



PHOTO 3050



PHOTO 3038



PHOTO 2869



PHOTO 2863

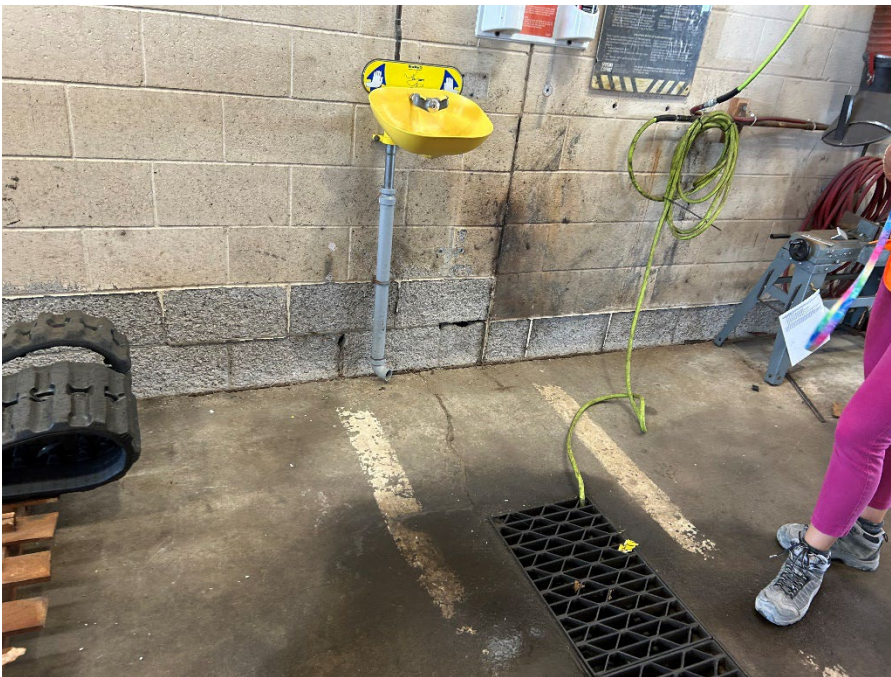
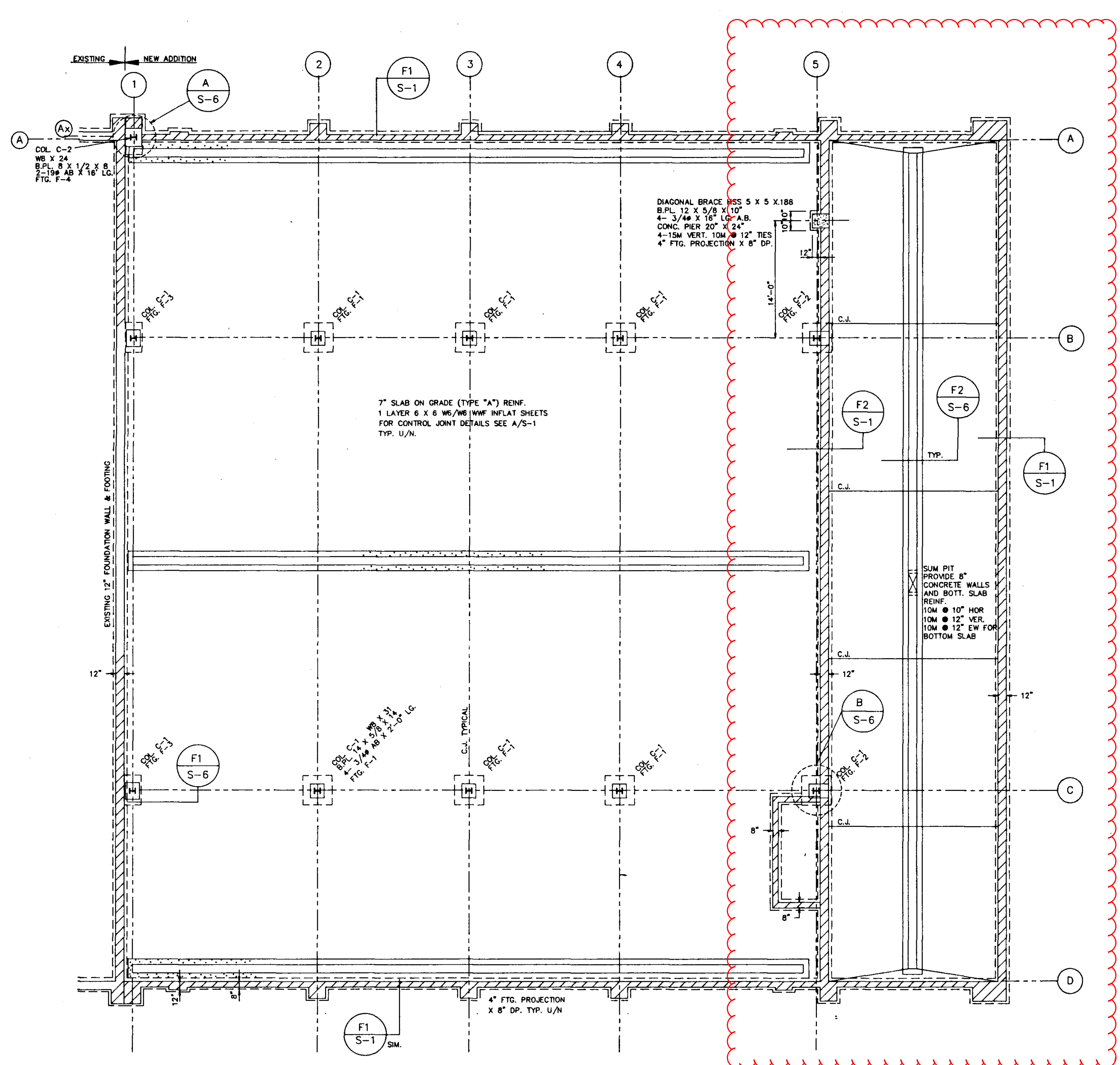


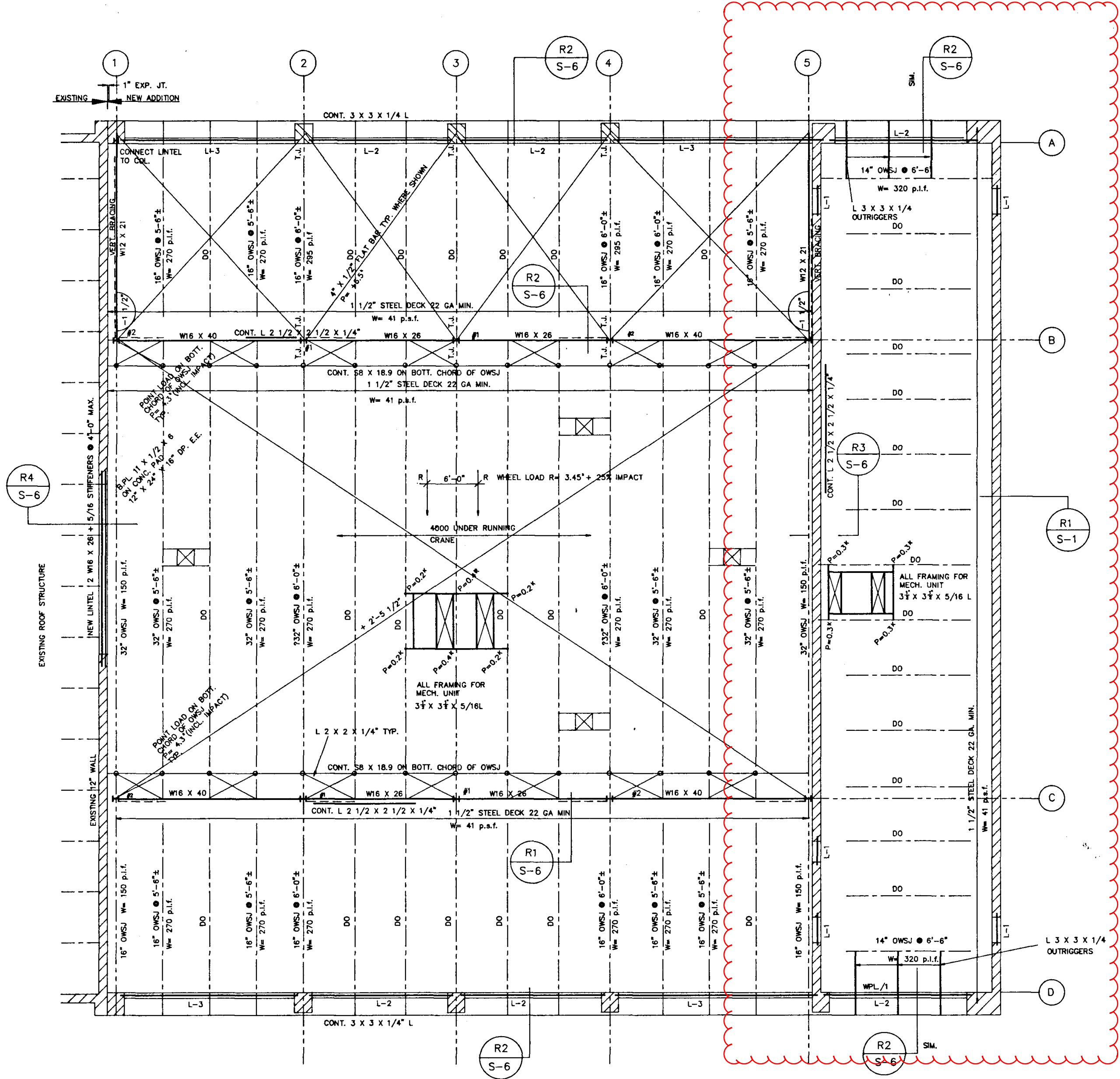
PHOTO 2879



FOUNDATION PLAN SCALE 1/8" = 1'-0"

- TOP OF SLAB IS AT +0 BELOW FINISHED GROUND FLOOR EXCEPT AS CROSSED AND NOTED. SEE ARCHITECTURAL DRAWINGS FOR SLOPES AND DEPRESSIONS.
- UNDERSIDE OF FOOTINGS SHALL BE AT ELEVATION 141.28m UNLESS OTHERWISE NOTED. ALL FOOTINGS SHALL BE PLACED MIN. 4'-0" BELOW EXISTING GRADE EXCEPT AS NOTED ON PLAN. FOOTINGS EXPOSED TO FREEZING SHALL BE PLACED AT LEAST 4'-0" BELOW FINISHED GRADE.
- REFER TO SOIL REPORT PREPARED BY JOHN EMERY GEOTECHNICAL ENGINEERING LIMITED, DATED JANUARY 4, 1989.
- FOOTINGS SHALL BE PLACED ON NATURAL UNDISTURBED SOIL CAPABLE OF SUPPORTING A PRESSURE OF 6000 p.s.f. (300kPa).
- UNDERSIDE OF COLUMN BASE PLATE IS 10" BELOW FIN. FLOOR TYPICAL UNLESS NOTED OTHERWISE.
- SEE ALSO TYPICAL DETAILS AND GENERAL NOTES ON THESE DRAWINGS.
- PROVIDE 4-15M VERT. & 10M @ 12" TIES FOR ALL CAPS U/N OTHERWISE.

FTG. TYPE	BASE	CAP	REINFORCING EA. WAY BOT.
F-1	3'-6" x 3'-6" x 1'-0"	1'-8" x 1'-8"	5-10M X 3'-0"
F-2	3'-6" x 3'-6" x 1'-0"	2'-2" x 1'-8"	5-10M X 3'-0"
F-3	2'-0" x 3'-6" x 1'-0"	2'-0" x 1'-8"	5-10M X 1'-6" 3-10M X 1'-6"
F-4	2'-0" x 4'-4" x 1'-0"	2'-0" x 2'-2"	5-10M X 1'-6" 3-10M X 1'-6"

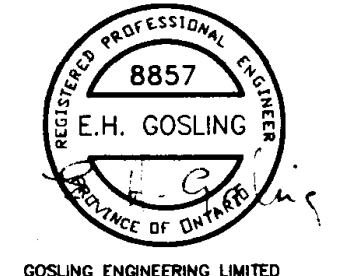


ROOF FRAMING PLAN SCALE 1/8" = 1'-0"

- TOP OF DECK IS ±0 BELOW TOP OF ROUGH ROOF EXCEPT AS CROSSED AND NOTED. FOR ROOF ELEVATIONS AND SLOPES SEE ARCHITECTURAL DRAWINGS.
- TOP OF STEEL BEAMS IS 4" BELOW TOP OF STEEL DECK UNLESS NOTED OTHERWISE.
- LIVE LOAD IS 30 p.s.f., DEAD LOAD IS 20 p.s.f., ROOF UPLIFT IS 10 p.s.f..
- W" FOR STEEL DECK IS TOTAL LOAD (LL+DL) IN POUNDS PER SQUARE FOOT.
- W" FOR GUSSET IS TOTAL LOAD (LL+DL) IN POUNDS PER LINEAR FOOT. ADD FOR POINT LOADS WHERE SHOWN.
- UNLESS NOTED OTHERWISE PROVIDE 3 X 3 X 5/16 L REINFORCING AROUND ALL OPENINGS IN ROOF DECK.
- SEE ALSO GENERAL NOTES AND TYPICAL DETAILS ON THESE DRAWINGS.
- UNLESS NOTED OTHERWISE PROVIDE 6 X 1/2 X 6 BEARING PLATE EACH END OF ALL STEEL BEAMS.
- REFER TO OTHER CONSULTANTS FOR ALL ROOF SUPPORTED AND SUSPENDED UNITS. SHOW THE UNITS ON THE STEEL FABRICATORS SHOP DRAWINGS.
- WPL/1 3 X 1/4 CONT. STEEL PLATE WITH 5/16" X 8LG. STUDS @ 2'-8" C/C SET IN BLOCK VOIDS FILLED WITH 20MPa CONCRETE.

MARK	MATERIAL	TYPE	REMARKS
L-1	3LS 3 1/2 X 3 1/2 X 5/16		
L-2	WB X 24		B.P.L. 7 X 1/2 X 7 E.E.
L-3	W16 X 36		NOTE (A) B.P.L. 7 X 1/2 X 9 E.E.

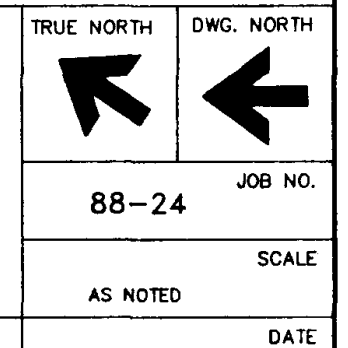
NOTE (A)
PROVIDE 3/4" A.S. GROUTED INTO BLOCK VOIDS OF PIER BETWEEN OPENINGS WHERE APPLICABLE.



DATE _____ REVISIONS _____
JOB _____

**MAVIS ROAD WORKS DEPOT
- RENOVATIONS -**

3185 MAVIS ROAD MISSISSAUGA
DRAWING
**ADDITON PHASE II
FOUNDATION PLAN AND
ROOF FRAMING PLAN.**



88-24 JOB NO.
SCALE _____
DATE APRIL 18, 1989
PRINTED APRIL 18, 1989
DWG. NO. S-5

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